Radio Guide

Radio Technology for Engineers and Managers

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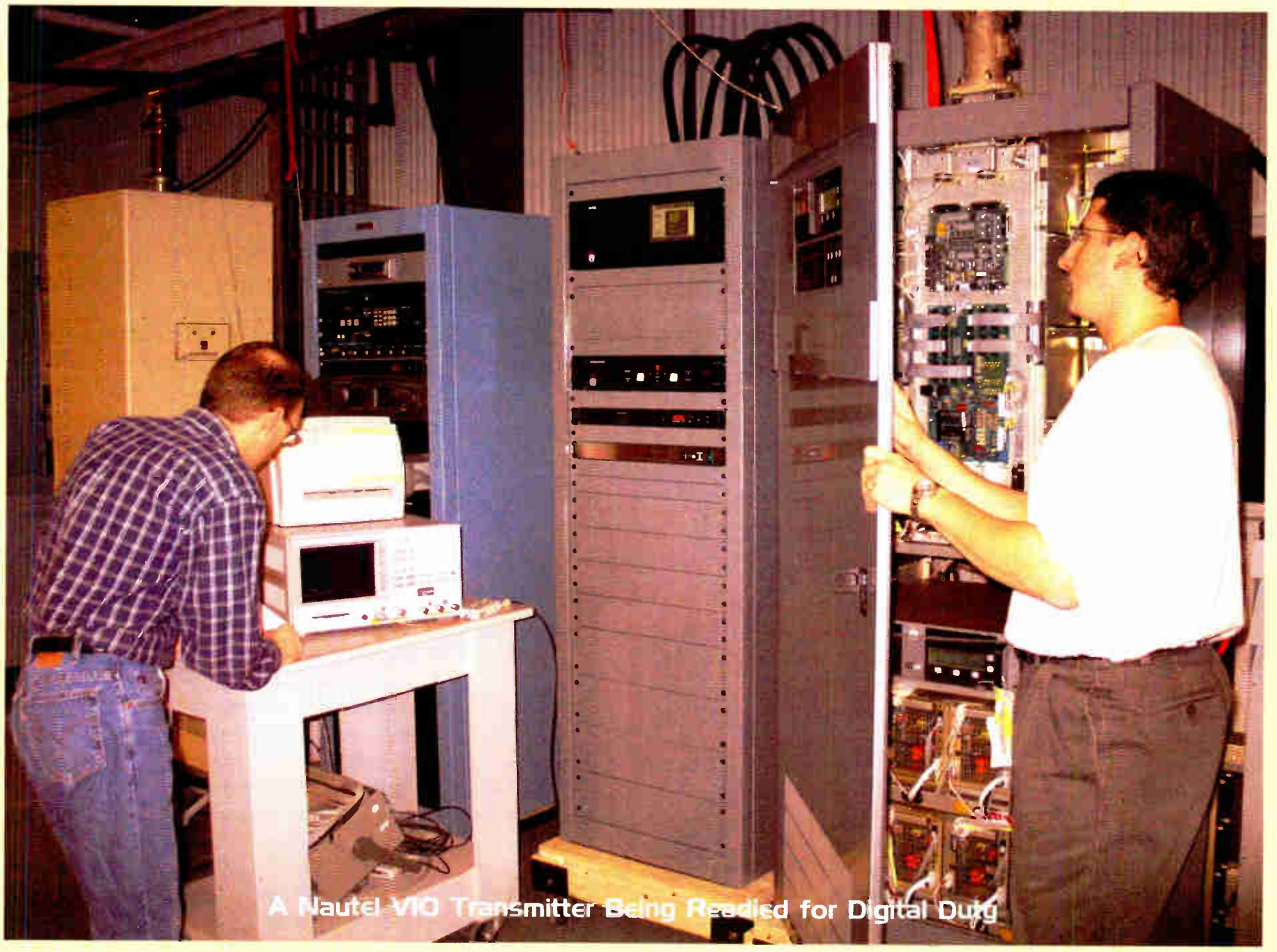
Volume 12 Issue 12

Planning the Digital Conversion



A Nautel VIO Transmitter Being Readied for Digital Duty

Six Ways to Tomorrow

Page 4 – Consider this chilling scenario: You – an FM station's chief engineer or engineering contractor – are called into a management meeting. You are informed and queried, "We have decided to implement HD Radio. How much will it cost and when can we be on the air?"

Yikes! Where to start! Well, as it turns out, you need to start at the end – the transmission plant. Proper analysis of your existing transmission configuration will determine the nature of your HD Radio upgrade

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Page 8 – Proper, secure fencing and entry points are a necessary part of your overall site security management. Perhaps that is not how you might feel while fumbling with a lock and key on a cold, rainy night, but better that than the aftereffects of vandalism, right?

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Controlling What We Can

When I was young, we had horses. One lovely morning, my dad and I headed home after a "breakfast ride," a lovely morning meal out on the trail. The horse, however, wanted to go her own way. No matter how I adjusted the reins, the horse just kept pulling, trying to move in a different direction.

Eventually, I noticed the horse was moving down the trail very nearly sideways; to my horror, her rump was swinging around toward the "front." Only a few moments later, that rump met a cholla cactus. In a flash, the horse took off ... and I was left lying awkwardly in the dust!

Could this be a metaphor for what is happening with digital radio?

As we prepare to enter the new year, things are "happening." In 2004 the spigots opened, and some real money began flowing into the infrastructure of radio stations – much of it to buy and install digital gear.

You may be a "true believer," unsure, or a cynic about the quality of analog to digital (and back) conversions, transmission or audience acceptance. Nevertheless, a transition is going on in radio. Some prefer to debate and criticize the actions and motives of others with assumptions, even nastiness. We may even see an effort to tie up digital radio in court hassles.

Meanwhile, more than a few have become adopters of the technology.

Sure, many still have reservations about the technology, predicting a "wave of interference" from IBOC sidebands. Others question the economics of buying "an expensive receiver to listen to ten spots in a row "in digital clarity."

But the bottom line is that we must learn as much about digital radio as possible, so we can discuss it from an informed viewpoint, not an emotional one.

This is much better than letting your horse's rump get hit by a cholla bush!

Six Ways to Tomorrow

Six Solutions for FM HD Radio Implementation

by Jeff Johnson

[CINCINNATI, Ohio - December 2004] Consider this chilling scenario: You – an FM station's chief engineer or engineering contractor – are called into a management meeting. You are informed and queried, "We have decided to implement HD Radio. How much will it cost and when can we be on the air?"

Yikes! Where to start! Well, as it turns out, you need to start at the end – the transmission plant. Proper analysis of your existing transmission configuration will determine the nature of your HD Radio upgrade.

Here are six possible solutions, one of which will be best for a particular situation. (Until recently, five methods of implementing FM HD Radio had been available; an additional method has now proven highly beneficial for some stations.) When one is chosen, bidding and "roll out" can proceed.

SPACE COMBINING

The first two upgrade paths utilize "space combining" – that is, combining in the RF field after the analog and digital signals have been radiated by separate antennas or by interleaved arrays (Either way, the digital signal is radiated *separately* from the analog signal).

Although now approved by the FCC, space combining has its drawbacks. First – the added wind, weight, and possible ice loading from the additional elements. Second – tower space constraints may limit or preclude additional hardware. Third – radiation patterns must match or the ratio of analog to digital signal strength may deviate beyond acceptable limits at certain locations.

An interleaved array of identical elements can be seen to be optimum, however use of a differing auxiliary antenna for the digital signal is unlikely to produce an identical pattern. Consider the instance of a multi-bay main analog antenna paired with a single bay auxiliary antenna for digital. Close-in, lobe nulls of the analog antenna may result in locations where the digital signal is stronger than the analog causing interference.

According to engineers at Harris, space combining "cannot guarantee the correct Analog / HD Radio signal ratios and duplicate coverage - tracking - even with interleaved antennas due to the opposite polarization rotation sense of the interleaved elements."

THE DUAL INPUT ANTENNA SYSTEM

A third method is via a dual-input antenna or system. With this method, all elements radiate both the digital and analog signals, but with an opposite circular polarization sense. The vagaries of space combining are reduced since the patterns are equal, but the signal ratio in the far field is still subject to variations due to the unequal addition of multipath components from the two different polarizations for the analog and HD Radio signals.

Perhaps the dual input method outlined by Bob Surette of Shively at recent NAB engineering sessions – that of "backfeeding" a master antenna combiner with the digital signal – is the simplest. This is available only to a station on a master antenna system, however.

ERI has introduced a dual-input side mount antenna wherein all elements are energized with both analog and digital signals. This antenna also minimizes, but does not eliminate, space-combining problems and requires no additional vertical tower space. However it doubles the number of bays and, being half wave spaced, presents a different radiation elevation pattern.

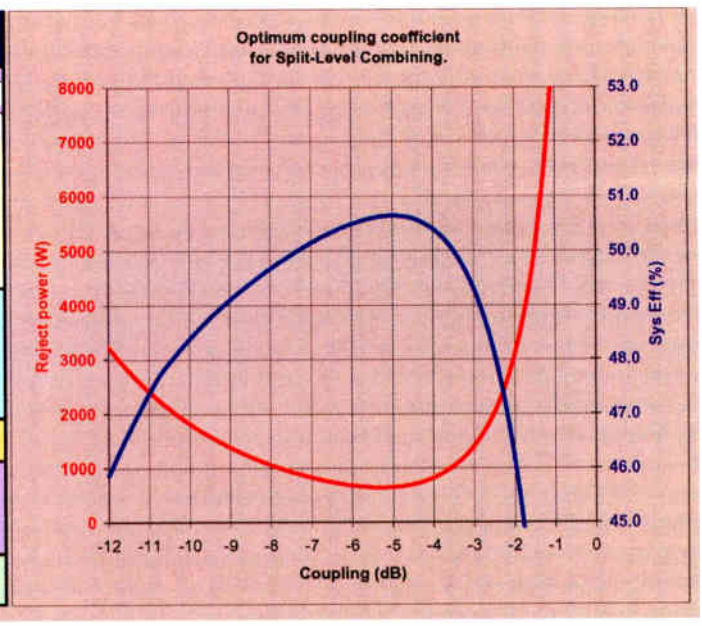
These first three methods avoid significant efficiency loss, requiring only a small digital transmitter, however, they come at the expense of greater tower loading and/or the uncertainties of space combining.

LOW LEVEL

The fourth and fifth methods are the well-known low-level and high-level RF combining. With these methods, assuming a suitably broadband existing antenna, no changes are required on the tower. However, significant inefficiencies are encountered generating or combining the RF power.

Low-level combining takes place before the final RF amplification. Since the combined signal has amplitude components introduced by the digital portion of the signal, a linear final amplifier is required. Linear amplification is inherently less efficient.

Separate Amplification	Enter TPO (Watt) here: 19,000	Split-Level Combining
	COUPLER	Select Coupler & TX:
-10	Coupling Factor (dB)	-4.77
Z12HD	ZHD TRANSMITTER	Z16HD
8,250	Psat (W)	11,000
1,900	HD Power (W)	570
NA	FM Power (W)	4,319
NA	HD/FM Ratio, dB	-8.8
NA	Total RF Power (W)	4,889
5,166	Dissipation (W)	8,065
7,066	AC Power Comsuption (W)	12,953
26.9	Overall Efficiency (%)	37.7
	MAIN FM TRANSMITTER	
111.1%	FM Power (% of TPO)	78.8%
21,111	FM Power (W)	14,970
14,074	Dissipation (W)	9,980
35,185	AC Power Comsuption (W)	24,950
60	Overall Efficiency (%)	60
	REJECT LOAD	
3,821	Rejected Power (W)	669
	SYSTEM PERFORMANCE	
23,061	Total Dissipation (W)	18,713
42,251	Total AC Power Comsuption (W)	37,903
83.4%	Combining Efficiency (%)	96.6%
45.4%	Overall Efficiency (%)	50.6%
Split-Level Calculator Rev D	Reduction in dissipation Watts	4,348
	In percentage	-18.9%



As pointed out by Geoff Mendenhall at Harris, linearization may be accomplished in part by predistortion of the input signal exactly complementary to the non-linearity of the amplifier. Thus the amplifier may be biased closer to Class C, the most efficient. Nevertheless, low-level combining encounters amplifier inefficiency, and is generally unsuitable for Transmitter Power Output (TPO) levels beyond about seven kW.

HIGH LEVEL

High-level combining encounters technical problems in the combining process. The question was asked, "Why not combine in the same way used for a common antenna?" Harris engineers explained the closeness of the frequencies involved exceed the ability of combining technology to isolate the signals within practical filtering constraints and acceptable group delay.

Up until now, it is usual for a combiner with a coupling factor of 10% to be used. This combiner rejects 10% of the analog signal and 90% of the digital signal; the analog transmitter must produce 10% more TPO, while 90% of the expensively produced digital RF is wasted.

This wastefulness results in a need for increased electrical service, increased cooling capacity, and greater floor space.

Other complications in using the High Level combining method include the potential where the analog transmitter already may be at its maximum TPO and – unable to deliver the additional required power – must be modified or replaced. Aside from the equipment cost, floor space may not be available at any cost. Furthermore, upgrading utility power and air conditioning at the site may be difficult or impossible and will be expensive.

SPLIT-LEVEL COMBINING

In his article in the October, 2004 issue of ***Radio Guide***, Dave Agnew, FM Applications Engineer at Harris Corporation, introduced a concept known as "Split-Level Combining," a sixth method.

The new Split-Level Combining technique entails finding an efficiency "sweet spot" by setting the combining ratio (coupling factor in dB) to -3.01dB, -4.77dB, or -6.02dB and optimizing the transmitter power levels to achieve a maximum efficiency at the required TPO.

(A software tool developed by George Cabrera of Harris is available on the Harris web site at: http://www.broadcast.harris.com/extremedigital/hdradcalc.asp allows fine-tuning of these values until the optimum combination is found.)

With this method, the new digital transmitter supplies not only the required digital signal, but also a portion of the analog signal. To provide a working example, please note the figures below, in this chart generated by the Harris software.

This study is based on a station requiring 19 kW TPO (a range where Split-Level combining is most effective) in order to reach the authorized ERP.

At this TPO (19.0 kW), a sweet spot of maximum over-all efficiency (blue line) and minimum reject power (red line) occurs near the -4.77 dB coupling factor. The reject load expels 669 watts as opposed to 3,821 watts with conventional high-level combining.

However, the use of a linearized HD transmitter for a portion of the analog power results in less overall analog amplification efficiency. In other words, the digital transmitter generates some of the heat otherwise rejected by the dummy load.

BETTER EFFICIENCY

It is important to note in our example that overall efficiency is improved by 5.2% and wattage dissipation is reduced 18.9%. Other examples achieve similar efficiencies at a lower TPO.

Agnew notes, "While the dissipation and efficiency improvements begin to move closer to 10 dB combining at the 37 kW to 45 kW range, using Split-Level Combining can allow you to use a single cabinet digital transmitter versus a much higher priced dual cabinet transmitter."

(Continued on Page 6)

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Six Ways to Tomorrow

Six Solutions for FM HD Radio Implementation

Continued From Page 4

As an example, at 37 kW TPO, Split-Level Combining at -6.02 dB is less efficient, however only a single Z16HD digital transmitter is required.

With split-level combining, as with high and low-level combining, changes on the tower are unnecessary and no space-combining issues are encountered. Distinct advantages realized by the Split-Level technique:

1) No modification or replacement of the existing analog transmitter is necessary. Actually, the current analog FM transmitter's power is reduced, resulting in longer tube life.

2) The digital transmitter may serve as a partial-power backup for the analog transmitter. If a facility presently has no backup transmitter or cannot physically accommodate a third transmitter, the Split-Level combining technique solves these problems.

3) Up to an 85% reduction in reject-load wattage.

4) Up to a 7% improvement in overall efficiency over conventional high-level combining.

In such higher-powered station situations, Split-Level combining appears to show some impressive advantages. However, it is important to check out all the variables discussed; as we have seen, weighing the different factors can lead to a different transmitting solutions.

Jeff Johnson is Network Engineer for Xavier University's X-Star Radio Network. Contact him at: Jeff.Johnson@xstarnet.com

Digital Transmission Choices Summarized

METHOD 1:
Separate Antenna Space Combining

If you own your tower and there is space available, you can rent additional space at reasonable cost, or you presently have a suitable auxiliary antenna within 70-100% of AGL and coordinates within three seconds of your main antenna, transmitting the digital signal with the separate antenna approach may be optimal.

There will be no combining loss, and you will need only a digital exciter and low power transmitter. Additional electrical power costs for transmitting and cooling will be low.

METHOD 2:
Interleaved Antenna Space Combining

Inconsistent digital to analog power ratios will be lessened, and less tower real estate will be consumed. However, wind and weight loading will increase. Transmitter considerations will be the same as with the separate antenna approach.

METHOD 3:
Dual Input Antenna or Master Antenna Combining

An existing or modified dual input master antenna or master antenna combiner is required. Alternately a new side mount dual input antenna may be installed at significant cost and increased wind and weight loading. Additional electrical power costs will remain low.

METHOD 4:
Low-Level Combining

For TPOs of less than approximately seven kW, this is commonly an economical solution. A new transmitter will be required with lower efficiency than an analog-only transmitter.

METHOD 5:
High-Level Combining

This is has been, until recently, the simplest method to implement for TPOs above seven kW or so. However the analog transmitter will have to produce 10% more power, the inherently less efficient digital transmitter will have to have ten times the power actually broadcast.

All of the power lost in the combiner is rejected as very expensive heat; cooling loads will be higher. Adequate utility power and square footage may not be available.

METHOD 6:
Split-Level Combining

This most sophisticated, new method has been recently introduced. If antenna additions or modifications are ruled out, split-level may be the best way to proceed.

Survival Guide

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

By Rich Wood

[SPRINGFIELD, Massachusetts - December 2004] Ever since Sarnoff dissed Armstrong there has been an uneasy balance of terror between broadcast disciplines.

IN THE BEGINNING

In the earliest days, Engineers roamed the earth with impunity. It literally took dozens of them to keep the equipment running. We had no choice.

Without warning, Raptors appeared in the form of General Managers, Program Directors and, worst of all, Personalities. Engineers found themselves nipped at the heels from every direction. It gets worse every year as more equipment takes care of itself and folks get downsized or puppetized by Headquarters.

In such an environment, "turf" becomes more important than ever. Merely justifying one's existence in 21st Century Broadcasting can become a full-time job.

WHICH DEPARTMENT IS MORE IMPORTANT?

Personally, I have this quaint belief that every department in a radio station is critical to its success. The question "Can't we all just get along?" becomes more critical as Wall Street (greed) replaces Broadway (entertainment) as our reason for being.

Sadly, some of the most serious conflicts are between Engineers and Program Directors. Neither can do their jobs without the other. Yet an uneasy, often-broken truce exists from day to day.

Picking on Program Directors as major engineering irritants is probably unfair. There are so many contributors in other departments that we need several articles (or a book) to cover all the possibilities. In the olden days, Program Directors actually made decisions, so we will tackle them first.

UNDERSTANDING THE CULTURES

As a long-time programmer with a lot of computer and engineering "geek" in me, I understand both perspectives. No department can honestly argue that entertainment is not our Prime Directive. Without compelling programming there is no reason for any of us to exist.

That compelling programming brings with it huge egos which must be buffered by the Program Director. No Engineer wants to be faced with angry talent on loan from any Higher Power. Neither Personality nor Engineer is known for U.N.-style diplomacy.

Yet, the Engineer sees the PD as a badly dressed creature with hair (or intentional lack of it) configured to match the programming. I remember when we changed the format at XTRA to New Wave. Overnight the programming staff changed from recognizable humans to the undead with spiked hair. It was trendy. Still is.

The PD sees the Engineer as someone dressed in something flannel, and with jeans that were torn at work rather than at the factory. He has an overloaded pocket protector and enough white medical tape to repair a lifetime of glasses. (Those who have attended a Hamfest know exactly what I am describing.)

After consulting a friend steeped in the ways of contemporary fashion, I have been assured the "Geek look" is even trendier than spiked hair, so Engineers win this one. However, never wear white tape after 6 PM – have a pair of evening glasses with black electrical tape handy.

FAILURE TO COMMUNICATE

Another culture war escalates when the Program Director, under orders from the Sales Manager, sets up a remote (that is *really* remote) for early that same afternoon. Although Telco says "two weeks for an ISDN install," the advertiser's check has already been cashed and he is expecting his "KIA Karnage" extravaganza to go off without a hitch.

Something got lost along the way. The Engineer told the Program Director about the lead-time, and the PD passed it along to the Sales Manager who forgot to tell the Account Executive. The General Manager now gets into the act and wants to know who screwed it up.

It must have been the Engineer! Engineers are known to work miracles, so one was expected. (Free advice: go easy with miracles or you will end up always being expected to pull off miracles, including the loaves and fishes thing, because you are so handy.)

CONTRASTING COMMUNICATION STYLES

This is a communications industry. That is probably why we rarely communicate well. There is nothing more frustrating for someone who deals in things ephemeral – like formats or a "personality" making $285 million needing a ride to work – than to be confronted by an Engineer supported by the laws of physics. There is just no wriggle room.

Engineers have to use that awesome power for good (preferably their own good). Engineers with great people skills usually have fewer problems. Nearly every other department requires people skills in one way or another – they need cooperation. It may seem like they are snookering each other, though it is really the social lubricant that makes a complex system work.

The most well-liked and effective Engineers I have worked with have been willing to take the time to carefully explain the process. "Why does it take two weeks?" "Because Telco says it does." "Why can't I wrap the needles around the meter pins?" "Because we are digital and everything goes sour when you hit the digital brick wall."

Even the best employees will need help when analog goes digital and most of the staff has been downsized. Most people understand simple explanations, especially when backed up by detailed memos/directions and training. The PD who gets the blame when the local Ranchero station beats you – in a market where no one knows what that is – needs someone on whom to lay it off.

You do have time for all that – right?

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

Security Guide

Do Fence Me In

by William Bordeaux

Transmitter site security is an ongoing concern, made more important in recent times by various incidents of vandalism, and worries about terrorist activities. In this article, Bill Bordeaux helps illuminate some of the good and not so good implementations of a station's first line of defense – the fences and gates.

[SAN LUIS OBISPO, California - December 2004] Proper, secure fencing and entry points are a necessary part of your overall site security management. Perhaps that is not how you might feel while fumbling with a lock and key on a cold, rainy night, but better that than the aftereffects of vandalism, right?

True, fencing does not generate revenue, it does not attract new listeners, and it cannot even be called "sexy." Furthermore, good fences and a good locking arrangement do not come cheap. Nevertheless, done right – and with a little maintenance along the way – it will save time and money and protect the station's bottom line.

WHY A FENCE?

Clearly the mandate from the Feds is all about safety. Is the fence high enough and is it strong enough to do the job of keeping people safe? These questions should be answered when planning a fence and assessing the condition of fencing around a site. No doctorate needed here.

Beyond safety, each site should be evaluated for other protection afforded by fencing. This includes:

- Limiting vandalism
- Protecting equipment and structures from damage by animals or vehicles.

Most sites are susceptible to vandals and most will experience some form of vandalism at one time or another. This can range from graffiti to break-ins with the theft of valuable equipment. Unattended sites, particularly in urban areas need to be hardened with tall fences, bright lights, security systems and razor wire where applicable. Some sites can get away with a six or ten foot chain-link fence and never suffer harm.

Either way, do not be surprised when a visit to a site finds that you have had a visitor or two crawl under or over a fence. If someone wants to get into a site bad enough, it is likely they will succeed.

SMALL "LOSS," HUGE EXPENSE

Recently, a site had unwanted visitors that liberated all of the copper ground bus bars that could be reached from the outside of buildings. It seems that the thieves went through a lot of trouble for little payback. The copper was worth a few hundred dollars at most. The major expense for the affected site users was the labor to reinstall the ground bus bars and reattach the ground cables.

While the vandals may not gain a lot of value from stolen copper, the cost of repair can be very high.

Another reason to keep fences in good repair it to protect the site from inadvertent damage. Kids love to take four-wheel vehicles on tower sites, as there is a lot of room to "spin around." However, in addition to the potential damage to the ground system (just think of what happens when a truck tire sinks down!), the trucks can also clip a guy wire, and then you will have a major problem.

Among the various dangers to the guy wires and anchors are landscaping companies mowing the field. And broadcast lore is filled with stories of landscapers who decided the quickest way to "clear the field" was to scrape it – leaving behind a set of chopped spaghetti formerly known as a ground system.

Sites that allow grazing animals or farming operations nearby also need to be concerned about accidental damage from animals or farm implements. Especially the guy wire anchors and coax exits (and paths) should be carefully protected by fencing.

These guys and the anchor are protected from accidental damage.

Years of rubbing from itchy cows will eventually take its toll on guy wires or other structures. I recall one site where an itchy cow scratched his itch using the piping off of a propane tank that fed the station's emergency generator. Eventually the fitting on the pipe broke off and the cow went dashing for cover as 450 gallons of propane fuel steamed off into the atmosphere. Needless to say a small fence around the propane tank would have paid for the cost of the tank repair and refill.

CONTROLLING ACCESS

The easiest – and at the same time most difficult – way to control access to a site is a locked gate. Easiest, because a locked gate should keep out casual visitors. These are the folks the FCC especially wants you to keep away from excessive RF radiation.

The "Chain O' Locks"
One misplaced lock can prevent access in an emergency.

Hardest, because a lot of engineers seem to hate to get out of the truck, especially in inclement weather. True, a lot of emergencies occur during storms, and finding the right lock on a "chain o' locks" to get the gate open can leave someone fairly well drenched.

Leaving the gate open is not a particularly good solution. In addition to unwanted visitors, the FCC might come calling, and question whether the public could receive excessive RF. Since each tenant on a site can be cited by the FCC, it pays to have good local cooperation, and make sure the gates are closed, especially if you have two-way or cell neighbors, who might be quite lax about closing and locking up while on site.

Some sites have found a common combination lock works well. Other times, some entities (often a local utility) might fight the use of a common lock, preferring to use their own specially keyed locks. A way to keep some order and make things function under this arrangement are special gate mechanisms that will open when any one lock is removed. A minor installation expense when shared, but such a mechanism can save a lot of hassle in an emergency.

This system provides predictable, easy access to each station's lock.

NATURAL FENCES

There are many ways to keep fencing costs in line. One clever approach I have seen is to use natural features of the landscape to enclose the property.

For example, at one site, located on a desolate patch of Pacific Coast mountain ridge, it was determined (and rightly so) that the thorny scrub brush encircling the property and steep terrain would effectively keep all but the most determined trespasser safely away from the equipment within.

A ten-foot high fence rimmed with barbwire was constructed in areas were the brush was thin or nonexistent. A gate with multiple locks insured only authorized vehicles had access to the property. And so it was that the site was secured from vandals as well as the curious public.

Then, one dry, hot August morning, the sky turned a hazy brown as a wild fire crept along a distant ridge. As the sun came up and with it a strong breeze, the fire exploded across the mountaintops and incinerated everything in its path. Luckily, the equipment shelters on the peak were spared, but not so the brush "fence line." Suddenly the site was accessible to anyone who happened by.

It had been almost a hundred years since a fire had gone over that particular mountaintop. Yet, sometimes even the best-laid plans go afoul for reasons that are unimaginable. Naturally, the fence contractor had to be called out to install more fencing, whether the CAPEX was ready or not.

WHY IT IS IMPORTANT

Of course, the users of the site all managed to pony up for the necessary improvements, and the site was secured. On the other hand, imagine if an FCC inspector happened by about that time to be sure that we were complying with ANSI regulations regarding RF exposure and public access. I suppose that there was a good excuse, but the explanation to the FCC would have been an interesting one.

The FCC only gives general guidelines regarding fencing requirements at AM sites:

Section 73.49 – AM transmission system fencing requirements. Antenna towers having radio frequency potential at the base (series fed, folded unipole, and insulated base antennas) must be enclosed within effective locked fences or other enclosures. Ready access must be provided to each antenna tower base for meter reading and maintenance purposes at all times. However, individual tower fences need not be installed if the towers are contained within a protective property

For FM and TV, there are no such rules but rather the FCC uses the ANSI/IEEE RF exposure guidelines to require fencing to limit access to high RF energy areas. In both the AM and FM/TV cases, the bottom line is this: Install fencing that will prevent the public from entering the area and harming themselves. By fencing and locking access, only trained, informed workers will have access into the area. It is really that simple.

A nice and properly fenced site.

WHEN "LOCKED" DOES NOT MEAN "LOCKED"

A check though the files of the FCC seems to show there is some confusion as to the interpretation of what constitutes an "effective locked fence" as the following shows:

"On December 28, 1999, the Enforcement Bureau's Seattle Office received a complaint from the owner of the property where KOBB(AM)'s antenna is located, that the fencing at the base of KOBB's antenna tower was in disrepair and falling down. The complainant expressed extreme concern because of the addition of a children's daycare facitility on the property at this location."

After contacting the owner of KOBB(AM), explaining the Rule (73.49) and faxing him a copy of the same, the FCC was told the fence now met the requirements of the Rule. Of course, the FCC Field Office thought it prudent to see the fence first hand. After a visit, it wrote the following:

"On January 22, 2000, two Seattle agents conducted an inspection of the KOBB(AM) antenna site in Bozeman, Montana. The agents found that the fencing was old wooden fencing, most of which was rotten and fallen over on the ground, leaving the antenna accessible to the public. There did not appear to be a locked gate associated with the wooden fencing. There was some temporary

(Continued on Page 10)

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Security Guide

Do Fence Me In

Continued From Page 8

orange plastic net fencing, which was also partially falling over. A subsequent telephone call from the property owner revealed that he had installed the plastic netting to offer some temporary protection."

Based on the inspection visit by the Field Office and the subsequent response from the licensee, the Commission itself responded as might be expected, assessing a $7,000 fine on the station:

"The Commission assesses monetary forfeitures pursuant to Section 503(b) of the Act and Section 1.80(a) of the Commission's Rules, which both state that any person who willfully or repeatedly fails to comply with the provisions of the Communications Act or the Commission's Rules shall be liable for a forfeiture penalty. For purposes of Section 503(b), the term "willful" means that the violator knew the requirement of the Commission's Rule, but did not take corrective action to comply with the rule."

Clearly, replacing and maintaining the fence would have saved everyone lots of time and money. In this case the licensee got to pay for the fence twice.

IS IT A FENCE OR IS IT NOT A FENCE?

This example is not to say that there are not instances where the function of the fence might be debatable. For example:

"On March 8, 2002, an agent from the Philadelphia Office inspected the three-tower array of WOYK(AM) in York, Pennsylvania. The agent observed that the middle tower (antenna structure registration number 1029250) was not enclosed within an effective locked fence. The agent determined that the middle tower could be accessed through an opening in the fence created when a portion of the fence fell off a warped fence post."

The FCC issued a Notice of Apparent Violation (NAL) and suggested a fine of $7,000 be in order for this violation. The licensee responded:

"WOYK states that the fence was repaired less than 24 hours after it was notified that the fence needed repair. Further, WOYK contends that because the Philadelphia Office did not send it a Notice of Violation regarding this matter, it never had an opportunity, pursuant to Section 503(b)(2)(D) of the Communications Act of 1934 as amended ("Act"), to speak to the nature, circumstances, extent or gravity of the violation.

"WOYK also contends that although the base forfeiture amount for a violation of AM tower fencing is $7,000, this is not a situation in which the licensee had no fence or a partial fence. WOYK argues that in this case, the violation was minor in that there was a slight gap in the fence which was almost immediately repaired and posed no danger to the public or the environment.

"The licensee also claims that during the inspection, the agent only mentioned the fence "in passing" and never inquired again about the fence or returned to the station to reinspect the fence. For these reasons, the licensee contends that the forfeiture should be rescinded or reduced."

The bickering about who said what and when is best left to the lawyers, but for me the heart of the matter is did the "gap" in the fence really pose a health and safety issue? Clearly the previous site located near a daycare facility should raise some eyebrows, but if what WOYK says is true then should they still have the book thrown at them? The FCC considers the matter and agrees with WOYK and rescinds the fine.

"Section 73.49 of the Rules states that antenna towers having radio frequency potential at the base "must be enclosed within effective locked fences or other enclosures." WOYK submitted a signed declaration from its president, who repaired the fence, stating that the fence section at issue is generally secured to the fence post at the top, middle, and bottom, and that the fence section referred to in the NAL only fell away from the top, creating a six to twelve inch gap, but that the fence section remained secured to the fence post at the middle and bottom.

"WOYK admits that the fence may have been in some minor disrepair but argues that it would have been virtually impossible to access the tower without climbing over the fence or breaking it down. After reviewing the record before us, we conclude that there is not enough evidence to support a finding that WOYK failed to maintain an effective locked fence in violation of Section 73.49. Consequently, we cancel the NAL."

As we have seen, attention to the fences and access to your site is important. Just because "only the engineer goes out there – and not very often" is not a reason to allow the fences to deteriorate and create problems ranging from fines to insurance liabilities.

When done right, and properly maintained, your fences will serve you well for many years without requiring extensive costs in either time or materials.

Bill Bordeaux is a contract engineer based in San Luis Obispo, CA. You can reach him via email at: bill@stationengineer.com

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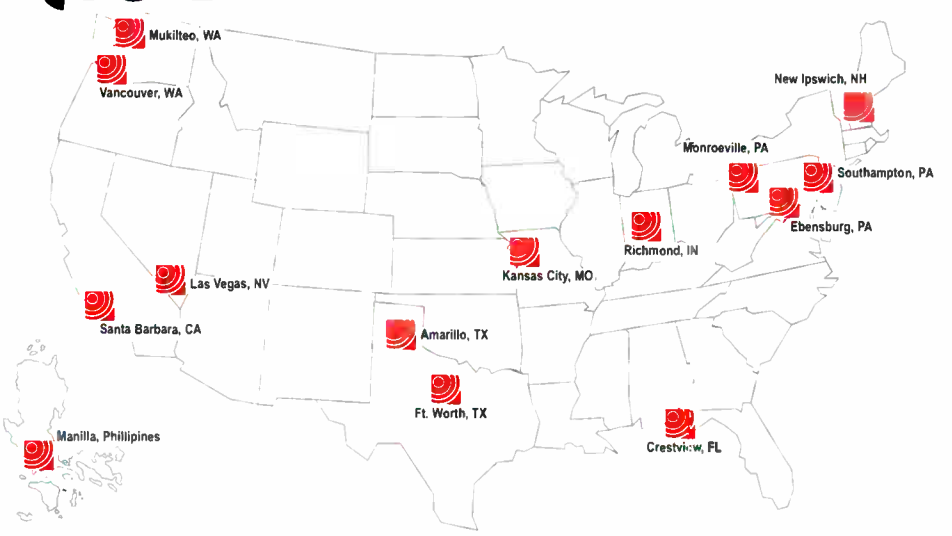

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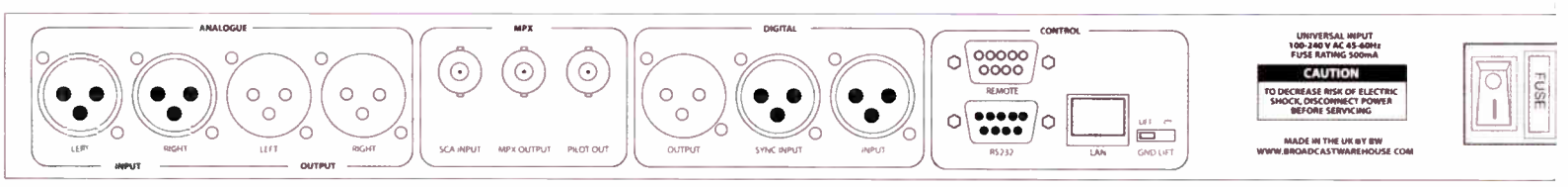

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Audio Processing From the Ground Up

Part 18: Getting the Right Sound

by Cornelius Gould

When we last heard from Corny, he was telling us to take our time as we adjust processing, not to rush it. Well, he took his own advice, and has been "lost" in his lab for the past several months, as he developed some new tweaks and tips to share with us.

[CLEVELAND, Ohio - July 2004] I hope the past few months allowed you to use some of the knowledge that you have gained during the series to spruce up your station's audio. If you recall, our goal is to help achieve the sound you want – a "signature" for your station – rather than just sounding like everyone else.

At this juncture, it is appropriate that we discus audio processing for the newer radio mediums – and what is a hotter topic in radio right now than "HD Radio?" Digital processing does not necessarily mean digital audio.

It might help to go back and "refresh" yourself on all the articles you have read so far, as this one ties into most of them. If you are a new subscriber, you can find my previous articles at http://techcentral.cgould.com. They are also on the Broadcaster's Desktop Reference (BDR) mentioned elsewhere in this magazine, or at www.oldradio.com/bdr.htm

SQUEEZING AUDIO

Processing for HD Radio has a lot in common with many of the new digital broadcast services available to listening audiences right now. These include Satellite radio and Internet radio audio.

None of these services would be possible without the technique of "bit-rate-reduced digital audio" CODECS. The term "CODEC" is an acronym for "enCOder – DECoder." I covered the basic idea behind coded audio in "The Rock and The Pin" article in the September 2003 issue of ***Radio Guide***. *[Available on the BDR, CD-ROM, see page 19]* Now we come to the point where we start to use the basic information in that article and tie it in with audio processing.

To briefly re-cap my "The Rock and the Pin" article, the idea behind coded audio is to attempt to remove certain aural elements of a digital audio signal that we would not normally notice, but are present in the captured audio stream. Doing so dramatically reduces the amount of bandwidth needed to transmit digital audio.

This is very important for digital radio broadcasters as there is insufficient bandwidth available within our assigned channels to transmit normal (linear) digital audio.

To accomplish this digital bandwidth reduction, the coding equipment (software) takes advantage of the quirks of human hearing with regards to frequency, time, and loudness masking to remove elements we would not instinctively notice, either because of time and frequency proximity, or loudness masking (or all of them at the same time). Again, please refer to my Rock and Pin articles for a little better picture of the basics of what is happening in these coding systems.

Basic processing concepts remain true regardless of the digital broadcasting standard used. However, because of CODECs and a number of other factors, we all have to re-think the way we handle audio processing.

CLIPPING IS BAAAAAD

The biggest change comes in the form of the venerable ol' loudness clipper. It is gone in this digital arena – typically replaced by a device called a "look ahead limiter."

This change is necessary for two reasons. The first is the reality of having a finite bandwidth. Even if we were able to broadcast linear digital audio, clipping will still present a problem as it takes a really high sample rate to accurately recreate a square wave. This is because the "sharp corners" of the square wave consists of audio harmonics that extend well beyond the range of human hearing.

Since digital audio typically is concentrated within the 20 - 20,000 Hertz range of normal human hearing, it is almost impossible to reproduce such a form within normal digital audio sample rates – with the one exception of the clipping of lower frequency elements such as "bass." (See my May 2003 article in ***Radio Guide*** for more information on this effect).

The second change comes from the fact that there is no pre-emphasis curve to deal with (or compensate for) in the digital broadcast domain. Since most engineers have most likely heard most of us processing geeks mention this point more than once, I will stop here, and explain what we mean. This is also something programming people need to be aware of as well for reasons that will make sense soon!

PRE-EMPHASIS

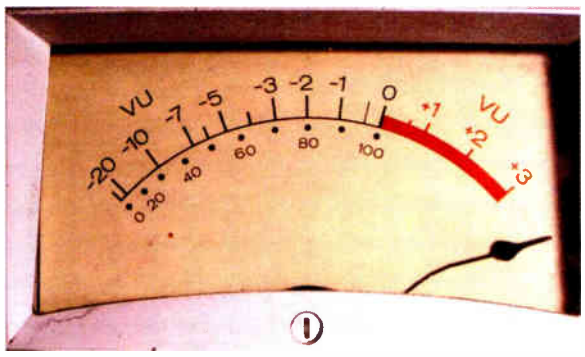
If you remember from my previous articles, pre-emphasis is used in analog broadcasting to compensate for noise normally picked up by radio receivers under typical reception conditions.

The way it works is basically like this: at the transmitter end of things, we broadcasters boost the "high end" (treble) by a pre-determined amount, defined in the US as a maximum of 75 µS. The listeners' radios are designed to do the opposite, bringing the frequency response back to normal. While this sounds sort of nebulous, it can be described fairly simply.

(For the examples given below, imagine a typical VU meter as a reference.) The audio frequencies from deep bass to about 2 kHz are flat (all at 0 dB on the VU meter – the division point between the red and black areas on the meter)

The treble boost used for pre-emphasis starts at about 2 kHz (roughly the frequency area where "the chalk on the blackboard scratching noise" is most prominent) with a 2 dB boost (+2 dB on the VU meter). As you go higher in frequency, the boost continues rapidly higher and higher until you reach 15 kHz – the upper limit that most people can hear. (For those, like me, who can easily hear that high, 15 kHz is about the frequency of the high pitch tone or whistle your TV set makes while it is on.)

At 15 kHz the boost is around +17 dB. On a typical VU meter, this would be waaaaaay off scale!



①

The radio receivers out there tuned into broadcast signals apply an opposite response curve to the audio to bring the final frequency response back to normal. Now, let us return to what this means to the audio processor, and why it is so different in the digital domain.

WHAT IS 100%?

The typical FM station is limited to a maximum of 100% modulation. On a VU meter, 100% modulation typically is defined as that boundary between the red and black areas. Already, you might see that we have a little problem here.

The only way to fit everything in without going well into the red is to turn down the level until the 15 kHz audio components do not exceed 0 VU. This will place the bass energy at about -17 dB (barely registering on the VU meter). This is the game the audio processor has to do when we require them to be used for our loudness wars, only the audio processing has to react to this change rapidly to keep program audio disturbances to a minimum.

Those who remember the sound of processing during the classic era of radio using wideband solutions may recall how stations became really quiet during cymbal crashes, and sharp "Ess'es." Another anomaly commonly heard back in the good 'ol days of processing was when you had a song where the drummer is tapping away on the cymbals while the singer holds a note.

Every cymbal tap would rapidly modulate the singer's voice downward. After the cymbal tap, the voice level would jump back to normal levels till the next "tap" of the cymbal. The overall effect was sort of like the singer was pounding on their chest at a rate matching the cymbal crashes. I call this effect "high frequency pumping."

HIGH FREQUENCY LIMITING

Processors in the late 70's got around this problem by splitting the pre-emphasis band where the boosted frequencies basically went to their own limiter, leaving unboosted frequencies alone. This solves the problem of high frequency pumping.

This change allowed for greater loudness gains. Managing the pre-emphasized audio with processing causes a profound change in the "balance" of the audio texture. This is especially true when maximum loudness is needed. It causes the high frequencies to become "smeared, or smashed."

The split-band technique (which lives on today in one form or another) causes the high frequency texture to become extremely "thick" under heavy processing needed for loudness. This is most easily heard when punching back and forth between the "program" and "air" on the studio audio monitor.

High frequency management these days is performed primarily by the audio clippers, which are used to "chop off" any audio peaks that exceed 100% modulation. The louder you need your station to be, the more you drive the clipping level, which also increases distortion on the audio. We discussed this effect in April last year.

Since we are boosting the high frequencies much more than the lower frequencies, the treble area of the audio sees much more clipping than the low frequency material. This becomes most noticeable when listening to snare drums.

When punching the studio monitor between "program" and "air," you will notice that in "program," the snare drum sounds clear, and in the forefront. In "air," the snare drum all but disappears. (By the way, the louder your station is on the radio dial, the more you will notice the disappearing snare drums.)

With these two points in mind, the biggest thing you will notice when jumping into the digital space is the complete disappearance of the above two observations.

CLEANER PROCESSING

Since pre-emphasis is not needed in any digital audio broadcast medium, increasing loudness does not mean an increase in the above odd anomalies with which we have become familiar in analog broadcasting.

This is a big plus in one way, although it could be a negative for radio operators who have defined their programming around this sound. It is possible to recreate this effect to a degree, and as we wrap up this part of the series, you will hopefully have the knowledge needed to do that without disrupting the quality of the digital signal too much. More on what I mean by that later on!

The digital audio broadcasting world has introduced most of us to a new tool for "modulation" control. Since we cannot use audio clipping, we have to look to something called a look-ahead limiter. How does it work? Why have we not been using it for processing before now? That will be our next topic.

Cornelius Gould's mission is to rid the world of bad sounding audio. Meanwhile he moonlights as Senior Staff Engineer for Infinity Broadcasting in Cleveland, Ohio. Corny can be contacted at: cg@radiocleveland.com

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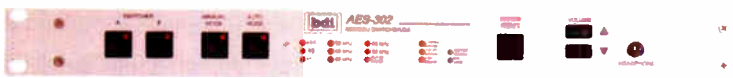

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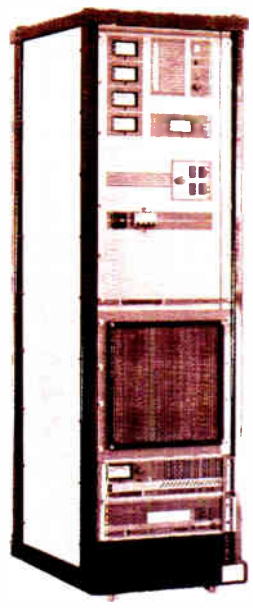

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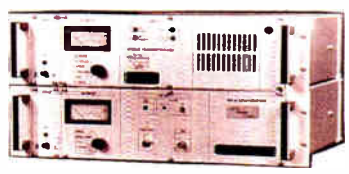

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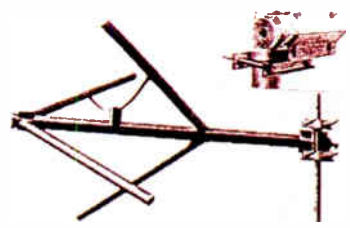

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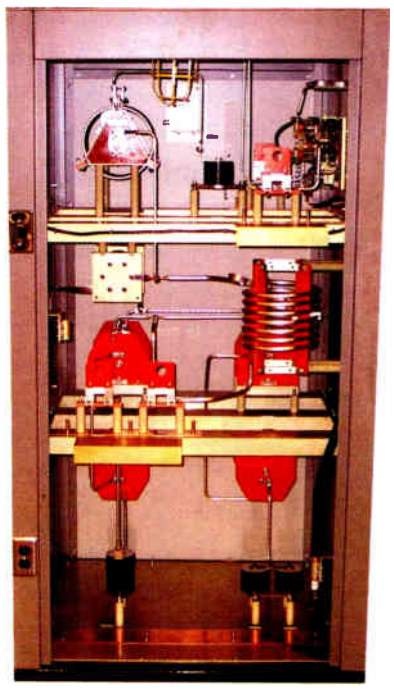

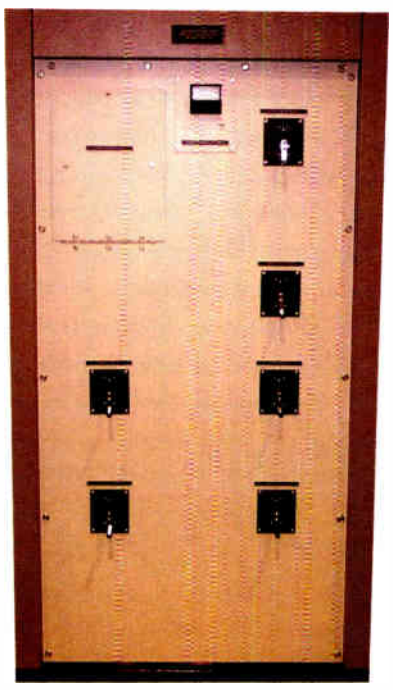

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Tower Topics

We Deal in Steel – The Truth About Towers

Part 3 – Towers Meet Mathematics

by Leonard Weenou, P.E.

[SEDONA, Arizona - December 2004] In this series, we have been discussing the selection and design concepts of towers in general, and using the information to start planning a "fantasy" tower. Last time we considered the principle specifications and loads, and identified the limitations of our location for our theoretical project.

Although we promised last time to start pinning down some specific details, on reflection I think in our discussion today we should make sure we define and understand some of the important terms.

WHAT IS THE TOWER'S PURPOSE?

Among the most important things we need to answer: exactly what does this fantasy tower – or your real tower – really have to do for us?

At the most basic level, we can reduce the criteria to these areas:

1. **Hold up the station antennas. (or *be* the antenna if it is for an AM station)**
2. **Hold itself up.**
3. **Survive duress.**

Now there are tower 'builders' who are the people who put up structures by rote to accomplish these goals, and they just replicate what others have done in non-critical applications. There are tower designers who just use tables and basic GEP (Good Engineering Practice) to tailor installations.

Then there are the engineers who know the physics and mathematics of what they are dictating to be erected, and can speak with authority about the structure. These latter talents are especially needed in purpose-built, near one-of-a-kind or highly customized structures. So how do they do this?

ENGINEERS LOVE TRIG!

The fruits of trigonometry* are all over and around us and most of the world we know. Trig helps define and evaluate many of the forces that we encounter. Trig is so ubiquitous, it has become part of our lexicon.

A tower is a mass of triangles.

1. Hollywood writers refer to the story "arc."

2. We all know people who are "off on a tangent."

3. And all through the sixties, everyone wanted to know "hey baby, what's your sine?"

Seriously though, for design and evaluation purposes towers, in the main, can be divided into a large series of triangles, and trig is for triangles.

Why this love affair with triangles? Because the triangle is the strongest form in nature. Even without physics training, a study of nature, even human nature would show you this. For example, when challenged, most people move into a triangular support stance – legs out, forming a triangle with the ground and leaning forward, creating another vector triangle with the ground.

A study of a well-designed tower through field glasses or a spotting scope will reveal that it is a mass of triangles. Even four legged self-supporting towers achieve rigidity and strength through using face diagonals and gussets or wedges in the corners making triangles.

A closer look at a "mass of triangles." Recently assembled seven foot face, by twenty foot high, triangular sections await stacking."

THE TRIANGLE AND THE GUY WIRE

In a guyed tower, a most important diagonal (or hypotenuse) of that triangle is quite often a guy line.

It is worth noting that a guy line has no strength in compression and so contributes its supporting capability only when in tension. Even so, only when in extreme tension does the line take on the characteristic of a straight element. For the most part, the guy line geometry is a catenary – an arc. By the way, trig works for arcs as well because what is an arc for evaluation purposes but a long series of very tiny triangles?

The purest catenaries are unilateral with even elevation high points at the ends and the maximum sag in the middle such as you see on power lines in southern New Jersey, the flattest land space on earth. The even elevation of the end points and the uniform weight of the wire create this symmetry.

Since the guy line connections on our guyed tower are uneven in elevation (low earth point at ground level at the anchor and a higher connection point at some elevation on the tower), the arc is uneven with the maximum deflection (sort of a sag) not normally at the midpoint of length.

Guy wires have no strength in compression – only in tension.

Now I mention this catenary circumstance for three reasons:

- One, the use of straight-line calculations for stress analysis is a fiction. However it is a fiction close enough to be accurate.
- Two, because of the catenary, cable length, the varying tension, etc. the phenomena of line resonance and period harmonics becomes of interest and possibly some concern. We will get back to this – I promise.
- Three, deflection (the differential value of sag from a theoretical straight line between the two connection points) and period of oscillation can be used then as secondary indicators of cable tension and guy tension balance.

Next time we will delve further into tower fabrication and define some more terms we have or will encounter, so we are all on the same page so to speak. Please bring your calculator.

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* To be precise, trigonometry is only that portion of mathematics that deals with the special properties of a right triangle. However we will include here much of geometry and some other small sections of helpful related math elements and throw them into what most of us think of as "trig."

A legendary consulting engineer, Leonard Weenou has overseen many tower projects. So far as we can tell, all have stayed erect! Contact him at editor@radioguide.com

ENGINEERS AND TOWER ERECTORS (RIGGERS)

[SEDONA, Arizona - December 2004] In a gross simplification, the difference between engineers and riggers is that the former have a strong knowledge of concepts and a workable knowledge of materials. Conversely and complimentary, riggers have a workable knowledge of concepts and a strong knowledge of materials.

If these two groups work together and harmoniously, your tower has the greatest chance of being as close to perfect as possible. Even on the simplest of projects, riggers should never be allowed to do their work without ready access to the design engineer.

In the case of a new tower, the execution of its construction is normally straightforward, and unless erection limitations are noted on the drawings, the riggers can normally just follow good construction practice and mandatory regulations to safely and expeditiously proceed to conclusion.

Retrofits, especially in the current tower sharing enthusiasm, represent the greatest danger to the rigging crew with the real possibility of exceeding the design limits of the structure. The static loads of the final installation may be well within capability, *but* the dynamic forces during the retrofit may exceed safe limits unless precautions are taken.

In the above circumstance, the engineer should dictate a detailed CPM (critical path method) schedule of exactly how the work should proceed (sequence, manner, means, limitations, hazards, etc.).

On the other hand, riggers should neither feel free to vary from this CPM nor should they feel that they could not question the plan. We are all human (with those feet of clay) and we do make mistakes. Good riggers understand that when your life is on the line, you have the right to ask questions to ensure if what is written is really what is needed to be done.

Rigging work is tough and demanding even on the ground. Two pros manhandle a tall tower anchor fanner plate adapter into place to be "pinned."

Clarity is everything in these instances and a good dialog and exchange of concerns between the different disciplines does nothing but lead to a safe, zero-defect project. – *Radio Guide* –

FCC Focus

Keeping the Antenna System Legal

by Alan Alsobrook

As promised in September's issue, Alan returns to his discussion of some key areas targeted in inspections by the FCC and the Alternate Inspection Program.

[ST. AUGUSTINE, Florida - December 2004] When inspecting a station's plant, it is impossible for anyone to think of every place to look, even with an FCC Self-Inspection Checklist in hand. More importantly, there are many things that – while not illegal – can degrade operations unless they are caught by regular maintenance.

As with our previous discussion of technical operations, the goal of this article is to help you find the right places to check *before* the inspector arrives.

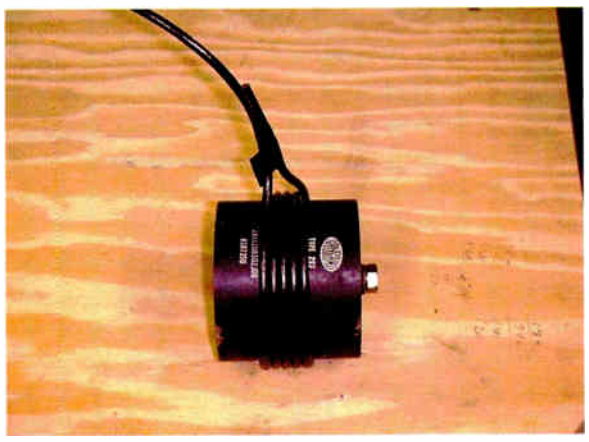
GROUND SYSTEM INSPECTION TOOL

Another fairly recent addition to the AM checklist concerns a visual check of your ground system. What an inspector will be looking for on a visit is that all of your radials appear to be intact, and that they are properly buried as per your station license. (If your license specifies a buried ground system, you should not have any radial wires showing above ground.)

How can you tell if your ground system is in good shape? After a visual check for exposed sections, you can locate your buried radials quite easily with a FIM (field intensity meter) that has an external antenna jack and a sniffer probe.

You can make a sniffer probe easily in your shop. What you will need to make a sniffer loop is about eight feet of shielded coax (RG-58), and a pole on which to mount it. To make things easier for me, I ended up using a broken golf club, which works out very nicely.

To make the sniffer, wind five or so turns about three inches in diameter and tie the center conductor and shield of the end of the loop back to the shield at the start of the loop. I used a G3 capacitor as a form.



Forming the loop.

Tying the ends of the loop together.

Right in the middle of the loop – in this example where we used five turns, it will be the top of the third turn – open the shield. The easiest way I have found is to use some white-out to mark the spot, and then remove the capacitor and cut down to the inner insulator.

Marking the center of the loop.

Cutting the shield at the center of the loop.

When you get the coax shield cleaned at the mid-point, this will give you a small-shielded loop antenna. Then just use electrical tape to hold it all together and dress it for use.

Wrapping the loop with electrical tape.

On the end of the cable you will need a BNC connector; in use, this will connect to the external input of the FIM.

SNIFFING AROUND THE GROUND SYSTEM

Now you can sweep your newly made loop along the ground in line with the radial, and you should see a large upward deflection on the FIM as you cross a radial. (The "Log" mode setting on the FIM works best for this application.)

By the way, I trust when you go to look at your ground system you had to unlock a gate to get to the base of any energized AM tower. The fencing requirements in the FCC Rules are that an "effective" locked fence be protecting the base of every AM tower. Effective is defined for this purpose, as it would keep small children away from the tower.

This leaves quite a bit of latitude for inspector interpretation. From what I have gathered from different inspectors over the years, the fence should be at least four feet high – although many prefer six feet – and of such construction that small children cannot get over, under, or through it.

DIRECTIONAL ARRAYS

At this point, we ought to consider some aspects related to directional arrays. To make sure an array is legal you need to (1) regularly check the monitor points, (2) make sure they are in tolerance, and (3) log the readings. Additionally, when you go to check your monitor points you should be able to get to them following the *exact directions on your license*. Licensees should make certain each point can be located based solely on the description provided in the station's license or a copy of the letter sent to the FCC to correct the license.

The Ground Loop Sniffer ready for use.

Sometimes cities will change things (road alignments, names, numbers, etc.), especially if a new subdivision is built around your monitor point. If you cannot get to the monitor point following the existing "official" directions, you will need to make a correction. To do this, the station must file a letter with the Media Bureau, Audio Division, FCC, Washington, D.C. 20554, containing a corrected description.

You will find a corrected license authorization will not be issued solely for this change, so a copy of the letter must be maintained with the station's files. I would also make sure to place a copy of this correction letter with all posted copies of the station license so that any inspector would be sure to find it during an inspection.

How often you visit your monitor points is up to the individual station. Under the old Rules it was monthly for most stations; under the new Rules it is "as often as necessary." At an absolute minimum I would recommend at least quarterly measurements. (If you do not have an approved sampling system, as stated on your license, you are still required to take measurements at a time interval not to exceed 120 days.)

Meanwhile, back at the transmitter building, do you have adequate metering to make sure the array is operating as required? By this, we mean an antenna monitor system, preferably using an approved sampling system. Normally the allowable tolerance for the current ratio is 5%, and 3% for the phase angle of each radiator, unless otherwise stated on your license.

DOCUMENTATION

Back to something we keep saying is very important: the paper work. When the array was initially installed a full Proof was required. Can you locate it? Not only is this invaluable information, should there be a problem with the array over the years, but all stations are required to have the original Proof along with the most recent Partial Proof on file for inspection.

Again – and I cannot repeat this enough – never throw away any Proof information on a directional array. While some of it may no longer be required to be kept on file, the information in it could save many thousands of dollars when trouble shows up and adjustment is necessary.

Directional arrays can be very difficult to maintain if some part of it deteriorates, and recreating the data of the original Proof prior to working on the problem could be quite expensive. But that is for another discussion; in this one we are basically interested in covering the legal requirements for the array.

If you read this and discover that your array is out of tolerance, for your own financial well being – please – under any circumstances – *do not* run over to the phasor and start cranking knobs unless you really know what you are doing. A few cranks of the wrong knob on the phasor could easily cost you over $10,000 in consultant fees to get it back in shape.

(Continued on Page 18)

FCC Focus

Keeping the Antenna System Legal

Continued From Page 16

TRANSMITTER CONTROL

Another area where inspections often uncover problems is transmitter control. Station operating personnel must have the ability to turn off the transmitter within three minutes, should an out-of-tolerance condition occur. Thus, it is important to make sure that you have a reliable method of turning off the transmitter at all times.

For those stations that have different powers and modes of operation, you must change modes within three minutes of the time stated on your license. I have received some questions about the three-minute time tolerance for switching modes, which is stated in Section 73.1350(d)(2).

For those stations using automated control systems, they should be capable of determining an out-of-tolerance condition and either correcting the condition or terminating operation if necessary for improper mode, excessive power, or excessive modulation.

Manually controlled stations must have a person who can monitor the operation of the station, on duty at a fixed location at all times the station is in operation. After the FCC changed the Rules on controlling of stations they placed the burden of proof back on the station.

The rules also allow unattended operation where there is "Highly Stable" equipment that you can just walk away from as long as you meet all requirements of Part 11 (EAS). Again, if the FCC comes in and finds the station operating illegally, then obviously the equipment was not stable enough to be left unattended.

MAINTAIN CONTROL

If you read the Rules, you can get many different ideas from them. For some issues, it appears you may have up to three hours to make corrections to an out of tolerance operation. On the other hand, some AM transmission problems require correction within three *minutes*, or the station must be shut down.

The bottom line remains that you need to know what your station is doing and be able to control it promptly. Additional information from the FCC on remote control operations is available at http://www.fcc.gov/mb/audio/bickel/noonehome.html.

Obviously, with these requirements you need to have some way of determining that you are in compliance with both modulation and power output rules. This would indicate you need some metering devices such as modulation monitor, base current meter(s), output power meters, or some other valid method of determining your correct output power.

Several years ago the Rules were relaxed as to exactly what you need to make sure you are in compliance. Of course some stations decided that that means you do not have to have anything.

This is obviously not the case since you are required to be able to determine your compliance with these items at all times. So not only do you need to have them but, also, they must be calibrated and you should keep a record of that calibration.

Please note that according to the Self-Inspection Checklist, you are required to log all meter calibrations per Section 73.1820(a)(2)(iii). But when you read that section you will see that it only applies to AM directional stations without an approved antenna monitor. If you should get dinged for this you might be able to make the argument that the Rules do not require the logging of calibrations. Of course the first choice would be to avoid any hassles all together and log the calibration.

HOW LOUD IS TOO LOUD?

Finally – if you are feeling brave, let us take a quick look at your modulation monitor. For AM stations the Rules state, "In no case shall the amplitude modulation of the carrier wave exceed 100% on negative peaks of frequent recurrence, or 125% on positive peaks at any time." I am not sure exactly how you can exceed 100% negative modulation, so the best bet is to not to even hit 100% negative modulation. With the current processor technology there is no reason this should be a problem.

For FM stations the Rules allow you to run 100% as referenced to 75 kHz deviation. You may add up to 10% more modulation at a rate of 0.5% for each 1% injection of an SCA signal up to a maximum of 82.5 kHz deviation. While out inspecting, I have walked in on stations that were modulating as high as 115% – without any subcarriers. Had I been the FCC, I would have whipped out my NOV pad.

In a future article, I plan to go into depth on how to determine your station's modulation. While it seems simple enough, according to those Rules cited above, it can get quite involved. Hopefully, I will have a chance to take a close look at some of the newer modulation monitors to see how well they work, and pass on some information to you.

Alan Alsobrook is a contract engineer based St. Augustine, FL, when he is not out inspecting stations for the Florida Association of Broadcasters AIP. You can contact Alan at aalso@bellsouth.net

The Worst I've Ever Seen

A periodic display of curious solutions for technical problems.

[December 2004] Sometimes we need to attenuate a signal in order to properly handle it.

Most know that each connector carries with it a small insertion loss. Of course, at times it might be easy to let this concept get away from us ...

Do you have a picture demonstrating genius in engineering, or something that wouldn't win the "consolation prize?" Send it on to us, so we can share the good, and the not-so-good! Email your worst to: **radio@broadcast.net**

Leading POTS Codecs Compared.

	Comrex Matrix	Tieline Commander	**Zephyr Xport**
Audio Bandwidth @ 24 kbps	14 kHz	15 kHz	**15 kHz**
@ 19 kbps	11.2 kHz	9 kHz	**15 kHz**
Direct Internet Software Updates	No	No	**Yes, via Ethernet port**
Digital PC Audio Input	No	No	**Yes, via Ethernet port and supplied driver**
Audio Metering (XMIT/RCV)	Transmit only	One-at-a-time	**Simultaneous**
Audio Processing	None	Simple AGC	**Digital multi-band AGC with look-ahead limiter by Omnia**
Remote Control	No	RS-232 and dedicated computer	**Ethernet via Web browser**
Auto Dial Storage	19 Numbers	50 Numbers	**100 Numbers**
Frequently-Used Settings Storage	none	none	**30**
Standards-based POTS Codec	No - Proprietary	No - Proprietary	**Yes - aacPlus (MPEG HEAAC)**
Transmit-Receive Quality Display	No	Yes	**Yes**
Contact Closures	2	2	**3**
Display Resolution	120x32 LCD	120x32 LCD	**128x64 LCD**
Analog Cell Phone Interface	Optional	Standard	**Standard**
Mixer Inputs	1 mic, 1 mic / line	2 mic / line	**1 mic, 1 line**
Phantom Power	No	No	**Yes - 12 volt**
Automatic Voice-Grade Backup	No	No	**Yes**
Power Supply	External	External	**Internal auto-switching**
Local Mix Audio Outputs			
Headphone	Yes	Yes	**Yes**
Line Level	Yes	No	**Yes**
Direct Receive Audio Output	No	Yes	**Yes**
Uses ISDN at the Studio Side for More Reliable Connections	No	No	**Yes - your Zephyr Xstream becomes universal POTS and ISDN codec.**
Available ISDN Option	$850.00 (adds MPEG L3 & G.722)	$850.00 (adds G.722)	**$495.00 (adds G.722 & state-of-the-art AAC-LD for high fidelity and low delay)**
List Price:*	$3,700.00	$3,650.00	**$2,495.00**

The world's most advanced POTS codec
is also the world's lowest priced POTS codec.

Telos
AUDIO | NETWORKS

* Refers to base MSRP without ISDN option as of 5/1/04. The Telos logo, Zephyr, Zephyr Xstream, Zephyr Xport are all registered trademarks of TLS Corporation, © 2004. aacPlus (TM) Coding Technologies. Comrex, Tieline and associated trademarks are property of their respective owners. Product spefications quoted from manufacturer's most current published documentation at time of printing.

The routing switcher gets a new twist.

(About five twists per inch, actually.)

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

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

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

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

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

Are you still using PC sound cards?

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

Livewire

< · · · > 100/1000

There's a better way to get audio out of your PC. No more consumer grade ¼" connectors — with Axia your digital audio stays clean and pristine.

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

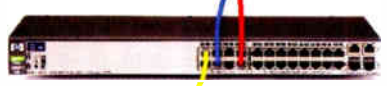
Put your preamps where your mics are.

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

Put your snake on a diet.

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

An Axia digital audio snake can carry hundreds of channels of digital audio on one skinny CAT-6 cable. We know you're not going to miss soldering all that multi-pair...



With a little help from our friends.

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

Would you like some control with that?

There are plenty of ways to control your Axia network. For instance, you'll find built-in webservers on all Axia equipment for easy configuration via browser. PathfinderPC® software for Windows gives you central control of every audio path in your plant. Router Selector nodes allow quick local source selection, and intelligent studio control surfaces let talent easily access and mix any source in your networked facility.

Control freaks of the world, rejoice: intelligent Axia mixing surfaces give talent complete control of their working environment. Reconfigure studios instantly and assign often-used sources just where they're most useful.

ENCO SYSTEMS

Scott Studios

radio SYSTEMS

BALSYS

Axia is already working with some great companies. Like Enco Systems, Scott Studios, Radio Systems, Balsys Technology Group, and of course Telos and Omnia. Check AxiaAudio.com/partners/ to find out who's next.

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

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Remote Broadcasting on Campus – A Primer

by John Devecka

[BALTIMORE, Maryland - December 2004] While having a well-designed and staffed studio helps provide a truly professional image for any campus station, it is when the station "goes out to the listeners" that it really becomes an integral part of campus life.

For example, sports events seem a natural for remote broadcasting, although some of the rights may have been sold to local commercial broadcasters, and may present some difficulties. However, sports events can also be the hardest events to do right. What about the other myriad of events that are going on – right there on campus – that you can promote, highlight, participate in, and broadcast?

YOUR EVENT IS THERE, BUT YOUR STUDIO IS HERE

Of course, once you have decided to spice up your broadcasts with some sports and maybe some campus events programming, how do you do it? You could lug a recording system out there – and bring back the material for editing and later playback – or you could find a way to remotely feed your main studios with the programming.

Remote broadcasting presents some common issues, and there are a wide variety of solutions for these problems. Like anything in broadcasting, when someone asks: "how do I do it?" the first reply is always, "how much ya got?" So, as we look at the various options and explore a bit, perhaps some of these suggestions will fit your situation, or remind you of the people you need to call.

What follows is ranked (very roughly) by typical cost from the cheapest to the ones for which you go for a grant. Nevertheless, as we move along we will try to avoid an overly detailed discussion about exact costs, since some of these items can be had for a wide variety of prices.

The cheapest way to send audio from a remote site.

As an example of your options, allow me to mention two reasonable resources for used broadcast gear: www.radio-classifieds.com and www.ebay.com. There is one caveat though: you should also be friends with someone who knows which end of the soldering iron burns, just in case your used gear looks like Jake and Elwood's car at the end of the Blues Brothers.

FIRST THINGS FIRST

There are a few basic things you should do, before you even begin to embark on a remote broadcasting quest. One is to make friends with the people who handle telecommunications on your campus. And I mean, go and meet them, buy them a coffee, ask them questions about their jobs, about how phone infrastructure is done on campus – anything and everything you can do to make sure that they *like* you, so when you ask for a favor, it just might happen.

If you do not know how to make friends like this on your campus, *learn now*! This is how many special "things" happen on campus, things which might not ever find their way into the records. Make friends with the IT people the same way.

You get a zillion spare CDs for promotions, right? Do you know what kind of music the IT guys like? Or the guy that will come fix your broken door or get you the magic key for a storage closet? *Learn!* You will be amazed how much better things can go on a campus when the behind-the-scenes people like you and know that you respect them.

SIMPLE AND QUICK

Here is where those friends in telecom come into play: The easiest solution is to have direct audio connections from key campus sites, like the sports centers or the Mall, to the studio. This is usually done using a "dry pair" line from the location to the studio.

(A "dry pair" is a line running from one point to the other without passing through any transformer or patch locations. In other words, it is like running a phone line all across campus, except you do not have to deal with "ring voltage.")

Usually, you can get a campus phone technician to provide this kind of line for you. If so, it makes it much easier to walk over to the event location, connect up your audio and go right on-the-air. On the studio end, you simply connect the line like any other input on the console and run it.

It is possible the phone techs on your campus will do this at no cost to you. While nothing is ever truly free, it is possible. Assuming you are able to accomplish this, your basic portable mixing board can be connected (line out) to the line back to the studio and away you go. You also may require amplifiers or equalizers to do this, but they are relatively cheap. See – your newfound friends have already paid off!

OTHER CONNECTION OPTIONS

The second easiest solution is a direct audio connection using coaxial, fiber optic, ethernet or another point-to-point cable from the remote site to the studio. With these options, you will need some kind of analog-to-digital converter to make the audio enter and a digital-to-analog converter to exit the cable, but that is usually not too expensive.

A heavily wired campus may have some or all of these options already in place. And, your friends (remember them?) in telecom or IT may very well have some of the gear you need sitting on a shelf.

In our case, everything audio on campus is "home run" to a central phone room, and everything video to a cable TV room. Chances are that your main sports areas will already be wired in some manner for audio and video. If not, there are wireless options, and we will get to them; for now, please be patient and let me finish this one first.

If you have a cable TV system running on campus, you can probably use sub-band, or "T" channels to insert programming that can run all over the system but not be seen (or heard) by the standard cable connection. This means that you can insert audio at the sports location on channel T-9 (for example) using a cable TV modulator, and extract it anywhere in the system using a T-9 receiver.

By the way, do not be surprised if your campus cable guys have a couple of these units just lying around. At the very least they can probably point you to cheap sources for these. As a bonus, if you need it, you can also send video this way, opening up all sorts of possibilities ranging from letting the studio engineer see what is going on at the remote to aiding staff in troubleshooting various problems that might come up. ("Use the second jack on the left side. No, the *other left side*!")

USING THE TELEPHONE SYSTEM

The on-campus telephone system will usually offer you a variety of options, especially if there is a campus phone line near the event location. The most common approach would be to directly connect an open telephone line to the studio – similar to using a "dry pair," but likely to have more "noise." To do this though, you need to strip out the "ring voltage" that exists on standard lines using inexpensive phone taps. Warning: forget to do this and you may fry gear at both ends!

Another way to get audio to the studio would be to use the campus phone system as a dialup connection to the studio phones. The main disadvantage is that this requires the purchase of equipment to connect and dial. The advantage would be that you would be able to use the dialup equipment for away games as well.

Sometimes, you can get these systems connected with analog lines in your studio (or other places) – again by asking your campus telecom friends. They often need to put in analog connections for fax machines, so you can just tell them you need a fax line in your studio (but I would suggest you make sure it is analog anyway). At our campus, we have determined the campus PBX system easily can drop analog lines in most places that we need them with only a couple of days' notice

DIGITAL PBX FUN

However, there can be some real issues with campus telephone systems. Generally, these are digital PBX systems (meaning Private Branch eXchange) that are centrally connected on campus before they go out to the "real world." Digital systems have special methods for carrying the signals around campus and use special handsets. They are virtually all proprietary and unique; all too often your gear is not going to be directly compatible.

For that reason, you need to make sure anything you use to connect is able to deal with the digital signal. The easy solution – as usual – involves money: JK Audio [www.jkaudio.com] introduced a PBX hybrid at the last NAB show and it offers the simplest solution. They claim this unit is compatible with all digital PBX systems, barring handset-wiring issues.

Once you have hooked up this gear, you can call in from anywhere on a regular handset to make announcements. If you desire to make mixes, look at other products from JK like the ComPack. It connects into a PBX from the other side of campus and lets you do your remotes quickly.

If you cannot get analog lines, do not have access to equipment which can protect you from ring voltage or digital signals and you just *have* to make a wired system work, there is one more option. Transformers can be used to knock out voltage at both ends of the line; a quick and dirty example is using a transformer to connect your speakerphone to the console. I can direct you to a very nice site where Rane has offered a lot of information: http://www.rane.com/note150.html

"Can you hear me now?"

Perhaps more flexible in many ways – but more expensive – are wireless links. We will pick up with that topic next time.

John Devecka is the Operations Manager for WLOY at Loyola College in Maryland. He has friends in IT and Telecom, and is currently trying to get them to do their own radio shows. For more advice on butt-kissing around campus, email John at: wloy@loyola.edu

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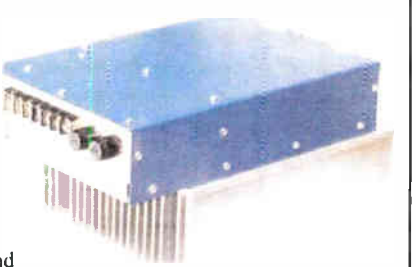

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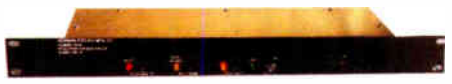

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Things You Need to Know

Dealing With Flu Season

Reports coming in from all over the place indicate that this year's flu season has started. Due to the way the news reports have sensationalized the reduced supply of flu shots, many people have become much more worried than usual about becoming infected.

GERM CENTRAL

Since flu is very contagious – passed on by air and skin contact – a radio studio could be among the more difficult places to work without endangering one's health. While health professionals advise staying out of places where people are coughing, sneezing or showing flu-like symptoms, the Control Room is hard to avoid. Just one sick announcer could take out the whole staff in a matter of days.

Fortunately, it does not take too much effort to provide a measure of protection for your staff, and with a little cooperation, it is indeed possible to get through the flu season without losing all your live announcers. Furthermore, some of these suggestions are worth implementing all year long. It will promote a healthier environment and staff, with fewer lost workdays.

BASIC STUDIO HYGIENE

Many people immediately focus on the microphone, as that is a place where many announcers hold their lips millimeters from the metal or windscreen. As they speak, they naturally transfer saliva – or worse. Even in good times,

However, the first line of defense should start before anyone even gets close to a microphone. While it might raise the overhead for a few days, an alert GM or PD will help the entire staff to see the need to stay home when sick. In fact, being overly cautious would not be wrong.

The second line of defense is basic personal hygiene. Each staff member owes it to his or her workmates to give close attention to the work area. Washing hands (the station could well provide anti-bacterial soaps and hand wipes) before touching the door, the console, the microphone, the telephone, etc, are all important. But what of the person before you?

Many stations have a can of some anti-bacterial agent in the Control Room. Sadly, the container is often empty. Not only should there be proper cleaning products available, the staff should have training to actually use them. The agent can be as little as a 10% solution of Clorox and water, or something much stronger. Cleaning wipes and paper towels should be readily available.

Remember that flu germs, like many others often are transmitted when someone touches a place where the germs have been deposited, and eventually touches the face, eyes, etc. The key then, is to clean the air and places where people are likely to touch.

CLEANLINESS IS NEXT TO HEALTHINESS

Some of you may remember the days when each announcer was told to clean the heads and pressure rollers during his/her shift. Today's training is not so very different: at each shift change, the Control Room should be disinfected. By cleaning all common surfaces, we go a long way to preventing germs from being transferred.

One warning: be careful about spraying liquids on surfaces. Liquid solutions can get into and destroy many things from key contacts to monitor screens. Whatever is used should be tested, and best carefully applied with swabs, paper towels, etc.

After surfaces are cared for, it is important to give attention to the air and ... yes ... that aural scoop that is the focal point of the room – the microphone. You probably do not need a CSI team to know there are billions and billions of germs hiding right there in the pop filter or windscreen.

The best way to handle this is to give each announcer their own windscreen, and make them responsible for regularly cleaning it. If that is not possible, clean and rotate several common windscreens.

Just as with the various surfaces, chose the method of cleaning carefully. Hot water and a mild cleanser may well provide longer life for the pop filter/windscreen. Check with the manufacturer if you want to use something stronger.

That leaves the air in the studio. While the obviously best approach is to have good air movement, so the air is constantly replaced with fresh air, this can be difficult in weather extremes, or in studios designed merely for quiet air flow.

Some advocate the use of electronic devices that use ozone or other methods to cleanse the air. A few products advertise their "disinfectant action" to the air passing through.

SELF PRESERVATION

Staying healthy can be a challenge. Drinking fluids, taking proper doses of vitamin C, zinc, echinacea, etc, will go along way to keeping your body's natural defenses strong. Bring your own pens to work. And remember: Mr. Monk is not the only person who wipes his hands right after shaking hands with someone.

The goal is to stay healthy and avoid the flu. We wish you good health! – *Radio Guide* –

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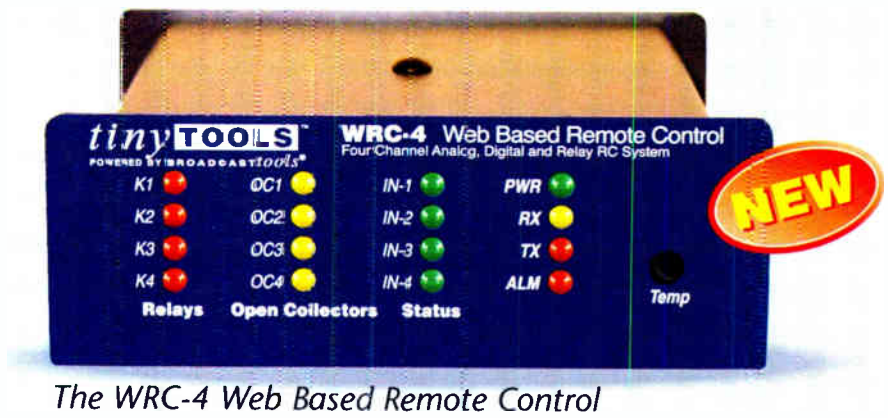

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High Voltage is Not Your Friend

by Dave Dunsmoor

[MINOT, North Dakota - December 2004] When working with equipment utilizing high voltage, it is a given that we stay clear of energized elements. But what constitutes "high" voltage? And how far away is safe? How can we determine both what is safe for us and safe for our equipment?

Forty volts seems to be the threshold that activates the "HV" annunciator on many DVMs today. I never used to consider this seemingly low voltage to be a problem. However, manufacturers (or their attorneys) presumably have done the research indicating anything over 40 V is potentially hazardous.

Current is the dependent variable here; its value is the result of the applied voltage and skin resistance. Very low currents – way less than 1/10 of an Ampere – can bring severe pain, loss of breathing and/or muscular control, and even heart fibrillation. As little as 50 mA can be fatal. This is why the "One Hand in the Pocket" Rule is a good one – it has saved me at least once.

Since I personally prefer to avoid such empirical research into the subject, I will use 40 V as the point where I do not poke about with my bare hands.

Now that I have defined 40 V as "high voltage," just how do we go about safely troubleshooting equipment that generally has far more potential in it than this? After all, it seems like many feel it is just "common knowledge" that you have to do some "fingerpoken" to get the job done.

KNOW THE CIRCUIT

Probing equipment with a voltmeter can usually be done safely if you are very careful to keep in mind where your hands are and where the energized parts are located. This rule works well until you get distracted, or are tired – situations that can easily occur during a callout to make repairs.

Older audio boards, new audio boards' power supplies, older transmitters, newer transmitters, receivers, and computers all have high enough voltages in them to be truly hazardous. If you treat them all with the required care and respect you will reap the benefits of (1) keeping your life and good health, (2) keeping your repair time to a minimum, by not having to run out for more repair parts or test equipment, and (3) keeping your self respect and professional status with your clients intact.

Few things will make you seem to be the dull-witted, nerdy stereotypical engineer quicker than a "snap!, flash!, and a puff of smoke." Someone will always notice the event.

DANGER COMES QUICKLY

Consider this: the override of your nervous system when you contact a high voltage source is instantaneous. You have no control over the muscles involved. Just like the FM capture effect, the strongest signal prevails. Your fist will clench, your arm will jerk, chest muscles contract, and your heart may stop.

Even if you do not receive a severe enough shock to do permanent damage, you may suffer substantial cuts as a result of this involuntary reaction. Worse, while your hand is busy impaling itself onto some hardware, that open wound now provides an even better electrical path, and the damagecould become even more life threatening. This is an immediate effect – you simply cannot pull your hand out before the electricity has done its work.

I have managed to arrive at the ripe old age of 53 relatively unhurt, partially by luck in my earlier years and mostly by being careful in the later years. Troubleshooting or adjusting transmitters often requires the determination of high voltage levels and comparing these values to either published specifications, or to theoretical or logical values. The only safe way to do this is to power the equipment down, carefully connect your test equipment, then power everything back up and interpret the metering indications.

Truthfully, I (almost) always do this for anything over 24 volts. And I when I say power down, I mean for you to give it time to discharge completely. Use the shorting stick – after all, it is there to protect you.

TAKE YOUR TIME

Sure, I have poked around in live service panels checking for an open fuse, as I am sure all of you have. I just no longer think it is worth the time saved. First, it is just too easy to contact live parts, and secondly, the test leads and probes can fail to provide the insulation protection as designed. You do not need any information so immediately as to chance being hurt or killed while doing your work

I was nearly knocked off the chair at the bench some years ago by "only" 500 volts in a two-way radio. I felt it clear into my chest even though I did have one hand in my pocket.

Many DVMs now indicate 40V as "High Voltage."

Mentally reviewing the event later on, I guessed that the shock I received was similar to the charging of a capacitor – me being one plate, the carpeted floor the insulator and the concrete being the other plate. I do not know for certain what the actual dynamics are. But it was intense, and I do not ever want to experience that again.

An acquaintance of mine was troubleshooting a 2 kV power supply problem some years ago by probing it "hot" with a voltmeter. He was nearly killed, and suffered some severe burns across his chest. Possibly the probes were dirty, cracked, or maybe his hand slipped. No matter, if he had powered down, connected the meter, then powered up when he was outside of the equipment, he would have not have spent time in the ER and ICU.

True, 2 kV does not seem like much when compared to the 10 kV or more usually associated with FM transmitters, but it is a dangerous and potentially lethal voltage. I will submit to you that contact with the 5-10 kV B+ inside tube transmitters will likely kill you before you even hit the floor.

KEEPING THE EQUIPMENT SAFE

Earlier, I mentioned "safe for the equipment." This refers to how you dress your test leads outside the cabinet before you power it back up. I usually bypass interlocks with their built-in mechanical override, then continue. However, if the door or access point you have open does not want to stay open, please be sure to block it open.

Although a set of test leads may fit under the door without being completely pinched off, they can still arc through – or worse, be cut by the door's edge. Then you have at least one more problem to solve before you get back to troubleshooting. And the evidence of you having been there is left forever.

Next, consider test equipment placement. Just because your meter has a plastic or rubber case is no guarantee it will not flash over when you do re-apply the power. Whether it is sitting on the chassis or on the concrete, relying on the case to provide sufficient insulation can be risky.

Insulating matting (or electrical switchboard matting) is cheap enough, and available from many suppliers. It is sold in various lengths and thicknesses, and rated from 20 to 50 kV, with suggested working voltages from 3.5 kV up to 17 kV.

Check your favorite parts and equipment supplier, and if they do not carry it, there is always the Internet. I did a Google search and found several. For the extra $100 or so, I think this is good protection for you and your test equipment. It is also more comfortable than walking or kneeling on concrete.

PROBLEMS FROM LOOSE CONNECTIONS

Another aspect of working with electrical equipment is the open or loose neutral. This most commonly is exhibited by either dimmed or overly bright building lighting. What happens is this: the neutral connection from the utility power transformer becomes loose, which in turn causes the 240 VAC to the building to lose its center tap neutral reference.

The phase-to-phase voltage still reads 240, but measuring from the breakers to the panel neutral will show anything from very low to very high. I have had voltages from 65 to 185 volts at the 120-volt connection. The equipment on the low leg will run poorly or not at all, on the high leg will probably run OK (for a while) but its power supply will be over-stressed and will probably fail early. A third problem associated with this is the offending connection will run hot, and could even start a fire.

This applies to all connections from the utility power to the last bullet in your FM antenna, or the connector to your AM tower. If it is not tight, it is taking power from its intended purpose and generating heat instead. It is a good idea to go through your entire plant annually and check and retighten as necessary all connections, not just the high current/high voltage ones.

A new method to check connections is the non-contact, Infrared (IR) thermometers that are generally available for under $100 (Another Franklin well spent!). They make quick checks easy to do, but I still like doing an occasional physical "back off and re-tighten" as connectors not drawing much current will not heat up much, and thus will not show up on the IR thermometer.

RF VOLTAGE

The last item I want to discuss is an issue for many who maintain transmitter sites, and that is the RF voltages on the AM towers, on the output connectors of the transmitter, or the exposed portions of the ATU components. There is a real problem of RF burns.

I have had RF burns at power levels as low as five watts. So how much worse will 5,000 watts feel? Lots. As I said: I was more lucky than smart in my earlier years.

Five kilowatts into 79 ohms results in about 680 V RMS at the feedpoint – and with full modulation, it rises to over twice that (if you are running your processing hard). RF voltages will be even higher in the ATU, as the impedances are greater at some points in the tuned circuits.

Contact with exposed parts burns – and it burns deep. Quite often RF burns take a long time to heal as it seems like the wound goes clear to the bone, and heals from the outside in.

My "Elmer" once showed me "the wooden pencil drawing an arc from the tower trick," warning me: "Dave, don't ever do this!" Understanding the physics, I will not do that. Yet, some years later I started pulling the metering panel off an ATU while the tower was hot.

The metering cable was about a quarter-wavelength long back to the transmitter building. After the last panel screw was removed, what do you suppose I had in my hand? Yes, a very expensive, very RF hot meter panel. I must have gotten a half dozen good RF burns before I got it put back into place.

TAKE IT SLOW AND EASY

The lesson is clear: think about what you are going to do and how you are going to go about it. Take your time. Thinking a problem through and developing a careful course of action will likely lead you more quickly to an answer – and may also keep you alive.

Dave Dunsmoor prefers not being part of high voltage circuits. His email address is: mr.fixit@min.midco.net

Tips From the Field

Generator Maintenance: Replacing the Starter

by Warren Shulz

According to Warren Shulz, the generator starter is among the most important parts in a radio station. That is because "if that starter motor does not do its job in a power outage, nothing else will matter." Is your generator's starter on your maintenance checklist?

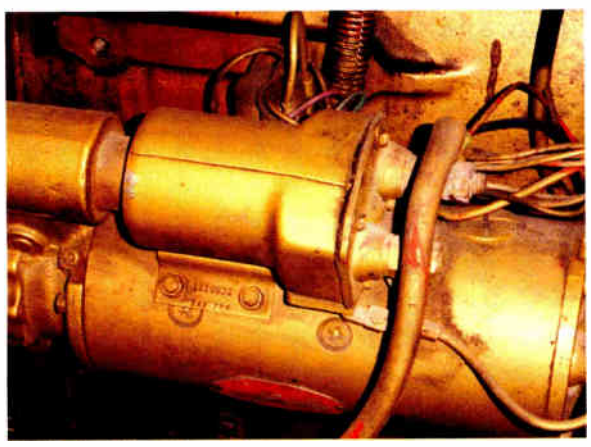
[CHICAGO, Illinois - December 2004] A recent project here at WLS was to replace the 28-year-old starter motor and battery cables on the diesel generator set at the transmitter. This course of action was recommended by the diesel maintenance technician during his last maintenance visit.

However, by doing the work in-house we were able to get the job done for under $600, saving approximately $450 in contract labor cost. If you are considering doing this yourself, you will likely find the major costs will be $450 for a starter and $108 for battery cables.

MAKING IMPROVEMENTS (AND LEARNING) AS WE GO

As with many projects, additional problems will often "appear" as you go, and can be corrected by inspecting the entire system. Often the failure can even be traced to something quite unexpected – or at least a different part of the assembly.

Carefully noting the make and model of the part being replaced will ensure getting the right replacement. It is also worthwhile to note the size of the part, since over the years it is not uncommon for a replacement part to have anything from a different mounting bracket to being a whole lot larger or smaller.



A reference close-up of the old starter.

In our case, the Cummins part number cross-referenced to a Cummins remanufactured 24-volt starter, with eleven teeth and a clockwise rotation.

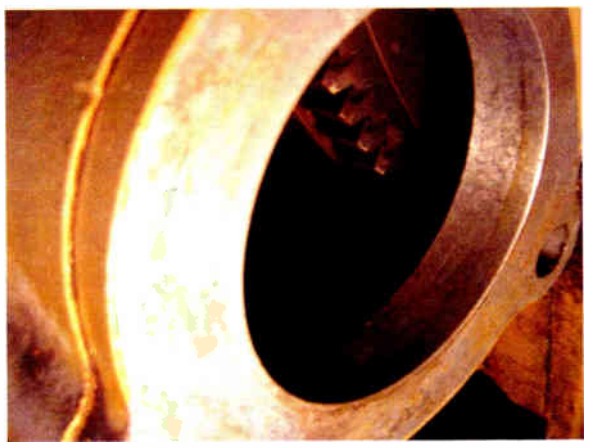
While removing the old starter we noted a concealed brad ground strap had never been connected to the engine block. This was corrected. Additionally, there were a total of twelve positive and negative wires involved in the assembly. Oddly, they were not color-coded. So, we carefully marked each wires "+" or "-" with appropriate tags.

A MINOR HURDLE OR TWO

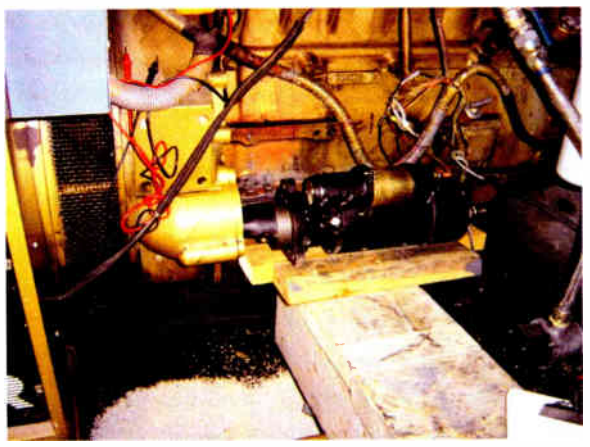
As we put the rebuilt unit on the generator, we did have a couple of small difficulties to overcome. For example, the attachment bracket (between starter motor and mounting surface) needed to be rotated in order to get the starter to mate properly.

This required a Torx bit set to accomplish; the good news was that we had just purchased a set for the tool box.

Prior to inserting the starter into the housing, it is important to inspect the flywheel teeth to make sure the teeth are in good condition for correct mesh so the starter can operate smoothly. If the flywheel teeth are shot, you are facing a big expense.



It is important to make sure the flywheel (shown inside the starter ring) is in good condition for a proper mesh with the starter gear.



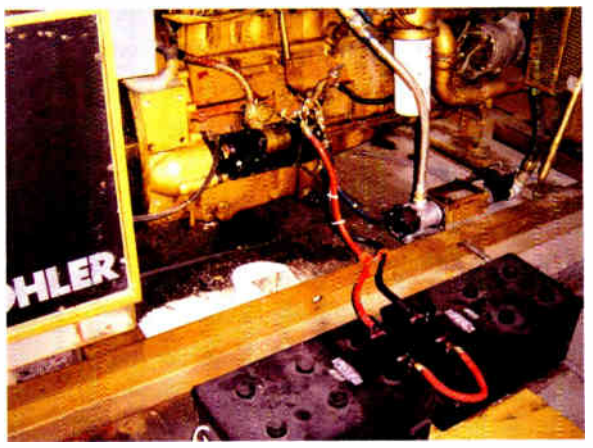
New starter being set in place with "car ramp" to hold it while mounting.

On the other hand, the auxiliary solenoid mounted without a problem, as did the new battery cables. We made up new 30-inch cables for both the positive and the negative connections. To make the best possible connection, we used solder-style lugs with factory installed battery end jumpers; the terminals were coated at the battery side.

As we put the whole package back together, we connected it to the "golf cart" style sealed batteries. We verified open circuit battery voltage and verified the battery charger was supplying rated charge current.

TESTING IT OUT

Once everything was in its place, we got ready and pushed the button for a "live test." As a reward for our careful maintenance and repairs, the generator roared to life without hesitation.



The new starter with new battery cables.

We tested the start-up procedure three times, using spaced intervals. Happily, the new starter plus the new battery leads really "kicks" the motor now. The start-up time is much faster than with old unit; the motor really gets going a lot faster than before. This should result in a faster re-start from a ComEd outage.

Overall, we were pleased that no additional major problems were noted, and I believe the unit is better than I found it. We stored the old starter in our storage area supply cabinet, along with the used block heater, the used day tank pump, and the used day tank sensor switch. Each of these "old" parts was removed before they failed so they become "used spares."

While many of you have generator shops to care for your power backup, sometimes it is helpful to be able to save a little cash by doing some of the work in-house. Additionally, by getting to know the generator better, you will be more confident of its operation should it be needed.

Warren Shulz is the Chief Engineer at WLS in Chicago, Il. Over the years, Warren has picked up a lot of experience in keeping old gear working, and is happy to share. His email address is: Warren.G.Shulz@abc.com

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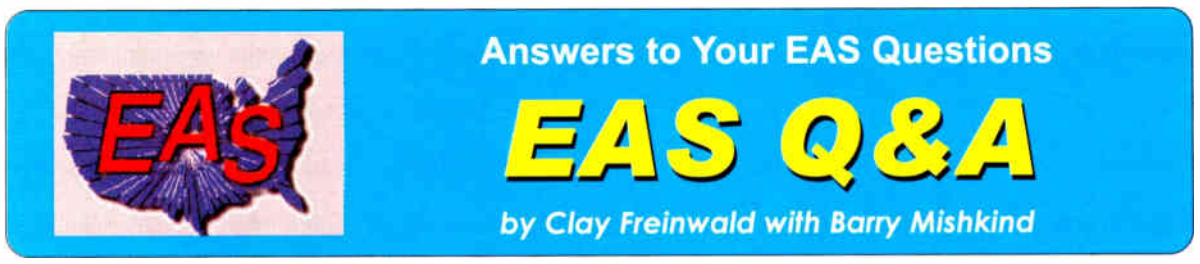


[SEATTLE, Washington - December 2004] As 2004 ends, the FCC's NPRM is on the minds of many in the broadcast and emergency management communities. While all the reply comments and the FCC's decisions are sorted out, those working with the system have questions about current operations. Clay actually has some answers.

HOW ARE WE SUPPOSED TO ...

Barry - Since there is nothing so constant in broadcasting as change, we get a lot of questions from folks who are new to a particular facility, and now have the responsibility to manage the EAS operations. Among the first questions these folks have is "where can we get help on understanding how our unit operates?"

Clay - While it may seem rather obvious, the very best place to start is with the manufacturer. If their manual does not answer your questions, contact them directly with your questions. Most will be pleased to assist you in ensuring their product is working properly.

Barry - Suppose the manual is missing?

Clay - Some manufacturers have their manuals on-line for downloading, usually in the "support" section of their web sites. Another solution is checking with your neighboring stations. Chances are good you will find someone with a manual: a few minutes at the copier and you will have your own manual.

Barry - That works for turning and testing the system, but how about checking the programming of the unit to make sure it is up-to-date and correct? Will the manufacturer help with that?

Clay - Yes and no. Manufacturers can help you understand what the unit is set to do, and even direct you to information on re-programming if that is necessary. However, they have no way of knowing, for example, what signals you can receive from LP stations. Furthermore, policies relating to which alerts to receive and/or forward are something for local management and the LECC (Local Emergency Coordinating Committee) to determine.

In Washington, we have developed some standardized programming to help stations deal with the myriad of options offered by some of the manufacturers. Check with your LECC and/or SECC (State Emergency Coordinating Committee) to see if they have customized recommendations for setting up equipment in your area/region.

WHAT DID THEY SAY???

Barry - Readers often complain about getting EAS messages via a government two-way radio channel. One problem is when the audio has a really annoying hum on it. What can be done?

Clay - Many two-way radio systems operate with what is called CTCSS or Continuous Tone Codes Squelch System. They transmit a continuous low frequency tone to permit selectively opening of the squelch on specific receivers. In land mobile type equipment this tone is filtered out in the receivers.

Unfortunately most of the receivers that Broadcasters purchase to receive EAS messages via these channels is not designed to filter this out. But there are some fairly easy solutions.

1. Get a receiver designed for two-way radio applications. It likely has a built-in filter.

2. Contact a local two-way radio shop; they may have a filter that will work, perhaps from an old radio.

3. Contact your local Amateur Radio Club. Ask to talk to someone that is involved in their "repeater" activities. They may well be able to offer assistance.

Barry - There are also common complaints about distorted audio, low level audio, even "missing" audio. Often, PDs want to stop relaying anything from those bureaucrats who have no concern for how stations sound.

Clay - Oh No – that way, everyone loses. In many areas it has taken several meetings with local emergency officials to help them realize the disruptive effect they can cause on local radio if they fail to prepare carefully before activating EAS. Often the LECC and SECC can be helpful in making the case for more care on their part.

Another, pro-active approach, is to offer help with their audio and EAS systems. They may not have a clue how to set levels, or even how they sound, unless you provide them an "air check." Quite a few local agencies have changed the way they train their personnel once they could hear the "final product" for themselves.

USING THE NWS

Barry - The National Weather Service (NWS) recently got approval to install equipment that will enable it to handle EAS messages. How is this going to work?

Clay - Unfortunately NWS did not want to simply adopt the system we are using here in Seattle (called the "Seattle Experiment") whereby NWR relays EAS messages much like an LP Station. They currently prefer a method where text messages are sent to them over the Internet via FTP (File Transfer Protocol). The messages then are passed along to be read by their text readers.

There may well be a place for this technology, however it may be a hard sell at your local emergency management office to get them to FTP a document to NWS – especially when it is a whole lot easier to encode their public warning message using EAS equipment.

Overall, the NWS has shown a willingness to work with the EAS community, so we can expect systems to get easier for everyone as these (and other) different approaches are tested and evaluated.

Clay Freinwald, Senior Facilities Engineer for Entercom in Seattle, is Chairman of the SBE's EAS Committee as well as chair of the Washington State SECC. He welcomes your questions about EAS at k7cr@wolfenet.com

Tech Tips

Keeping Stuff Out of Your Transmitters

By Gary Peterson

[RAPID CITY, South Dakota - December 2004] I hate cleaning transmitters. There are so many other things I can do with time otherwise spent removing dust and critters from the transmitter cabinets. So, you can understand that I am always on the lookout for tricks to keep stuff out of the transmitters in the first place.

If you dislike spending your maintenance time cleaning dirt and dead bugs out of transmitters, the following tips may help make your life more pleasurable.

HELPING THE FILTERS FILTER

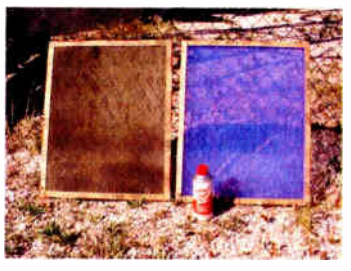
Your first line of defense should always be properly sealing the doors and other openings in the transmitter building. (Although most transmitters have some sort of air filtering, there is no law that says you cannot do as much as possible to trap dust and dirt before they reach the transmitter.)

Of course, the more stuff that your air filters catch, the less you will have to deal with inside the transmitter cabinet. I use disposable fiberglass filters and change them frequently. It is possible to greatly increase the efficiency of your air filters. The trick is to use a good filter spray.

For several years, we have been using RP brand "Filter Coat." It comes in two forms. One is an oily liquid in a plastic spray bottle. After experimentation, we find that we prefer the oily material in the aerosol spray can.

The Filter Coat is available at some hardware stores, and heating/ventilating and air conditioning shops may carry it. I would suggest you avoid the kind that smells like wintergreen. While it will make your transmitter shack smell like Life Savers, I have found that it does not catch dirt very well.

Application is easy: take the new air filter outside and lean it up against the perimeter fence. Shake the can well and apply a light coat to both sides of the filter before installing. You will be amazed at how quickly the filter gets dirty. When I began doing this, I tried spraying the filter on only one of the two transmitters at our site. Within a few weeks the difference was obvious.



The filter on the left is shown after three weeks in typical dry, dusty "Plains" service. It is compared with a new filter.

You will have to change filters more often. But as you can see from the picture, that dirt does not end up inside the unit, where it adheres to all manner of irregular surfaces and, therefore, is much more difficult to remove. If you try a filter spray, the next time you open up the equipment for maintenance, you will notice the difference.

INSECT BARRIER

Of course, use of a good insecticide around the walls and openings will go a long way to reducing the number of critters in the building. I also like to use naphthalene mothballs to discourage both little and some not so little "tenants" from taking up residence.

For whatever reason, certain years and/or seasons seem to result in huge infestations of various insect species. In a bad year up here in South Dakota, "miller" moths can quickly clog a transmitter air filter. They even seem to be able to easily get into what is, for all practical purposes, a tight building.

A FLYING CRITTER TRAP

When the millers get real bad, I leave a pan of water on the floor with a bit of liquid dishwashing detergent added. (Most soapy materials should work.) The only other thing needed is a trouble lamp to clamp to the pan.

Later on, when the transmitter room is dark, the moths will be attracted to and circle the light attached to the pan. Eventually each of the critters will hit the water and the detergent will wet their wings.

On my next trip, all I have to do is dump the water-detergent mix, with all the drowned moths, and refill it with a fresh mixture. None of those critters made it to clog the air filter on the transmitter. Just make sure that you use enough mixture to last until your next visit.

These are a couple of easily implemented ideas. Perhaps you have some other tricks that have worked at your site. If so, please let us know. After all, a clean transmitter is a happy transmitter!

Gary Peterson is the Corporate Engineering Manager for Triad Broadcasting Company in South Dakota. He can be contacted at kzerocx@rapidcity.net

Gear Guide: Automation – Digital Audio – Studio Control Devices

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

BSI

Simian from Broadcast Software International is powerful and reliable digital audio automation software, as well as being very affordable. Simian leverages the power of the Windows environment to give you many of the advanced features of the "super expensive" systems. They even provide some features that they don't, such as a multi-lingual interface and the ability to run other programs, generate dynamic web pages with play list info and remote error notification and control via standard email.

They've worked hard to make Simian a powerful, yet easy-to-use, automation system, with a touchscreen compatible, intuitive interface. You can also download the real software (not just a demo) right from their website.

Broadcast Software International
Phone: 888-274-8721
Website: www.bsiusa.com

Broadcast Tools

The Console Controller IIA provides the solution for interfacing non-broadcast consoles and digital workstations to the broadcast studio. The CC-IIA is equipped with three channels of insert switching. These three channels allow the ON/OFF control of each monaural microphone channel when connected to the console's insert points or between a source's output and a device's input.

The CC-IIA also provides front panel switching for internal (the console) and external (air signal) monitor inputs. Monitor muting and a front panel monitor level control add to the many capabilities of the CC-IIA. Multiple CC-IIA's may be cascaded to increase the number of inputs desired.

Broadcast Tools
Phone: 360-854-9559
Website: www.broadcasttools.com

CircuitWerkes

The pREX, is an incredibly powerful tool for managing and multiplying contact closures in any facility. You can use the pREX to manage your cue system and telephone hybrids, operate on-air lights from multiple inputs, start and stop skimmers, route audio around your studios, convert or multiply momentary satellite closures and more.

Individually programmable relays let you configure the pREX in almost any way imaginable, including momentary, latching, interlocked, pulse stretching up to 45 hours, leading or trailing edge triggered & more.

Free software interface lets you easily program or manage the pREX from any PC equipped with a serial port. Outputs appear on a telco RJ-21 for easy connectivity to a standard telco punch block.

CircuitWerkes
Phone: 352-335-6555
Website: www.circuitwerkes.com

Henry Engineering

Henry Engineering's Superelay is a control interface product that's essential when building or upgrading a broadcast studio. Superelay controls the On The Air warning lights, and provides utility switching for the studio.

Superelay is normally interfaced to a broadcast console's Mic Tally logic, e.g., a contact closure or DC voltage that indicates when the Control Room mic is on. Superelay controls 115VAC On The Air warning lights with a synchronous solid-state relay for noise-free operation without pops, clicks, or arcing.

Superelay's six SPDT relay contacts can be used to switch the various equipment functions that need to be controlled when the Control Room mic is 'live': telephone mute, intercom mute, skimmer start, speaker mute, etc.

Henry Engineering
Phone: 352-622-7700
Website: www.henryeng.com

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Prophet Systems
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The RU-AEC1 is the ideal choice in installations requiring high quality analog audio from an AES/EBU digital audio source. The RU-AEC1 input XLR is 110 Ohms terminated. Audio outputs are available both on XLR connectors and on the full-size barrier block. In the absence of a valid audio input, the output is muted. The RU-AEC1 features operation up to 24 bits, 96 kHz as well as automatic sample rate detection. The RU-AEC1 also features a digital signal error indicator.

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RDL – Radio Design Labs
Phone: 800-281-2683
Website: www.rdlnet.com

Sine Systems

The MBC-1 is designed to replace all the various strobe lights and colored beacons that are a part of most every broadcast studio. It has 15 inputs for relay contact closures or logic level sources and a single serial output that connects to an electronic message display – typically an inexpensive "Beta-Brite" by AMS. Each input can trigger a unique display on the message board and multiple message boards can be connected to a single MBC-1.

The messages are saved in the display so the same input signal can trigger different messages on different displays. A factory setup feature programs the display with a list of starter messages. The display is fully programmable by the user.

Sine Systems
Phone: 615-228-3500
Website: www.sinesystems.com

Radio Guide Tech Initiative

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

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

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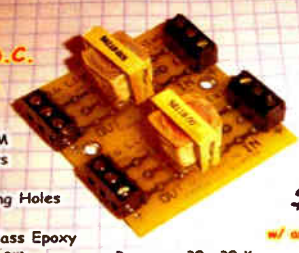

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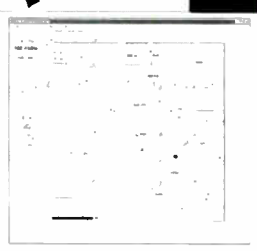

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Broadcast Warehouse - 1, 11	www.broadcastwarehouse.com
CircuitWerkes - 18	www.circuitwerkes.com
CKE - 15	www.rectifiers.com
Conex Electro Systems - 7	www.conex-electro.com
Comrex - 24	www.comrex.com
D&H Antennas - 33	www.dhsatellite.com
DRS Technologies - 27	www.contelec.com
Econco Tubes - 9	www.econco.com
Energy Onix - 2, 9	www.energy-onix.com
ERI - 5	www.eriinc.com
Freeland Products - 17	www.freeland-inc.com
Gorman Redlich - 23	www.gorman-redlich.com
Harris - 40	www.broadcast.harris.com
Henry Engineering - 2	www.henryeng.com
Inovonics - 5	www.inovon.com
JK Audio - 6	www.jkaudio.com
Kahn Communications - 27	none
Larcan - 34	www.larcan.com
Lightner Electronics - 6	www.lightnerelectronics.com
Logitek - 9	www.logitekaudio.com
Micro Communications - 23	www.mcibroadcast.com
NAB - 39	www.nab.org
Nautel - 29	www.nautel.com
Nott Ltd. - 17	www.nottltd.com
OMB America - 27	www.omb.com
Orban - 40	www.orban.com
Peter Dahl - 31	www.pwdahl.com
PTEK - 23	www.ptekpower.com
Phasetek - 13	www.phasetekinc.com
QEI Corporation - 30	www.qei-broadcast.com
RAM Broadcast Sys. - 17	www.ramsyscom.com
RF Specialties - 11	www.rfspec.com
Satellite Lynx - 23	www.satellitelynx.com
SCMS Inc. - 31	www.scmsinc.com
Shivley Labs - 34	www.shively.com
Sine Systems - 15	www.sinesystems.com
Superior - 13	www.superiorbroadcast.com
Telos/Axia - 20, 21	www.telos-systems.com
TFT - 33	www.tftinc.com
Tieline - 5	www.tieline.com
Transcom - 9	www.fmamtv.com

Radio Guide Calendar

List your Convention, Event or Gathering Here
Email information to: radio@broadcast.net

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

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

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

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

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

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

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

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

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

Letters from our Readers

Dear Radio Guide:

I just read George Nicholas' excellent article on *Customer Service in the Radio Station* in the October issue of ***Radio Guide*** magazine. Mr. Nicholas makes some excellent points; ones that we would all be better served to take to heart.

Most of us have heard the old saying: "The customer is always right." I would respectfully suggest that, in the radio or any other business, there are times when the customer is very much wrong. This includes when:

* The customer asks you to do something unethical. Example: If you are a contract engineer servicing several competing stations and the management of one station asks you to disclose upgrade, remote or other technical information of one of their competitors.

* The customer asks you to steal. Example: If you are ordering equipment and/or shop supplies and the Sales Manager asks you to order two pairs of high-end monitors; one pair for the station and one pair for his new apartment.

* The customer asks you to do something that is unsafe. Example: The GM asks you to travel to the transmitter site in obviously unsafe weather conditions. You're asked to climb the tower or STL when you do not have the proper safety gear. You are asked to overlook (or not given the budget to deal with) wiring situations that pose a shock hazard.

The last example is probably the most important, given the trend of station consolidation, staff reductions and budget constraints. When the customer, whether in-house or outside, asks you to put your life in danger, they are wrong – dead wrong.

Keep up the great work,

Charlie Farr
Virginia Beach, VA.

CAT5/5E Cable Tester

RF Industries has released the RFA-4218-20, cable tester for Cat5/5E cable assemblies. This light and compact tester, with two RJ-45 inputs, is used to test straight and crossover RJ-45 UTP, STP, EIA/10Base-T, 100Base-T, EIA/TIA 568A/568B, FDDI, ATM, TP-PMD and Token Ring cables.

The LED display is powered by a 9v battery and clearly indicates shorts, open wires, reversed pairs, crossed pairs and mis-wires. Automatically identifying the cable type it is connected to, the unit verifies all the connections in the cable.

RF Industries
800-233-1728 – www.rfindustries.com

Order Cable by the Foot On-Line

By customer request, **SystemsStore** is now offering the full line of Gepco cable products for direct ordering on-line, BY-THE-FOOT.

No more need to order those 1000' reels and boxes that sit around half empty when the project is done. Now you can order exactly what you need from SystemsStore, with the convenience of being able to order on-line. Your order will be cut to your required lengths, and shipped to you directly from factory stock.

Per-foot ordering includes the new CT504HD "Tactical" Heavy Duty Cat5-E cable. This new cable works like a data cable, but acts like a mic cable. Great for remotes and other applications where you need a data connection that will hold up to repeated use.

Also available by-the-foot at SystemsStore is the popular Gepco 61801EZ single pair analog audio cable (ref 9451). This 22 gauge cable is available in Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Grey, and White. It is also available in the popular dual pair "zip" configuration, widely used for left-right stereo equipment connections. The zip version has a blue jacket with a red stripe on one pair.

See the entire line of Gepco audio and video cable products on SystemsStore.com.

SystemsStore.com
Phone: 636-230-0046
www.systemsstore.com

Dielectric Introduces HD Plus™ Digital FM Antenna

Dielectric Communications has announced the introduction of the HD Plus™ FM antenna, which achieves a level of analog and digital signal isolation necessary for in-band on-channel (IBOC) broadcasts without the isolator required by the majority of separate antenna systems recently approved by the FCC for high definition radio operation.

The HD Plus antenna can easily be integrated alongside existing analog FM antennas, allowing the station the ability to continue its analog broadcast while also adding a digital broadcast of the same signal at the same frequency. IBOC broadcasts are transparent to radio audiences using analog receivers, while those with digital receivers benefit from improved audio quality.

With the HD Plus, special design considerations between the analog and digital antenna bays provide for isolation that exceeds 40 dB, over 10% more than the 36 dB required by the FCC. With such excellent isolation from the antenna, the need for a supplemental isolator in the system is effectively removed. This not only lowers the initial equipment expenditure, but removes a component which has until now proven to be a reliability concern.

Dielectric Communications
Phone: 207-655-8152
www.dielectric.com

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