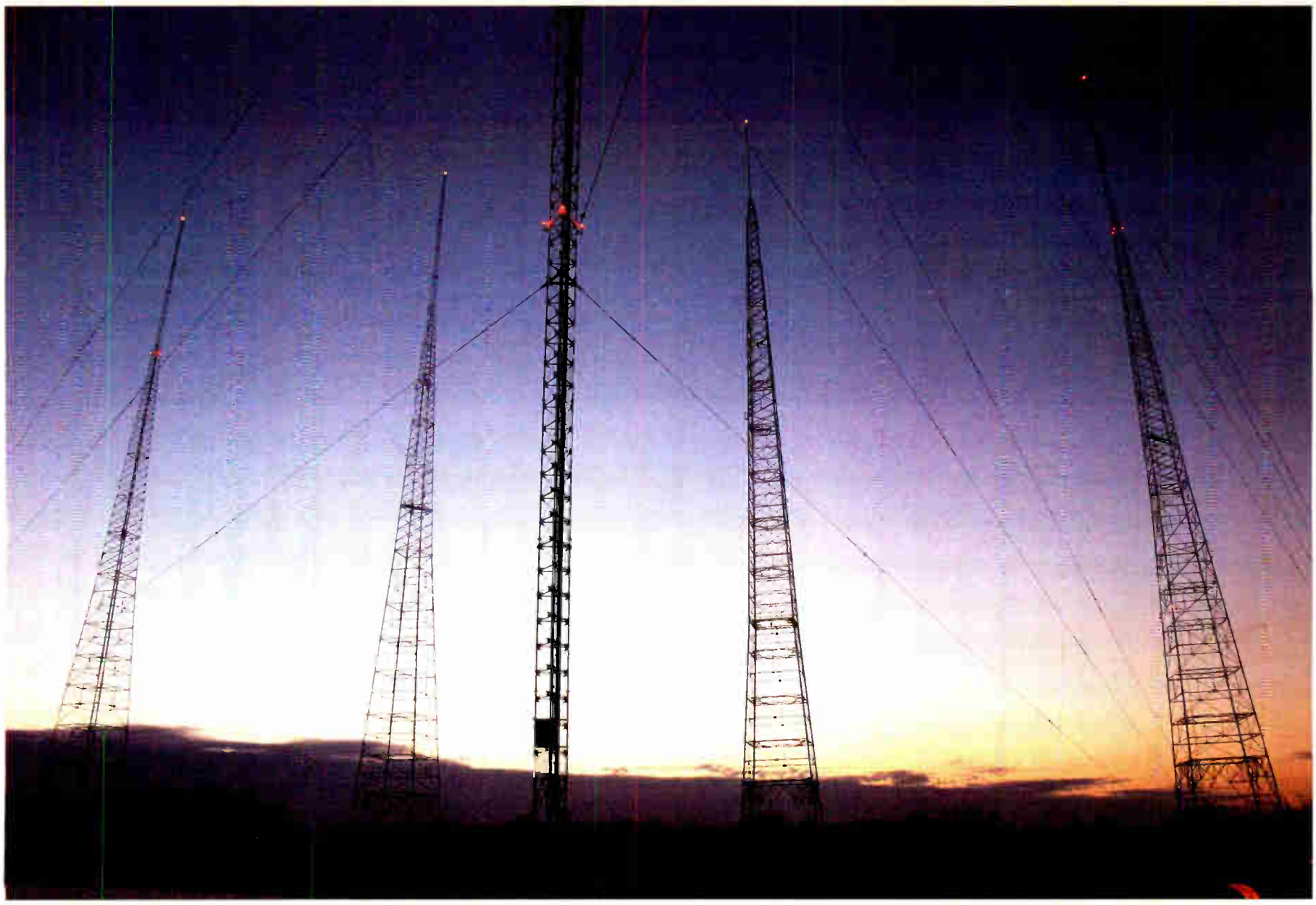
Radio Guide

Radio Technology for Engineers and Managers

August 2005

Is the Future of AM Radio Fading With the Sunset?



Inside Radio Guide

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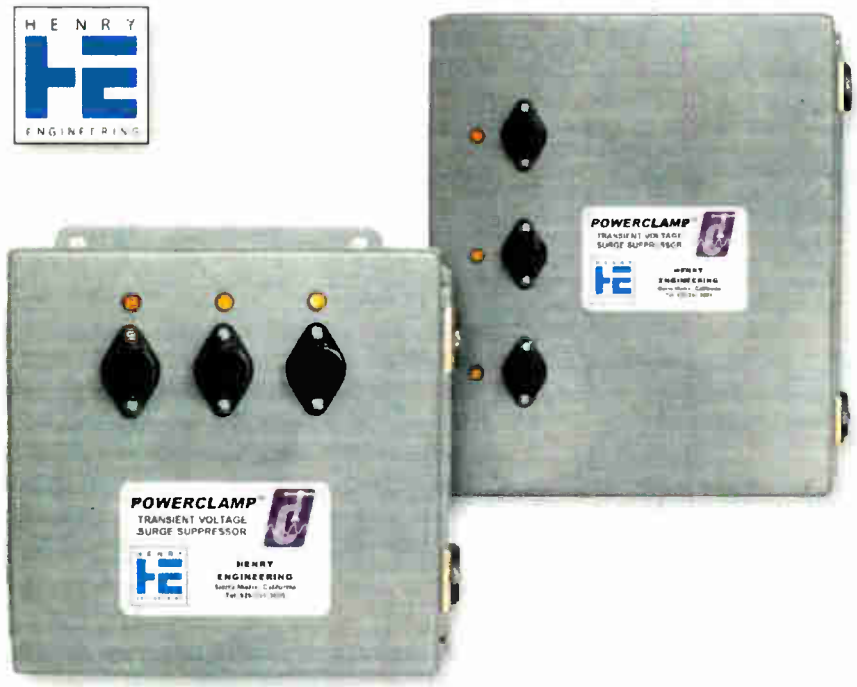

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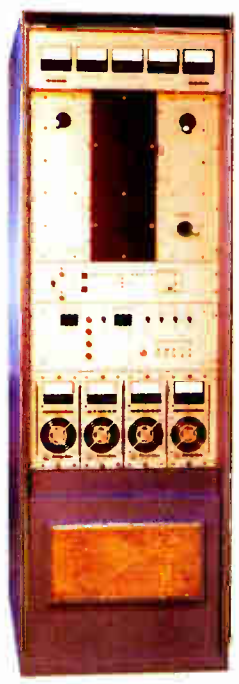

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Volume 13 – Issue 8

PO Box 20975, Sedona, AZ 86341
Phone: 928-284-3700 Fax: 866-728-5764

Ray Topp *(Publisher)*
Email: radio@rconnect.com

Barry Mishkind *(Editor)*
Email: editor@radio-guide.com

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Radio Waves

by Barry Mishkind – Editor

Living With IBOC

Around 450 stations have "lit up" digitally thus far. Many view this as a major advance for terrestrial radio. Other voices decry this as an industry disaster. As with many things, it depends upon your point of view.

Engineers and consultants benefit as station physical plants get rebuilt and a complete technical "clean up" – sometimes first for decades. Manufacturers are doing well. And GMs talk excitedly about the promise of extra inventory on the additional channels.

WHERE TO FOCUS

We could spend page upon page debating the wisdom of the chosen system – or if it should even be implemented – but the fact is: IBOC is here. The FCC made the decision over a decade ago.

Those on the technical side can either deal with it, or be replaced by those who will.

We see our mission as helping you understand the technology, its challenges and quirks. Instead of debate, we offer information – Barry McLarnon's series (Page 4) for example.

SOMETHING IMPORTANT IS MISSING

Information is hard to find in DC. The FCC mandates the Ibiquity system but, to the engineering community's frustration, allows Ibiquity to withhold important information about the codec, calling it a "trade secret." Real world receiver tests are scant.

Even in the new NRSC-5 standards, made part of the FCC's NPRM on 99-325, key standards are "to be announced." Meanwhile, lobbyists are pushing to have the FCC accept NRSC-5 "as is."

Ibiquity has made it clear that the engineering community is irrelevant to their plans. Nevertheless, we hope the FCC will use 99-325 and NRSC-5 as an opportunity to make Ibiquity provide necessary information. Otherwise, we will never know how to make the best use of digital transmission.

Transmission Guide

by Barry McLarnon, P.E.

Part 4 – AM IBOC:

Daytime Problems, and Disaster at Night

In the first three installments, Barry McLarnon's discussion of digital transmission looked at FM issues and co-channel issues for AM. In this issue, he takes a look at the physics related to adjacent channel signals on AM.

[OTTAWA, Ontario, Canada] As this issue goes to press, the window for Reply Comments on the FCC's NPRM for NRSC-5 (99-325) is open (through August 16, 2005). As one might expect, many comments express strong opinions both for and against IBOC operation on the AM band.

Unfortunately, much of the disagreement is focused on a disconnect between the financial incentives and various physical realities related to digital broadcasting. While it appears that a political decision will prevail, the near future may become technically difficult.

RECEIVERS AND FIRST ADJACENT SIGNALS

In our examination of FM interference, we found widely varying characteristics in the four receivers tested by iBiquity.

The differences were particularly noteworthy when it came to first adjacent channel selectivity, where the car receivers were relatively bulletproof and the other receivers were much less so. The car receivers could easily cope with first adjacent analog interference far in excess of the standard 6 dB D/U (Desired signal to Undesired signal) protection ratio. This good performance is due not only to superior IF filtering in these radios, but also to the use of techniques such as blend-to-mono and variable bandwidth.

No such disparity was found in the AM sections of these receivers where, according to the lab test results, the performance was uniformly bad. This could be indicative of the fact that AM is included in these receivers almost as an afterthought and little effort went into optimizing their performance. There are, of course, better AM receivers than these four available in the marketplace. However, there is also reason to doubt whether these test results really represent real world performance.

TEST POINTS

The first adjacent interference tests were done at three fixed D/U ratios: 0, 15, and 30 dB. The unimpaired output SNR for the receivers ranged from 40.8 dB for the Sony to 47.5 dB for the Technics unit.

When first adjacent analog interference was introduced at 30 dB D/U, the SNR of the four receivers fell into the 38 to 43 dB range. At 15 dB D/U, the SNRs dropped to the 26 to 30 dB range, and at 0 dB D/U, the SNRs ranged from 12 to 16 dB.

In other words, all four receivers showed some minor degradation at 30 dB D/U, and at 15 dB D/U, they were on the borderline of usability. At 0 dB D/U, none of them could deliver an acceptable SNR. When the tests were repeated with IBOC added to the interference, the measurements showed no significant further deterioration in the SNRs.

UNDERSTANDING THE TEST RESULTS

Recall that the nominal protection ratio for first adjacent AM interference is 6 dB D/U, though for historical reasons, something closer to 0 dB D/U tends to prevail. These test results would seem to indicate that approximately 15 dB D/U is actually needed for acceptable reception, so if these receivers are typical, the protection Rules are certainly not doing the job that they were intended to do. But is this a true picture of the reality of AM broadcasting?

For anyone who has spent some time tuning around the AM band at night, away from local signals, these results should strike a false note. Consider, for example, tuning through the lower parts of the band where the clear channels are clustered together.

You will generally find many listenable signals there, and they typically have similar strengths, though this may not be obvious unless your receiver has a signal strength indicator. The same thing is often true on the regional channels, though co-channel interference is obviously more common in that case.

In other words, you are experiencing successful reception in an environment where first adjacent D/U ratios are of the order of 0 dB, something that the iBiquity lab test results would seem to indicate was impossible.

NRSC CONCERNS

This contradiction also appears to have troubled some members of the NRSC working group who evaluated the iBiquity test results.

Their concerns surfaced in Appendix H of the NRSC AM IBOC evaluation report, entitled "Additional AM 1st Adjacent Compatibility Analysis and Tests." An informal nighttime listening test conducted with a car radio in the Cleveland area showed good reception of clear channel stations in the 750-780 kHz range, and a spectrum analyzer plot confirmed typical first adjacent D/U ratios of 0 dB, and in some cases, appreciably lower than that.

The anonymous authors of Appendix H concluded that "The undesired modulation models used for the objective and subjective tests were based on fully processed wideband music, a program format that does not fit the majority of contemporary nighttime AM broadcast stations."

They go on to say, "To make the laboratory tests represent real world interference, the test should have been conducted with talk and music interferers." The actual modulation used on the undesired first adjacent signal is described as "10 kHz low-pass filtered, processed and pre-emphasized pink noise."

This, one would think, should have been more than enough to send the iBiquity folks back to the drawing boards to conduct some new, more realistic, interference tests. This never happened. The main body of the NRSC evaluation report downplays the first adjacent IBOC interference problem, and although Appendix H is referenced in a footnote, its findings are not discussed. The report also mentions, but again with little comment, an even more revealing set of tests conducted by Clear Channel in February 2002.

MORE REAL WORLD TESTS

In the Clear Channel tests, the effect of putting IBOC on Class A WTOP-1500 was studied in terms of the daytime coverage of Class C WARK-1490. The latter station has a talk/oldies format, while WTOP is all-news.

The 0.5 mV/m contours of the two stations do not quite touch, so they provide first adjacent protection to each other of slightly better than 0 dB. Listening tests at a number of field locations were conducted with an assortment of different types of AM receivers while the digital signal on WTOP was switched on and off.

The tests were conducted at D/U ratios ranging from -12 dB to 22 dB. Without IBOC on WTOP, the desired station was found to be "very listenable" at *all* test locations on *all* receivers, even at a point (0.2 mV/m) well outside the protected contour where the D/U was a mere -12 dB.

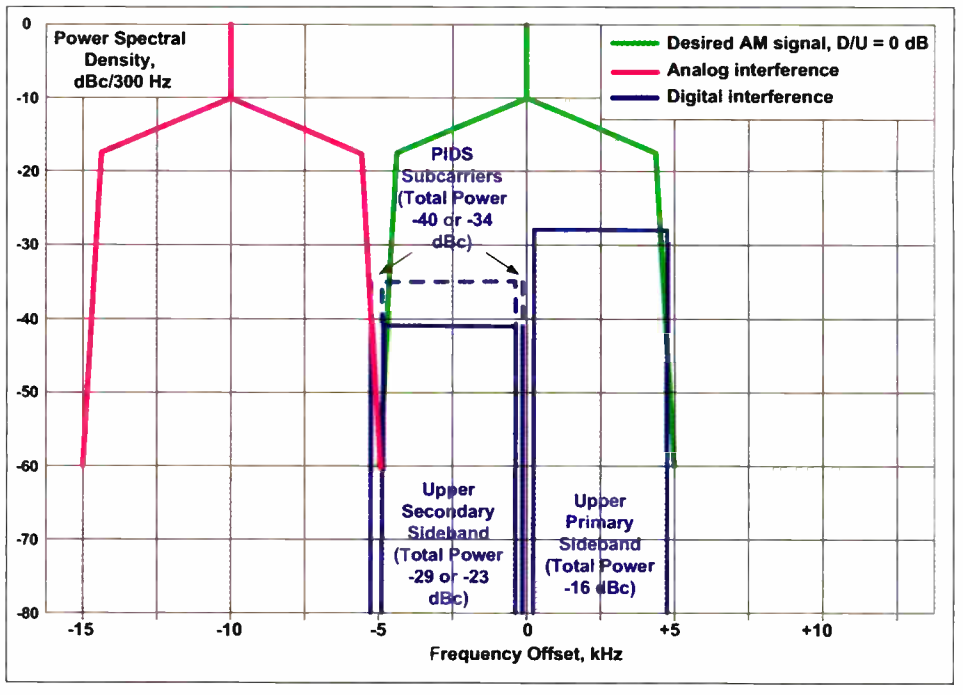
When IBOC was turned on, it should come as no surprise that reception of WARK at this location was completely destroyed. The interference was described as "objectionable" at all other D/U ratios except for the highest, 22 dB.

The author of the Clear Channel report, Jeff Littlejohn, concluded that "we do not believe that section J of the iBiquity report (Non-Host Compatibility) adequately depicts the deleterious impact of adding Hybrid AM IBOC to the existing AM band." He goes on to say that "if the results found in our abbreviated field test can be extrapolated to all situations, we feel the impact of adding IBOC to existing [sic] AM band will be profoundly deleterious." Amen to that! And yet, AM IBOC continues to soldier on.

SIDESTEPPING REALITY

What should obvious here is that we have another example of the "IBOC sidestep" around the protection Rules.

First adjacent D/U ratios of the order of 0 dB on protected contours are fairly common in daytime, and very common at night. Generally speaking, most receivers can deal with this quite well in the non-IBOC world, and often will deliver listenable signals at much lower D/U ratios; however, a 0 dB D/U first adjacent that goes IBOC plops a co-channel digital interfering signal on the desired signal, dropping the co-channel D/U ratio to about 16 dB.



Comparing analog and digital interference from the first adjacent channel.

This is 10 dB in excess of the co-channel protection Rules. Add one on the other first adjacent, and now our D/U ratio is only 13 dB. Coverage shrinks accordingly. This is a good idea?

Another question comes up in this analysis. So far, we have assumed that the interference from an on-channel digital signal at a given D/U ratio is equivalent to interference from an on-channel analog AM signal at the same D/U ratio – is this a reasonable assumption? Logic says "no."

DIGITAL IS NOT ANALOG

Consider that the reference power in the AM case is the carrier power, but the interference (assuming that the carrier frequency of the interfering station is close enough to that of the desired station that there is no audible heterodyne created) comes from the *sidebands* of the interfering signal, which have considerably less power.

In contrast, an on-channel digital interfering signal (i.e., the primary sideband from a first adjacent hybrid IBOC station) has no carrier, and all of its power is essentially converted to audible noise in the AM receiver's audio output.

(Continued on Page 6)

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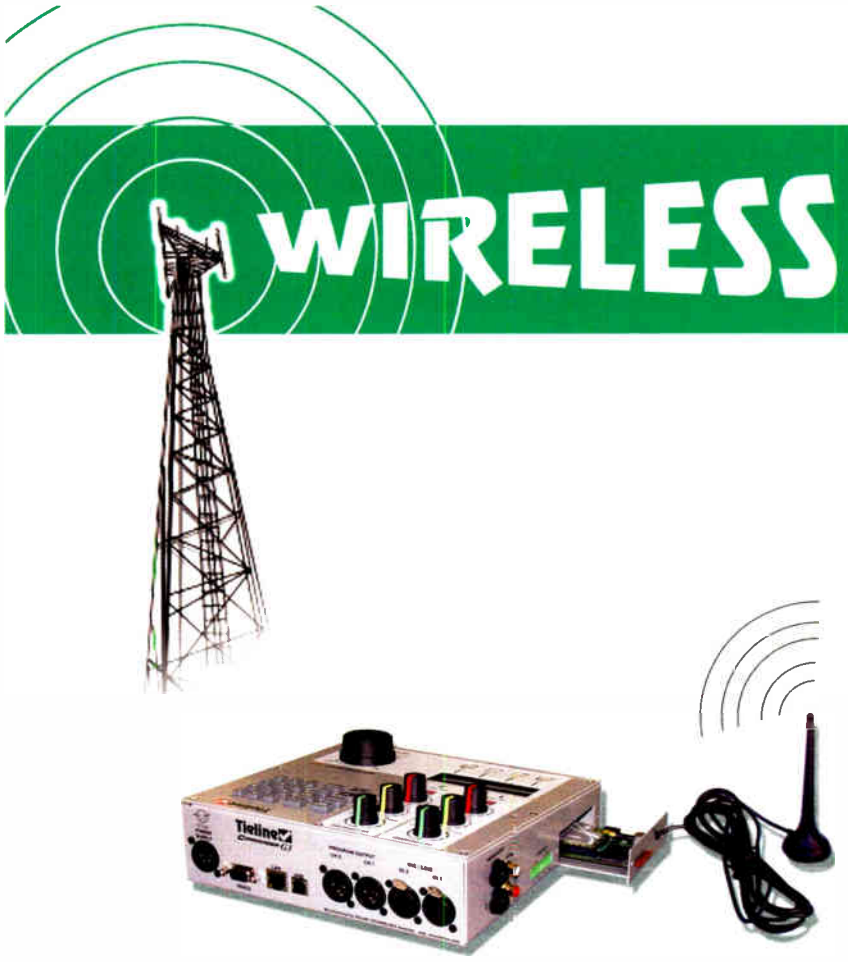

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Transmission Guide

by Barry McLarnon, P.E.

Continued from Page 4

THE DRM STANDARD

A clear indication of this difference in the potential to cause interference are the protection ratios adopted by the ITU for the DRM (Digital Radio Mondiale).

DRM uses the same modulation technique as AM IBOC, and, except for slight differences in bandwidth, an IBOC digital sideband looks identical to a DRM emission as far as an AM receiver is concerned. The ITU has determined that if an AM signal is replaced by a DRM signal, it must be operated at an average power that is *at least 7 dB lower* than the carrier power of the AM signal it replaced, in order to provide the same level of protection to co-channel stations.

If we apply this same factor to the US situation, we can estimate that the co-channel protection ratio should be increased from 26 dB to about 33 dB when the interference is a digital signal. A first adjacent hybrid IBOC signal at 0 dB D/U therefore would create on-channel digital interference that is *17 dB* in excess of this (hypothetical) protection ratio. Ouch!

SECOND ADJACENT INTERFERENCE

As noted above, the iBiquity lab test results for first adjacent channel interference were skewed by the use of analog modulation that was much wider in bandwidth than is normal practice for AM stations. This skewing should be less of a factor for second adjacent interference, and thus the results are more interesting and useful.

Of course, we remain handicapped by the small number of receivers tested. In addition, the tests were done only at the same three D/U ratios (0, 15 and 30 dB) as used in the first adjacent tests. This seems a bizarre choice, given that second adjacent D/U ratios in practice can be *much* lower than this.

As mentioned previously, there is generally no second adjacent protection for domestic stations, but in cross-border situations, a protection ratio of -29.5 dB applies. No tests were done anywhere close to this ratio, but even at 0 dB D/U, one can see problems looming. The 0 dB D/U test results are summarized in **Table 1**.

analog. When IBOC is turned on, the car receivers experience only a minor impact, but the other two receivers are in some difficulty, especially when the interference is on the lower frequency side.

One can only speculate how much worse it would be at a D/U ratio as low as -29.5 dB, but certainly the Sony and Technics receivers would be toast, and probably the others as well.

MORE POWER, MORE POTENTIAL PROBLEMS

With about 8 dB higher relative power being dropped into each first adjacent channel, the AM system has that much more potential for creating interference. Add to that the inherently higher susceptibility of AM to interference, the overlapping channel assignments, and the vastly more complex interference environment created by nighttime skywave. It is not a pretty picture.

Adjacent	Delphi Auto		Pioneer Auto		Technics Hi-Fi		Sony Portable	
Channel	IBOC Off	IBOC On	IBOC Off	IBOC On	IBOC Off	IBOC On	IBOC Off	IBOC On
Upper 2nd	45.1	43.6	45.5	43.3	47.4	37.9	40.6	**29.6**
Lower 2nd	45.1	43.8	45.5	38.2	47.4	**32.5**	39.6	**21.9**

Table 1: Measured SNR with and without IBOC on 2nd adjacent interferer at 0 dB D/U.

This is another example of the "IBOC sidestep," and it is a particularly insidious one. Here we have an undesired station that is (usually) in a position where it does not have to provide any protection, yet it is being allowed to add a new signal on a channel where protection does apply, without having to comply with the appropriate protection Rules.

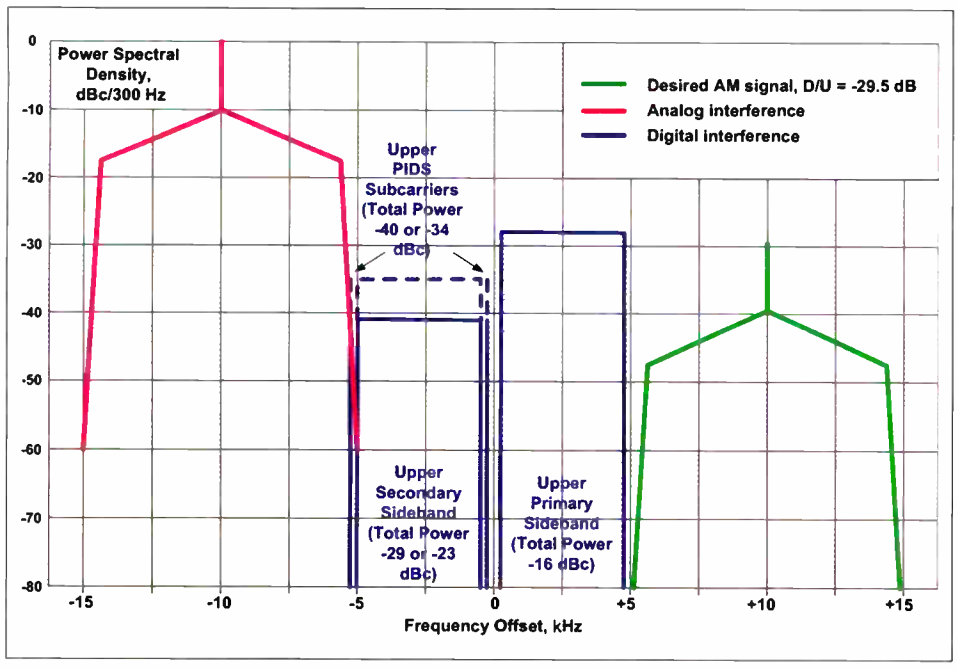
BIG PROBLEMS WITH GROUNDWAVE SIGNALS

Situations where second adjacent D/U ratios are highly negative are not uncommon, especially with groundwave signals. As an extreme example, some stations even have second adjacent stations located *inside* their protected contour.

This means that there will be a hole knocked in their coverage in any case, but the hole becomes much larger if the interfering station begins Hybrid IBOC operation. How much larger, of course, is receiver-dependent.

An example that has recently come to light is that of KHNC-1360 in Johnstown, CO, which has the KCFR-1340 (Denver) transmitter site inside its 0.5 mV/m contour. KHNC is said to have experienced greatly increased interference since KCFR began IBOC operations. The establishment of a low power station on 1350 at that location would be unthinkable under any other circumstances, but this is in essence what KCFR is permitted to do with its upper digital sidebands.

One of the earliest examples of second adjacent AM IBOC interference occurred in the same general area. KNRC-1150 (Englewood, CO) is located very close to the protected contour of KJJD-1170 (Windsor, CO). When KNRC fired up IBOC, KJJD reportedly received many interference complaints from listeners. In this case, the problem was resolved when KNRC voluntarily ceased using IBOC.



A look at the second adjacent envelope.

Recall from our discussion of FM IBOC that iBiquity determined that an audio SNR of 30 dB could be considered the "tune-out" threshold. This is the threshold at which half of listeners would no longer consider the audio quality acceptable, and would thus tune to another station or turn their radio off. Entries in the table that are close to, or below, this threshold are highlighted.

We can see that all of the receivers are capable of delivering 40 dB or better SNR when the interference is

AM COVERAGE IN THE IBOC ERA

In our survey of FM coverage and the impact of Hybrid IBOC, we arrived at a rather messy picture. Coverage in FM is highly dependent on receiver characteristics and on a particular station's interference environment, and it becomes even more so in the IBOC era. Many stations stand to lose significant portions of their coverage when neighboring stations go IBOC.

This loss will be mainly outside protected contours, but there is also potential for impact inside these contours. In addition, many receivers will exhibit a deterioration in analog SNR from IBOC on the desired station.

For AM, the picture has many similarities, but it is even messier. A major difference between the two systems is the digital power levels: -20 dBc in the FM system, and -12.3 dBc (or -11.7 dBc, if the high power setting is used) in the AM system.

As far as co-channel interference to analog from digital is concerned (and keeping in mind that we are considering only interference from stations that are *assigned* to the same channel), the AM and FM situations are very similar, differing only in some details.

In both cases, the only co-channel source that is significant is the desired station itself, and the extent to which digital noise bleeds through into the analog signal is highly receiver-dependent.

Another similarity lies in the fact that both systems have modes specified (Extended Hybrid in the case of FM, and higher power for the secondary/tertiary sidebands in the case of AM) that will increase the levels of interference heard in susceptible receivers. These modes are not in use during the current period of interim IBOC operation, but will inevitably be used in the future.

Finally, the configuration of the antenna system can be a significant complicating factor on both AM and FM. The use of separate antennas for the analog and digital transmitters on FM, and the use of DAs, which is mandated for the majority of AM stations, can upset the balance between the analog and digital components of the hybrid signal and cause increased digital crosstalk in analog receivers.

INSUFFICIENT DATA

In first adjacent interference, we see the "IBOC sidestep" in action. The tests done by iBiquity failed to characterize this problem realistically, and although the NRSC recognized the shortcomings of the tests, they did nothing to correct them, choosing instead to sweep the problem under the rug.

The nominal protection ratio is 6 dB D/U, but a grandfathered 0 dB applies in most situations. At 0 dB D/U, a first adjacent IBOC station plops a primary digital sideband on top of your desired station, with a D/U of only 16 dB, fully 10 dB higher than is permitted by the co-channel protection ratio.

Moreover, the protection ratios adopted by the ITU for DRM indicate that, on the basis of signal power, 7 dB additional protection is needed when the interference is digital, so the difference is really more like 17 dB.

IMPAIRED RECEPTION

Regardless of how you measure it, the result is significantly impaired reception inside the so-called protected contour, and much loss of reception outside of it.

We looked at an example of this in daytime coverage in the WARK/WTOP tests, but the problem is much, much worse at night, when many more interfering signals emerge. First adjacent D/U ratios of the order of 0 dB prevail, and not just on one segment of protected contours, but all around them.

AM IBOC proponents tend to deflect criticism by claiming that digital interference only affects secondary (skywave) service, and that such service is only provided by a handful of stations, and is anachronistic in these modern times. This is far from the truth.

Without even entering into the debate over the merits of skywave service, it should be obvious that first adjacent IBOC interference will have a huge impact on the nighttime groundwave coverage of many stations. The only stations that are unlikely to be significantly affected are those whose coverage is already severely limited by co-channel interference.

(Continued on Page 8)

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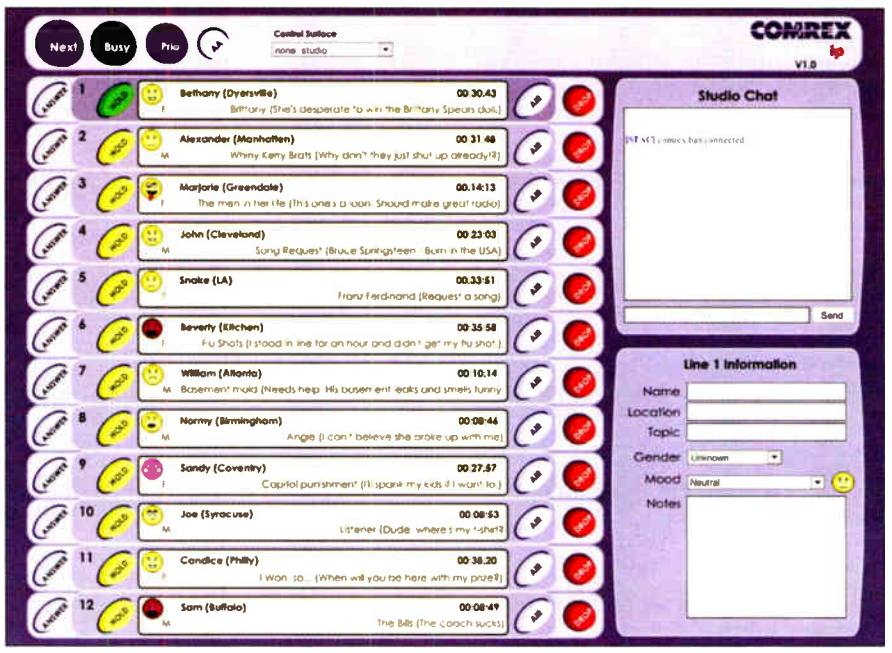

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SECOND ADJACENT

Interference from second adjacent IBOC stations is mainly a groundwave issue. Although it could be a factor at night, it will usually be washed out by first adjacent interference. Skywave signals on second adjacents generally cannot reach the levels needed to be the dominant source of interference.

Groundwave signals, however, are another story. Since there is no protection from second adjacent stations except in a few special cases, such stations can be very close to protected contours – even inside them in some cases.

This leads to enormously negative D/U ratios and a first adjacent digital sideband that is well in excess of standard protection ratios. Obviously, in these situations the analog interfering signal will itself cause some loss of coverage, but the point is that the hole in coverage becomes much worse if the interfering signal is also running IBOC.

The extent of the impact depends on the receiver selectivity characteristics. We looked at a couple of real world examples where this has already occurred. There will be many more. In some cases, IBOC (on FM as well as AM) will prove to be an effective means of cutting "rimshot" stations out of the action. Perhaps that is part of its attraction for some of the larger players on the field.

LOOKING AHEAD

My conclusion? The AM IBOC Hybrid mode is a very bad idea. We have not even touched on the problems of obtaining adequate digital coverage when this system is deployed in the crowded AM environment, but they are formidable.

Looking purely from the point of view of how it impacts analog coverage, the Hybrid system should be a non-starter. AM operators should bypass this mode and bide their time until it becomes feasible to deploy an all-digital system that is truly "in-band, on-channel." In the meantime, if attrition leads to a thinning out of marginal operations on the band, that should be a viewed as a positive step towards a revitalization of AM broadcasting.

The AM band in the Americas is a real oddity. It is channelized at 10 kHz spacing, yet stations are permitted to occupy 20 kHz of bandwidth, thus overlapping onto half of each first adjacent channel. It is hard to think of another narrowband wireless service that permits such an overlap; on the contrary, it is customary to have a small "guard band" between channelized signals.

The saving grace with AM signals is that the spectrum falls off rapidly, so that the occupied bandwidth, in terms of the standard definition (that bandwidth which contains 99% of the total power), is much less than 20 kHz.

In addition, many receiver manufacturers have reduced their AM receiver bandwidths to the point where they only respond to the signal in the central 5 or 6 kHz of a channel. In recognition of this fact, some ownership groups, led by Clear Channel, have reduced the bandwidth of their AM transmitters accordingly. The NRSC AM Study Working Group is looking at this issue more closely, and it is a good bet that they will end up recommending that all stations should follow suit (whether this will become mandatory at some point is another question).

TOWARDS GOOD SPECTRUM MANAGEMENT

Though this is a controversial topic, from a spectrum planning point of view, it makes good sense. It would do away with that anomalous overlap situation, and bring AM broadcasting in the Americas more into line with the rest of the world, where stations stay within their channel limits (9 kHz channel spacing, and 4.5 kHz audio bandwidth, so that the occupied bandwidth is less than 9 kHz).

Given this progressive trend, adding the Hybrid IBOC system to the band is a huge step backwards. As I have shown previously ***(Radio Guide**, July 2004)*, the occupied bandwidth of the Hybrid AM IBOC signal is approximately 28 kHz, almost completely overlapping the two adjacent channels. As we have seen in this and the preceding article in this series, this signal wreaks havoc on the band.

If we really want to clean up the AM band and get the most out of it, we should make this commitment: *no* signals with an occupied bandwidth of more than 10 kHz! In this brave new world of not squatting on our neighbor's land, how then would we go digital? The iBiquity all-digital system, in its current incarnation, uses 20 kHz bandwidth, so it need not apply.

Once again, our cousins elsewhere in the world have shown the way. The ideal candidate appears to be one of the 10 kHz bandwidth versions of the DRM system. But that is a topic for another day.

A veteran of digital radio studies in Canada, a consulting engineer and author specializing in communications systems engineering, Barry McLarnon (VE3JF) holds a BS in Physics and MS in Electrical Engineering. His email is bdm@bdmcomm.ca

Digital Audio Guide

by Donna L. Halper

NextGen101

Flexible and Cost-Effective Automation

[QUINCY, Massachusetts] A year ago, when I wrote about Prophet System's NexGen automation software, I had no problem finding satisfied users. Prophet has built a solid reputation, and station engineers and programmers praised the company for providing good tech support and being responsive.

NEW OPTIONS

But when I spoke with broadcasters in smaller markets, several expressed the wish that NexGen were more affordable. Granted, NexGen's basic price of about $4,500 is quite competitive, but for small market owners on a budget it was out of the question.

This year, however, the smaller station has a new option: NexGen101. Based on NexGen software, it was designed to give users flexibility and features at a very reasonable price – as little as $495 to start, with most modules costing $101 each.

NexGen101 Main Operating Screen

NexGen101 seems especially well suited for LPFMs, internet stations, and college stations. It is sold as a stand-alone product but by adding modules, you can adapt the system to your requirements.

"NexGen101 was designed as an inexpensive modular alternative to the standard way of selling automation systems," explains Prophet's Assistant Marketing Manager, Diana Stokey. "In most systems, you must purchase a package of features, whether you plan to use them or not. With NexGen101, you buy the core module, then add on modules for your specific needs."

MODEST HARDWARE NEEDS

In order to use NexGen101, you will need the following hardware:

- Windows 2000 or higher.
- P3 600 or greater
- 800x600 screen resolution, 256 colors
- 256 MB RAM (the more the better)
- 32X CD-ROM
- A network interface card (10/100 MBPS).

NexGen101 interfaces directly with Live 365 and Shoutcast. It uses most audio formats, and can export most fields in whatever the export format of choice. It has the ability to import TMC files, DAT files, Jones files, and Halland files.

SCALABILITY

When asked what the best thing about NexGen101 is, George Nicholas, Director of Engineering for the 88 station NRG Media Group, immediately replies: "It's scalability." In other words, for programmers on a budget, purchasing the basic NexGen101 will get them started. But if their needs change, they can expand the system's capabilities by adding new modules.

For example, with the purchase of a transfer module, data can be transferred from one work station to another. 101 can be used in either live-assist or automated mode, and it is also capable of doing voice-tracking – although a station will need to buy the additional module for that function.

Enhanced Voice Track Module Screen

Depending on how much space you have on your computer's hard drive, 101 is capable of holding several thousand songs. It comes with a very basic music scheduler included in the core module, but building clocks must be done manually. However, there is a scheduler module that will automatically schedule your music and follow the rules and parameters you set up.

SOLID SUPPORT

Another plus for Nicholas is that Prophet Systems is very enthusiastic about what they offer, and the company provides excellent customer support. "Prophet is very good about suggestions and ideas. [You can] go to their website and join their Prophet Community system. In there is a wealth of knowledge from both support staff and customers. You'll also see upgrade notes from each version, often by customer request."

Rich Chadwick is the president of MultiMediaPros Digital Studios, based in Salem MA. He consults several stations and found the price of NexGen101 especially appealing. He also agrees with George Nicholas that Prophet Systems has a solid reputation.

"...[All] of the NexGen lines have a perception of stability over other offerings," Chadwick said. "My experience is that even the low-end products are still based on the same "engine" as the high-end stuff. Plus the 24/7 support is great."

HIGH SCHOOL STAR

For Jeff Dupont, the General Manager of WEEM-FM, at Pendleton Heights High School in Pendleton, Indiana, NexGen101 was exactly what his station needed. It was recommended to him by someone he knew who had used it, and he has not been disappointed.

As with many users, the price was what first attracted him, but there are other reasons that Dupont likes the software. "I wanted to teach the students techniques of good radio, and having NexGen101 helps me to do that."

Dupont adds: "We got it this past October, and the students find it really easy to use. We can be on the air even in the summer because we got the voice track module. So we can maintain a vocal and community presence 24 hours a day, even when most of the students aren't around. Besides, having this software has improved their efficiency and made them think like professional broadcasters."

MODEST EXPECTATIONS

Of course, NexGen101 will not meet the needs of every station, and it was not designed to do so. Even though he liked the system, George Nicholas did not choose it for several of his stations; he decided the standard NexGen was more applicable.

"I've had several discussions with Prophet management about NexGen101 being a little too basic for a small-market station," Nicholas noted. "I could certainly use it in some of my smaller markets, but one main issue for me is it only supports four satellite sources. I'm trying to get NexGen101 to support an 8 channel switcher, similar to the standard NexGen."

Rich Chadwick reached a similar conclusion. He was considering 101 for one of the small market stations he consults. "We had looked at NexGen101 ... [but] I ultimately ended up going with NexGen Digital because I needed more robust satellite controls and triggers. I also found that by the time I added all the 101 modules I would have needed, I was in the NexGen Digital price range anyway."

That is an issue that Prophet Systems is working on right now. Jackie Lockhart, Vice President of Marketing, says that some changes are in the works. "NexGen101 was designed as a product that could be put together in modules, but we are looking at some different ways of packaging it. We may be making a basic on-air package available with the modules most people want."

In analyzing the various needs and packages of modules stations have been ordering, even with the purchase of several additional modules, the typical cost is under $1,000.

NOT "NEXGEN LITE"

Nevertheless, it is important to note that NexGen101 is not "NexGen Lite" – it will not do everything that its Big Brother does, nor was it designed to do so.

Stokey gives one example: "While NexGen101 interfaces with most audio cards, including Direct X/Wave, Soundblaster, MP3, Layla, and AudioScience, it does not always support all of the features available with the audio card, such as pitchless stretch and squeeze. [And] NexGen101 performs WANcasting via FTP."

Still, there is no denying that NexGen101 offers programmers a number of options. In addition to the voice track and music scheduler modules, another popular choice is the button bar, which can store a variety of audio (bits, jingles, liners, etc) so that board operators have easy access to it.

There also is a module for multi-source satellite feeds, and a module that loads traffic logs into the system. (All of the modules, and additional information may be seen on the NexGen101 website, www.nexgen101.com)

RESPONDING TO USERS

NexGen101 has also been making some improvements to the product, based on user feedback. Stokey says, "There were some initial problems with manual registration as opposed to online registration. We added a reload button so, should a problem arise with a NexGen101 database, an older copy can be reloaded. [And] we added a MusicGen template in MusicLoad to make setting up a music load using MusicGen much simpler."

So, while NexGen101 may have certain limitations, it definitely can do a very efficient job. Its flexibility and its low price are two major assets. If your station does not perform multi-tasking functions or use a lot of work-stations, or if it does not have a lot of satellite feeds to worry about, 101 might be perfect for you.

Donna Halper is a programming consultant based in Quincy, MA, well versed in matching automation programs with station operations. You are welcome to contact Donna at dlh@donnahalper.com

Control Freaks

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VAD-2

The tiny TOOLS VAD-2 is a user programmable two-input multi-number voice/pager auto dialer with integrated stereo silence sensor, designed for dial out paging and/or voice message notification. The VAD-2 is equipped with two dry contact inputs and stereo silence sensor, which, when tripped, will sequentially dial a pager and/or up to four different phone numbers and play back a user recorded message corresponding to the tripped input. The VAD-2 also provides two SPST one amp relays for the control of external equipment.

WRC-4

The tiny TOOLS WRC-4 is a fresh approach to remote site monitoring and control, or providing an inexpensive solution to Internet enabling your present remote control system. The WRC-4 combined with web access and your favorite web browser brings you the following features; A powerful built-in web-server with non-volatile memory; 10/100base-T Ethernet port; four each channels of 10-bit analog inputs with a large monitoring range; optically-isolated status (contact closures or external voltages) inputs; normally open dry contact relays; open collector outputs; front panel status indicators, a single front panel temperature sensor and 4-email alarm notification addresses. The WRC-4 is also SNMP enabled. The WRC-4 has carefully been RFI proofed, while including the accessories other manufacturers consider optional. The WRC-4 is supplied with removable screw terminals and loaded with a generic web page that may be easily edited by the end user.

SRC-2/SRC-2x

The tiny TOOLS SRC-2 interfaces two optically isolated inputs and two SPST relays to a RS-232 or USB port, while the SRC-2x does this via a 10/100baseT Ethernet port. Both the SRC-2 and SRC-2x can notify a user's PC software program that any of two optically isolated inputs have been opened or closed and allows your software to control two SPST, 1-amp relays. The SRC-2x is also able to send an email when either of the two inputs change state. The user may also add up to 48 ASCII strings per input and 16 user defined strings per relay. Communication with the SRC-2(x) is accomplished via short "burst" type ASCII commands from the user's PC. Also, two units may be operated in a standalone mode (master/slave mode) to form a "Relay extension cord," with two channels of control in each direction. The SRC-2 communicates using RS-232 at baud rates up to 9600 and the SRC-2x via 10/100baseT Ethernet. The SRC-2(x) is powered by a surge protected internal power supply. Either unit may be rack mounted on the optional RA-1 mounting shelf.

Time Sync Plus

The tiny TOOLS Time Sync Plus provides four separate GPS time referenced outputs. The first is a SPST relay, which pulses at 12:00, 22:00, 42:00, 54:30 each hour and is user programmable in each of four locations for any minute and second each hour. The second output is an active high driver with a 100 ms pulse each second, while the third output is a 4800-baud, RS-232 serial port providing a time zone adjustable hours, minute and seconds time code. The forth output provides an active high driver in the ESE TC-90 serial time code format. Indicator LED's are provided to display power/valid GPS data, programming mode and time sync relay operation. A Garmin 12 Channel GPS receiver with embedded antenna is suppled.

ESS-1

The ESS-1 provides a cost-effective, small profile solution for standard serial-to-Ethernet connectivity. Designed with the broadcaster in mind, the ESS-1 is equipped with extensive RFI protection. It is ideal for applications requiring data support for both RS- 232 and RS-422 communications. The ESS-1 allows any device with a serial port, Ethernet connectivity and is ideal as a serial bridge/tunneling or applications where a COM port, TCP Socket, UDP Socket, or UDP Multicast functionality is needed. The small profile of the ESS-1 makes installation hassle-free.

AVR-8

The AVR-8 is a voice remote control system that automatically reports changes detected on any of its eight status inputs to a remote telephone and/or pager. After speaking a greeting message that may identify the source of the call, the AVR-8 then speaks a unique message for each status input. The user may customize each factory-recorded message. After reporting, the AVR-8 is ready to receive commands through your telephone keypad. Functions include telling the AVR-8 to report on the input state of any of the eight status inputs, commanding the AVR-8 to pulse any one of its four SPDT relays for 750 ms and/or turning any one of the relays on or off. When a relay command is given, the AVR-8 speaks the relay 'name' followed by the 'on' or 'off' message.

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A Non-Comm View

by John Devecka

Going Mobile

[BALTIMORE, Maryland] We would all like to have a promotional vehicle for our radio (or TV) stations, but everyone knows these things are absurdly expensive. Or are they?

WLOY is a small unlicensed operation, but we have a radio (and TV) station van. Really. And we use it constantly. Whether we are moving gear around campus for events or showing up at the various festivals around town (you know – the ones the commercial stations pay to put their names on) the WLOY van is always on the move.

MAKING IT HAPPEN

How the heck did we get a van?! Yeah, a lot of people ask that. It started with a will to make it happen and figuring out all the angles before asking if we could actually do it. Take notes, friends, because a lot of these nifty tricks will be applicable at your school and you may find yourself with a van as well.

Now, to be sure, after spending some time looking at the beautiful work done on the remote trucks shown at the NAB Convention, you could be put off the whole project.

Yes, there are a lot of goodies here, but we need to be realistic.

Assuming your station does not have the budget of a major market commercial station, you need to think smaller if you want to get on the road. At WLOY we think smaller – and long term – and we like to share the load.

WHY A VAN IS USEFUL

In our case, the station is always trying to get involved in campus events. We play background music and offer DJ services for everything from "Relay For Life" to the Tennis Team's fund-raiser.

We have a tent with WLOY all over it (E-Z Up made ours – you ought to get one yourself!) and we have a very simple DJ setup with some self-powered monitors. We also usually have a ton of giveaway material in bins to haul along with us.

All of these wonderful items – and more – went around town/campus in my 1982 Chevy S-10 pickup for two years.

It was ugly. But it worked and you only risked getting tetanus if you touched the body. I put thousands of miles on the truck running station errands, going around between our campuses and hauling gear to/from events. Nevertheless, it would be a lot nicer, and a give a better impression of the station if we had a proper van.

WORKING TOWARD A VEHICLE

Thus, I began to mention our lack of a station vehicle in passing – but regularly – to the higher ups in my department. I wondered aloud how some other departments had gotten fleet vehicles or were able to use them. And, I spent time getting to know the manager of the transportation department.

As our TV station began to develop more staff and grew ambitious about doing remote recording of events, I found an ally in my counterpart there. We talked and found that we could easily share a vehicle to move gear, and we would often be at the same events. We also both wanted to develop remote production capability for sports and other events.

So, with our cosmic link discovered, we began to explore our options and costs. Unlike our budgets, our ambitions (as usual), knew no bounds. It always seems to work out that way, does it not?

We decided that we could combine our budget efforts, forego some of the things we had planned for the next budget cycle, and come up with $5,000 from each of our budgets.

That gave us (we hoped) a maximum budget of $10,000 to acquire and outfit our "new" promotions and production vehicle. Problem number one was where we would be able to find a reliable vehicle for that kind of money – something that would survive at least five years of service with college students.

DISCOVERING OPTIONS

Falling back on friends we had made in the transportation department at school, we learned about various deals that could be made at dealerships, lease options, used car lots and such. But, as we expected to modify the vehicle to meet our production needs, this eliminated any thought of leasing or trade out deals which would require keeping the stock condition of the vehicle.

Then the guys suggested government auctions. "Yeah, right" we said, with pictures of confiscated Escalades and Lamborghinis dancing in our heads. "No, no, no" they said (nicely leaving out the "you idiot" part). They were referring to GSA Fleet Vehicle auctions. It turns out that our campus transportation folks buy a lot of our vans, buses and cars from GSA auctions. Who knew?

The fine folks in the federal government have a huge fleet of various vehicles in service and rotation all the time – not much of a surprise, I suppose. What *was* a surprise was that they hold auctions all the time, all over the country, to sell off these vehicles. And they are usually a place to find good deals.

These are vehicles that are generally either at their mileage or age levels where the actuaries locked in some DC basement say it is time to off-load them. They are government fleet maintained (which should be good) and are usually free from significant defect. I was told that they could not sell them without declaring any significant accident damage or history (I did not verify that with a G-man though.)

WHERE THE TOYS ARE

We figured that this could be worth looking into. But it gets better. The folks at the GSA even run a website for this at www.autoauctions.gsa.gov which will let you find out when and where the auctions are scheduled, and see basic details on what will be auctioned well in advance of the event.

A little research resulted in our finding two regular sites around Baltimore where they hold these auctions. A week later, we hit the first one to see what it was all about.

Of course, auctions are a hit-and-miss proposition. You never know exactly what you will find lurking under the car, or if it will blow up as soon as you clear the lot. Furthermore, you never know if everyone wants the same car you do – driving up the price – or if they all really are interested in the lime green Aztec, leaving you a bargain.

We went to the preview day and spent a couple of hours looking around and learning, rather than showing up and trying to buy right away. We found out that the GSA folks leave the keys in the vehicles and you can start them, drive them back and forth, and see if everything works. And most of these were recent model years, and most under 40,000 miles.

IN THE TOY STORE

This was great for us. We crawled in and out of SUVs, minivans, cargo vans, extended pickups, even box trucks. We spent most of the time looking at configuration ideas for our future production fantasies. Would we really fit all the gear in that old Bronco? Could we really get a box truck around campus easily? What about a cargo van with flexible fuel options? And even simple things like how we could modify things for security and comfort.

By the end of the day we had decided that we wanted a large mini-van or a cargo van, but not a super heavy duty one since we would be transporting people to events as well as gear.

We also decided that a fully decked out production vehicle was not in our next few years' budget, or our immediate skill set. We also determined that anything bigger than a cargo van would be too much around campus, and too much on gas. There were several variations on our mini-van ideals from which to pick.

As we analyzed the results from our trip to the auction, we had a much better idea what our dollars would buy. Amazingly, they would go pretty far.

HELP WITH THE PLANNED ACQUISITION

We figured out we could do what we wanted within the budget, leaving plenty of room in our $10,000 for modifications, graphics, and repairs. So we sat down with the folks handling campus transportation to see what we could do about getting their help.

As always, here is where it helps to make friends! We would have to buy the vehicle (we tried but they would not buy it for us). But, *they* would be able to put it on the campus fleet plan so that insurance, maintenance and basic repairs (i.e. non-accident things) would all be covered under their budget!

This means that we pay for oil and gas and that is about it. So, with all these deals worked out and the budget set, we decided it was time to actually ask the Dean for permission to do this. We presented a solid case, fully researched, and got his approval in one thirty-minute meeting!

GETTING OUR OWN WHEELS

Off we went to the next auction, finding what we wanted among the offerings – a selection of several minivans, all Ford Aerostar EXT models with dual zone air conditioning.

We decided on this model because it had the best rear space, rear air conditioning controls (critical if you have production gear running in the back at an event), good reviews and estimated selling prices. We were the winning bidders on the one we wanted most – a 1996 model, in radio station green, with virtually no cosmetic flaws inside or out and only 32,000 miles on the odometer.

(Continued on Page 14)

Radio.edu

A Non-Comm View by John Devecka

Continued From Page 12

After paying the auction price, fees, taxes, registration and licensing (plus the WLOY vanity plate), we were out the door for under $7,000. The state inspection revealed a need for brakes and a ball joint – covered by our transportation department!

TRICKING IT OUT

Giddy with our new toy, we set off to add some basic features that we knew we needed. A call to Masterack (www.masterack.com/van.htm) produced their catalog, and we ordered a big ladder rack for the roof. We needed that both for carrying ladders (all of our transmission points require them for access) and as possible mounting locations for cameras at events.

As soon as the ladder rack arrived we took it to Maaco for a paint job to match the van (we did not really want a white rack drawing the attention away from the graphics on the side) and installation. Then it was time for the graphics.

We thought a lot about the graphics. We have very limited coverage off campus and yet we do a lot of events off campus. We wanted to make sure that the van guided them to the website first.

There are a zillion or more options for graphics on a van. We had a limited budget and did not want to burn it all on a wrap or custom paint. So, a simple set of graphics to declare who we were and where we were from got us started. I even added the website in reverse along the top of the windshield so it shows up straight in people's rearview mirrors.

A little research, a little effort, and we have a van!

The graphics package, the ladder rack, painting and installation used up about $1,000 more when all was done. And we were on the road, $2,000 under budget.

LOOKING FORWARD

Yes, we still have a long way to go – and I will share some of the details of our improvements as we start to make the modifications inside for the audio and video racks – but we hit the first day of school for our incoming freshmen with a WLOY van, and tons of free stuff.

A better recruiting tool was never invented (OK one, but hookers *are* illegal) and we got a great turnout from freshmen interested in the station and listening.

The van took a small contingent of students to art and music festivals all around Baltimore this summer. We usually have a bin of free stuff in the back for anyone that asks (and they do), and we make sure that we leave it in a conspicuous place whenever possible.

We have seen a significant jump in off-campus listenership, and we get recognition from a lot of local artists as the only station that actually shows up to support their events. Thanks to "The Van," our tiny, unlicensed, college radio and TV station is getting known, and my poor mangled old pickup has gone on to a better place – someone else's driveway.

John Devecka is the Operations Manager of WLOY at Loyola College in Maryland. Not everything he tries works out, so he has to show off the few that do.

If you have a promotions vehicle let him know - he wants to get inside them for an upcoming issue! wloy@loyola.edu

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DA Q&A

By J.S. Sellmeyer, P.E.

Identifying Problems in Antenna Monitoring Systems

[McKINNEY, Texas] A directional antenna system consists of several distinct parts, including the antenna and the sampling system. In this month's DA Q&A, Jack Sellmeyer shows how to zero in on some of the causes of sampling system problems.

Question: Some of the parameters on my antenna monitor have drifted way out of tolerance. However, I check all the monitor points regularly on all of the radials, and they continue to read normally. What should I do now?

Answer: In many cases antenna systems have been misadjusted because of unknown or unsuspected monitoring system problems. The "First Rule of Directional Antenna System Operation" is, or should be, *"Make no adjustments to the antenna system before checking the monitoring points."*

In "ancient times" when annual skeleton or partial proofs of performance were required for remote control of directional antenna systems, tests to verify the integrity of the monitoring system were a common part the annual proof.

In recent years, neglect of antenna systems has been an unfortunate but natural progression of the reduction in manpower imposed by "consolidation" in the industry. This has led to deterioration in the performance of many antenna monitoring systems.

TRACKING THE PROBLEM

The repeated measurement of stable monitor point values allows us to assume the directional array itself is functioning properly. This points us to the sampling system and monitor. Unstable or incorrect ratio and phase indications usually originate in one or two components of the antenna monitoring system.

This article will focus on the DA sampling systems and offer two simple measurements which can be performed to assist in determining the causes of instabilities in the monitor indications.

Assuming the monitor itself is functioning correctly, connection problems in the sample loop itself are frequently at fault. See the article on sample system connectors in the May 2005 edition of ***Radio Guide*** for more information on this subject.

The second area of concern is the electrical integrity of the transmission lines and connectors used to connect the current sampling device to the antenna monitor.

Ruptured outer conductors, defective connectors and contaminated dielectric material in the transmission lines are frequently responsible for unstable or erroneous ratio and phase indications.

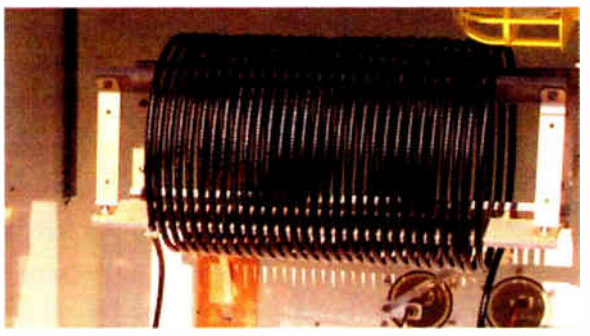
Typical single turn unshielded sample loop.

CURRENT SAMPLING DEVICES

Two principal types of current sampling devices are usually employed to extract a sample of the RF current flowing in each of the radiating elements (towers).

A single turn current sampling loop of the type illustrated is normally installed at the "current loop," or the point of highest current on the tower. This may be near the bottom of the tower for towers having an electrical length of approximately 90 degrees or less or at a higher location for towers with an electrical height in excess of 90 degrees.

The loop will normally be electrically bonded to the tower structure with both the loop and the associated transmission line operated at tower potential. The transmission line is isolated from the radio frequency potential across the base of the tower by a high impedance radio frequency inductor wound from coaxial cable of similar characteristics to the transmission line. A typical isolation inductor is illustrated.



Typical sample line isolation inductor.

In some cases the loop is mounted approximately fifteen to twenty feet above the base and insulated from tower potential. In this case the isolation inductor is usually omitted. The use of shielded loops or adjustable loops has been prohibited for many years.

TOROIDS

The second common system is the use of a ferrite toroidal current transformer placed on the radio frequency feed pipe to the tower.

Typical toroidal current transformer installation.

The toroidal current transformer should be used only for towers less than approximately 120 degrees in height or more than 200 degrees in height. The reason behind this statement has to do with the fact that the capacitive currents flowing to ground are being measured as well as the radiating currents flowing up the tower.

At electrical heights greater than approximately 120 degrees and less than approximately 200 degrees, the shunt currents to ground are an appreciable percentage of the radiating currents and significant variable errors are possible due to variations in the ground currents with seasonal changes in ground moisture content and variations in the ground vegetation.

Sampling loops may be used for towers of any electrical height as they respond with good accuracy only to the current flowing past the loop.

SAMPLE SYSTEM TRANSMISSION LINES

The transmission lines used in antenna monitor sampling systems are required by the Federal Communications Commission to have solid outer conductors.

The lines may be either air dielectric (pressurized lines) or the more common foam dielectric lines such as Andrew "Heliax", Cablewave "Wellflex" or similar lines. A few of the remaining "Post World War II" systems still employ 3/8 inch "semi-rigid" air dielectric copper lines. These are very good lines if they have been properly maintained over the years.

The use of braided and bonded shield type lines such as RG-8/U, RG-11/U, RG-6, and similar lines is no longer permitted in "Approved" installations.

The lines are not required to be of equal electrical length, although most modern installations are of equal or nearly equal length. Lines of unequal length must have characteristics such that the maximum variation in phase indication due to temperature extremes is less than 0.5 degrees. This can usually be accomplished by burying the lines below the frost line.

All sample lines should be bonded to the station ground system at the antenna monitor location and at the antenna coupler end of the line. If the lines are run overhead, they should be grounded at intervals of 0.1 wavelength or less.

SIMPLE TESTS FOR SAMPLE SYSTEMS

Two simple tests may be run on any sample system to verify the integrity of the transmission lines used to connect the current sampling devices to the antenna monitoring system.

A baseline series of measurements should be made and recorded when the system is initially installed. From this data, the transmission lines may be readily tested in future years. You may wish to utilize a form such as shown here.

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MEMBER AFCCE

SAMPLE SYSTEM MEASUREMENTS

STATION _____ FREQUENCY _____ LOCATION _____ DATE _____

OPEN CIRCUIT LEAKAGE CURRENT

TWR	XMSN LINE	ISOLATION COIL	TWR RUN	TOTAL
1				
2				
3				
4				
5				
6				

SHORT CIRCUIT RESISTANCE

TWR	XMSN LINE	ISOLATION COIL	TWR RUN	TOTAL
1				
2				
3				
4				
5				
6				

MEASURED BY _____ DATE _____

Suggested table for recording of data.

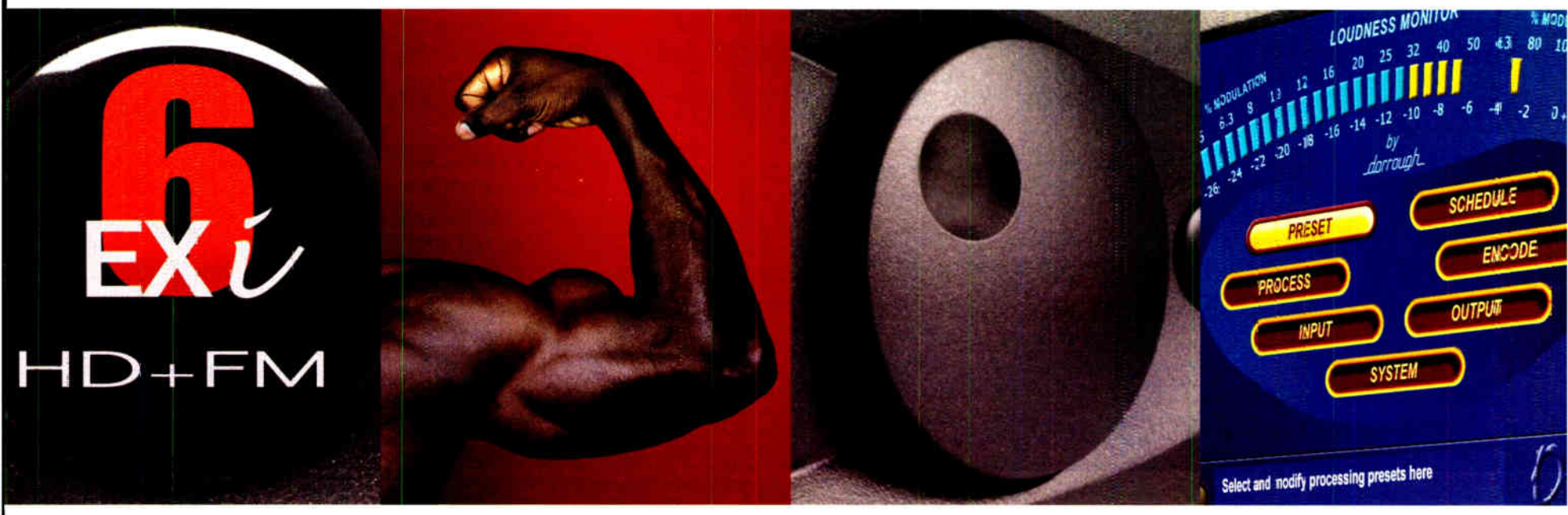
These tests consist of short circuit resistance measurements and open circuit leakage current measurements of the complete transmission line system and the sample loop, where loops are used. The following procedure may be used to systematically check the system.

Assuming toroidal current transformers are used as the current sensing elements, isolate all ground connections between the antenna monitor and the tower base as shown.

Mark and disconnect from the antenna monitor each of the transmission lines to the sample system.

Isolate the lines from the local ground in the transmitter or phasing system building. This is necessary to avoid "stray grounds" which will obscure potential faults with the transmission line.

(Continued on Page 18)



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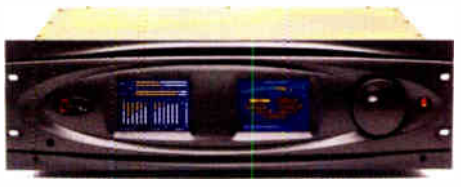

Features that Omnia pioneered — like dual, simultaneous processing paths for HD Radio™ and conventional FM at no extra cost. The world's first non-aliasing digital clipping system, with composite clipping for the ultimate in competitive loudness. The high-precision Multi-Band Look-Ahead Limiter (invented by Omnia) for perfect HD Radio processing. The six-band limiter for conventional FM, with adjustable crossovers for surgically-precise control over your signature sound. An integrated Dorrough™ Loudness Meter. And of course, the groundbreaking 96 kHz, 24-bit platform that delivers full 20 kHz bandwidth for HD Radio broadcasts. Always innovating.

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A lot of muscle? You bet. No wonder the competition is running scared.

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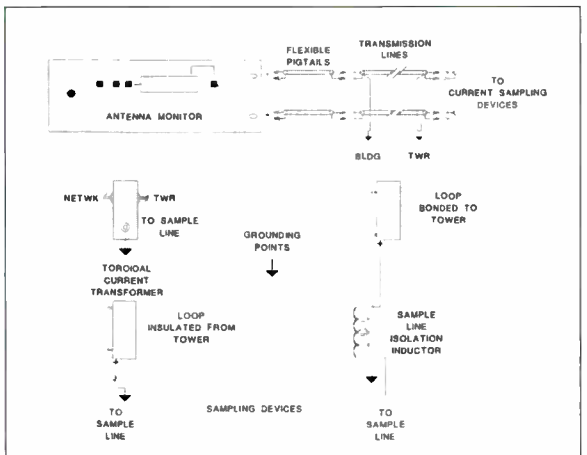
DA Q&A

by J.S. Sellmeyer, P.E.

– Continued from Page 16 –



Block diagram of sample system installation.

TEST 1

Connect a "megger" or other leakage current measurement system capable of supplying a low current DC voltage of a few hundred volts between the center conductor and the shield of each transmission line.

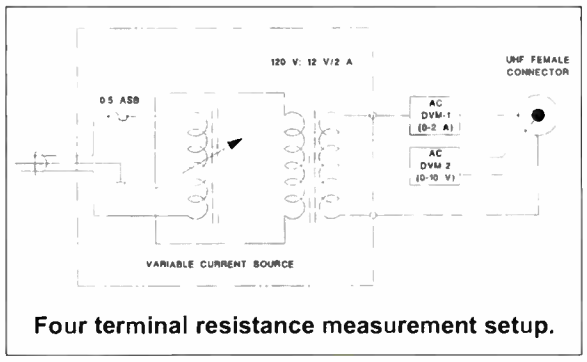
Apply a DC voltage, measure and record the leakage current and applied voltage or the leakage resistance as appropriate for each transmission line. There should be no significant DC leakage current on a good line.

Excessive leakage current or low indicated resistance, less than 100,000 ohms, is an indication of potential problems with the transmission line. This is usually caused by a break in the outer jacket of the line and entry of moisture into the dielectric of the line. This usually occurs at the connectors, at intermediate splices, particularly those underground which may be subjected to the presence of water, or at entry support points in isolation or antenna coupler cabinets.

TEST 2

The second test checks the continuity of the system by measurement of resistance by the "four terminal" measurement system. This is used in lieu of a simple ohmmeter test because it places the component to be tested under stress and will quickly reveal the presence of a marginal electrical connection in the component or system.

Connect a current source employing a variable transformer (Variac) feeding a low voltage transformer capable of supplying a few amperes of current. Arrange instrumentation consisting of an accurately calibrated true RMS AC voltmeter and an accurately calibrated true RMS AC ammeter as shown. Be certain to include any flexible pigtails used to connect the transmission line to the monitor and the pigtails used to connect the transmission line to the current transformer, if used.



Four terminal resistance measurement setup.

Disconnect the tower end of the sampling line from its termination (loop, isolation inductor or current transformer) including any ground connections to the line itself, if used. Place a secure short at the distant end of the line, using a connector compatible with the connectors employed in the system on which has been soldered a direct short.

Then check from the antenna monitor ground to the shield of each transmission line for lack of continuity to ground with the leakage test setup to assure that there are no sneak paths to ground on the transmission line runs to the towers.

Now apply one ampere of current to each of the transmission lines and record the resulting voltage read on the voltmeter. Calculate and record the resistance for each line. The line resistance should be very low, typically on the order of one to four ohms for sample lines employing 3/8 inch or 1/2 inch transmission lines up to about 1,000 feet in length.

If the line runs directly to the sample loop or to the current transformer the measurements are complete. If an isolation inductor is used and a line runs up the tower further investigation is required. (The services of a tower rigger may be required to remove the grounding bonds on the lines to the sample lines and to disconnect the sample lines from the loop connectors to measure open circuit leakage resistance or current.)

CHECKS AT THE TOWER BASES

The test setup will need to be relocated to the base of each tower to verify the individual isolation inductors and tower runs. It will be necessary to remove the connections to the "hot" end of the isolation inductor, both the transmission line and the RF feed to the tower, to test the inductor for leakage resistance and for short circuit resistance.

The measurements noted above should be made on each inductor. The open circuit leakage should be negligible, a few microamperes at most. The short circuit resistance should be on the order of one ohm or so for 1/4 inch through 1/2 inch line.

If the line running up the tower is long, the outer conductor should be bonded to the tower at the exit point and at intervals not exceeding one tenth of a wavelength. The grounding connections may need to be temporarily removed to provide accurate short circuit tests of the line. It is usually not necessary to do so if the line exhibits no DC leakage current or a resistance of 100,000 ohms or more.

A rigger will be required to disconnect the line from the loop. Test the line for leakage first and, if none is found, connect the short circuit test connector to the loop end of the line and make and record the voltage measurement for one ampere of current into the end of the line. It should be less than one ohm for lines of moderate length.

If significant leakage is noted, the cause should be investigated. This will normally be due to a ruptured jacket and outer conductor where moisture has entered the line and contaminated the dielectric of the line.

If the resistance is normal, reconnect the line to the loop and make a second voltage measurement with the loop connected. It should be very nearly identical to the line-only measurement. A serious discrepancy probably indicates a problem with the loop integrity. (The May 2005 ***Radio Guide*** discusses fixing loop connector integrity problems.)

Reconnect all parts of the sample system and make and record a final voltage measurement for one ampere of induced current into each line. Reconnect any ground connections removed from the lines while observing the voltage into the line. If a significant change is noted, the cause should be investigated.

The voltage into the component tested for each phase of the tests (short circuit resistance) should be the same for each tower unless unequal lengths of sampling line are employed. The total system resistance for each line and loop should be within one percent for a properly installed and functioning system.

If one or more components of the system show significant variation from the others, the cause should be carefully investigated.

ANALYZING HIGH RATIO INDICATIONS

The following illustration shows the mechanism involved in causing high current ratio indications due to a fracture of the outer conductor of the sample line.

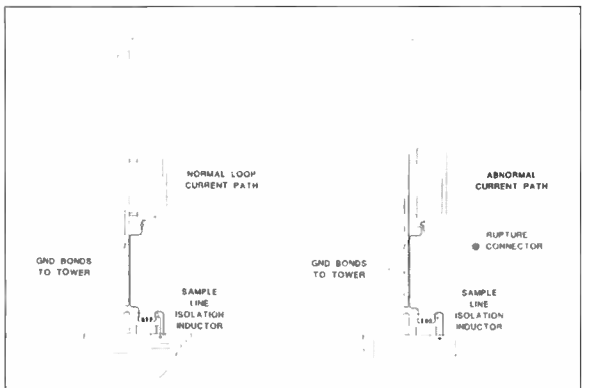


Illustration of normal & abnormal current flow in sample loops.

The current ratio indication, a voltage, is directly proportional to the loop area. The normal path for radio frequency current is entirely contained within the area of the loop with the return path being made to the outer conductor of the loop as shown on the left side of the illustration.

Assume the outer conductor has ruptured at or near the loop connecter producing an open circuit in the path from the outer conductor to the loop ground connection as shown on the right side of the illustration.

The new current will now return to the nearest bonding point between the tower and the outer conductor of the sample line.

It may be readily seen that the area within the loop is radically increased. This will produce a higher than normal ratio indication for any tower other than the reference tower. If the fault occurs on the reference tower sample line, all of the other ratios will be reduced. The phase indications may change as well, depending on the distance to the nearest bonding point and the rate of change of phase within the area where the fault is located.

Such indications may be intermittent, being at or near normal for long periods of time followed by intermittent abnormal indications. The changes may be prompted by temperature changes and/or wind conditions. The only solution to the problem is to replace the offending length of transmission line.

CONCLUSIONS

Once a baseline set of data has been properly made and recorded, it is a relatively simple process to quickly repeat the measurements when the system appears to be giving indications which do not properly reflect the actual operation of the array.

Jack Sellmeyer has designed, constructed and maintained many directional antennas over the years. President of Sellmeyer Engineering in McKinney, Texas. Jack can be contacted at jack@sellmeyerengineering.com

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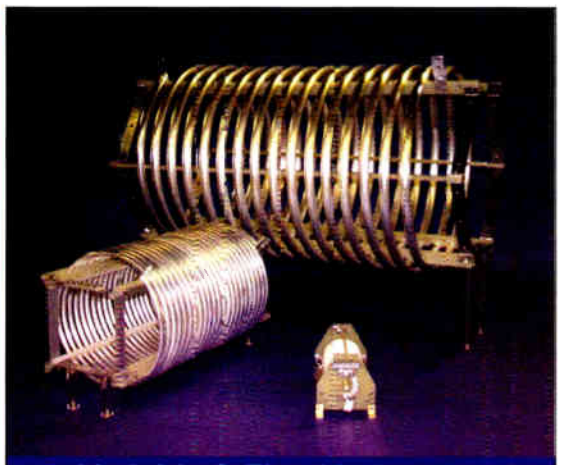

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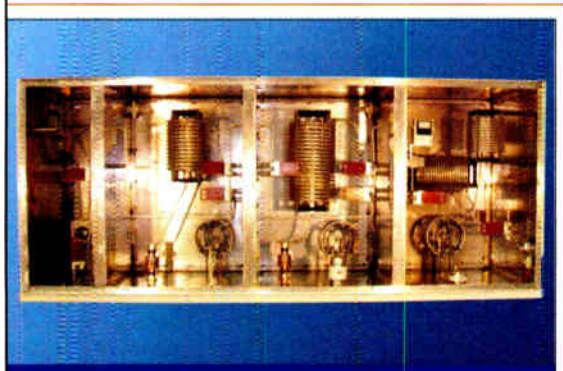

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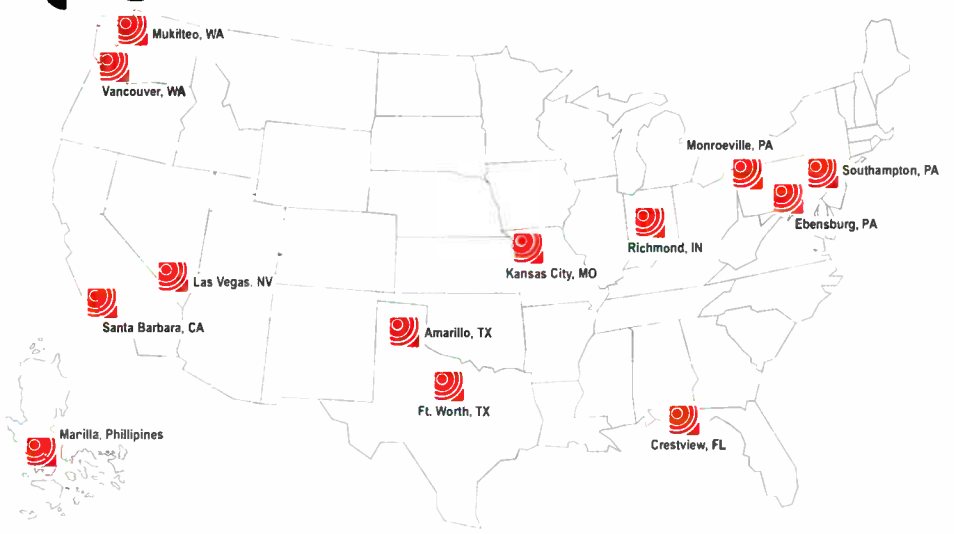

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Tech Tip

by Scott Todd

Solving Some Gates Five Problems

[EAGAN Minnesota] If your Gates Five has been in service for while, there are a couple of important things to check. It will save you a lot of hassle later, as sometimes it may seem like we are chasing rabbit trails.

For one thing, check the tightness of those B+ connections inside the transmitter. It took us some time to track it down as the cause of a "warm, smoky" smell in the back of our Gates Five. It clearly was the smell of burned phenolic board, but by the time we started searching there it had ceased burning, although there was enough left in the air to have circulated throughout the building

FOUND IT

Finally, we found the source. The warm smell was a combination of things – one of the big red banana plugs to the PA boards (Gates 5) was bad, plus the jack it was plugged into was a tad loose. More on that in a moment.

The problem turned out to have involved a couple of the PDM pull-up boards. I noticed it when I saw the transmitter running at only 3 kW and a couple of the PDM fault LEDs lit up. There is a high current point where these boards attach to the big filter caps. One ended up failing, while the other ended up welding itself back together, if you can believe it.

Here is what happens to a plug when it and/or the jack starts to loosen up:

Banana Plug from Gates Five

A week or two later a lightning strike apparently had blown out some of the doorknob capacitors putting this transmitter off the air again. I was beginning to wonder if I would ever get this thing to operate reliably.

The capacitors had cracked rather than shattered, otherwise what happened might have been much more obvious. There was no output and nothing I could find to account for what had caused the problem, so I had consultant Daniel Maxwell come help me find the problem.

While troubleshooting the transmitter, he noticed one of the B+ plugs was loose. I replaced it – although it was the same one I replaced earlier.

It turns out the heat came more from the jack being loose on the board than a defective plug. That explained the return of the warm phenolic smell, so I tightened it, replaced the plug again, and all is well (at least until Murphy comes calling again.)

These seem to be a common failure point in these transmitters, as I have seen some other charred ones removed by my predecessor. The jack had not seemed loose prior to this, so if you have a melted plug, be sure to tighten the jack as a routine measure.

REGULAR REPLACEMENT

Another common point of failure on these transmitters is the big electrolytic filter capacitors. Some engineers have noted that as they track down power supply problems, the big capacitors have been found to have turned "liquidy" inside, sloshing around when shaken.

Harris now recommends making those big electrolytics a routine maintenance replacement item; once every five years change all the big cans. If your transmitter has reached that age and you do not have the budget for changing them all, it is a wise measure to stock a few of them on site so you will be ready when they do fail.

By the way, if you do set up a maintenance plan to change out these parts, do not stop there – go through and change out all the smaller electrolytics, too. This tends to solve a lot of little problems.

For example, we were having some problems with low drive out of the oscillator. It turned out to be a dried out capacitor by the voltage regulator which created a rather ragged waveform out of the buffer transistor. After shotgunning all the small electrolytics, the beast returned to normal operation. (The cost of these small capacitors should total less than $30. Just be sure you get the ones rated for 105 degree Centigrade operation, as they will last longer.

Scott Todd is Chief Engineer of KKMS Radio in Eagan, MN. You can contact Todd at stodd@kkms.com

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"Share Your Knowledge"

Studio Guide

by Mark Shander

The Tricky Path to Microphone Selection

Selecting the right microphones for broadcast use is not always easy. As Mark Shander's experiment shows, personal preference and expectations can sometimes fool the ear.

[PHOENIX, Arizona] From time to time our readers share their views and opinions of our columns with words of wisdom and interesting feedback. One of our readers, Scott Todd, sent an email message that changed the whole tone of this month's column.

DO IT YOURSELF WORLDBEATER

"Your article reminded me of something I saw years ago on a website about someone who took a Radio Shack electret microphone capsule, mounted it in a piece of 3/4" plywood circle the diameter of a tomato paste can, and hid a battery inside the can.

"In a typical 'shootout,' without telling anyone specifically what he had done (it was hidden by a windscreen), that microphone beat out everything he was comparing! Unfortunately Radio Shack replaced that capsule with a different one, so you probably could not get those results today, though I suppose you could order a variety of capsules from Digikey and compare them."

With a total cost of about $10 for the microphone, you know I would have to challenge that result!

THE CHALLENGE

My daughter has forced me to watch enough episodes of Fear Factor recently for me to know how this should work. I built a long, narrow, wooden box, with four cubby-style sub-boxes in it. Each cubby was to contain a microphone for an old-fashioned shoot out. Each of the cubby sub-boxes were draped with old nylon hose (as close as we were going to get to acoustic material that day).

I then found three women and three men who work on-air in Phoenix to participate in this event. Without revealing what microphones were being tested, each of the six (three DJs, three talk hosts) took turns recording commercial copy into each microphone.

The panel was told they were helping with a microphone shootout and they would later be asked to help pick out the best-sounding microphones, from listening to playback together, for this column.

THE CONTENDERS

The first microphone was from a toy karaoke machine. Although I am not sure of the specific pickup pattern, it was a condenser strawberry.

The second microphone was actually an ear bud from the dollar store. The third microphone was an EV 635A, and the last was an old condenser microphone pulled out of an old Realistic portable cassette deck, with a toilet paper tube in front of it.

With only one microphone that could be called a real broadcast tool, I had each of the contestants read their copy in front of the nylon stockings.

LET THE GAMES BEGIN

The first contestant set the pattern stage for the rest: she insisted on using headphones. She then proceeded to read copy inviting her listeners to an exciting after-hours party at a night-club next Friday night, delivering her vocal diatribe into an impedance-matched, ground-lifted strawberry. Her verdict: she thought microphone #1 sounded a little flat.

Moving on to microphone #2, she noticed a thin cable coming out of the nylon covering. One earbud was hanging from the cubby in plain site, and the other was under hidden under the nylon covering. She ignored the hanging earbud and continued to pitch to her audience.

She said she thought microphone #2 was muddy, and that I should get rid of the crappy earbud someone left near the microphone we were testing.

Moving to microphone #3, the 635A, she started to look funny at me. I thought she knew something was up until she tried impressing me with her impressions of the tonal characteristics of the microphones she sampled. Microphone #4 sounded "too boomy" to her.

She liked the 635A, though she said she thought the first microphone (the strawberry) sounded a little better.

EVALUATING THE MICROPHONES

I told her good, low-end broadcast microphones such as the ones she was evaluating can list for anywhere up to $500 or so, and asked her to price the four microphones according to her perception of their quality.

She suggested that the strawberry was probably the bargain of the bunch, and priced it at just above $250. The earbud from the dollar store was priced at $200, calling it "a good value" for that price, though she suggested rolling off the low end and adding some EQ for presence. She had no idea she could have bought enough earbuds to cover 199 more studios with her price speculation.

She thought the 635A (microphone #3) sounded too close to Microphone #4 to call, and suggested $400 as a good price each for the two.

Turning to my five other participants ready to evaluate the microphones, I carefully logged, recorded and played back the results from each microphone. Here are the final results:

GROUP CONSENSUS

Microphone #1 (Strawberry) – Beautiful cardioid pickup pattern. Priced from $80 to $450.

Microphone #2 (Earbud) – Boomy low end. Priced from $150 to $350.

Microphone #3 (EV 635A) – Good choice. Price $400.

Microphone $4 (RS condenser microphone and TP tube) – $350-$500 and "wiped" the others clean.

At the end of the event, I revealed the microphones behind each nylon hose. After everyone had a good laugh, a bidding war started over the strawberry microphone. The first DJ insisted she had to have it, while the weekend garden show host insisted it should go to him.

By the time the bidding war ended the strawberry microphone, valued at $3.95, was sold to the garden guy for $85. He was willing to pay that, but in the end I let him off the hook.

Obviously, we need to develop more criteria than merely "personal preference" when selecting microphones.

Mark Shander has spent a good part of his life talking into microphones and comparing their output. Let Mark know what is your favorite microphone at mark@a shander.com

The Worst I've Ever Seen

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

> *If you have built castles in the air, your work need not be lost. That is where they should be. Now put the foundation under them.*
> -- Henry David Thoreau

Not all tower bases are made equal. But when reader Jay White opened the tower gate at one station and saw the base, he was a bit unsure whether to call for help, or just run away as fast as possible.

Fortunately, we have some dramatic photos to share. Jay tells us, "the two tower array is situated in a very wet area that, when it's dry, the earth is mushy. When it's wet, it's a swamp. Sometime over the period of a couple months, the base pier for the south tower of the two tower array listed to one side." Worse, it was clear the concrete was not in good shape.

The solution was simple: replace the pier. The job was *not* as simple. White says, "I've been on site many times and can tell you when a large truck goes by on the road adjacent to this tower, the ground below you actually bounces!"

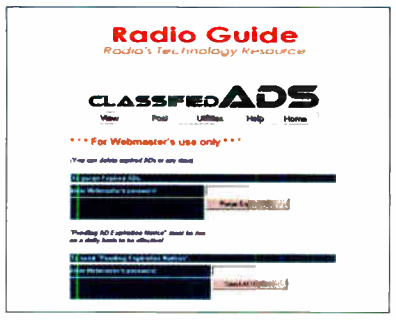
It took four concrete pads on a bed of compacted gravel just to provide the platform to raise the tower while the original base was demolished and replaced. Many yards of heavily compacted gravel, rebar and concrete later, the new base was in place and the tower was slowly lowered back in place.

The care taken in replacing the tower base is demonstrated by its stability: White reports "It's been four years and the tower has been checked for plumb periodically. It hasn't moved. More importantly, is hasn't sunk either."

– Radio Guide –

Radio Web Sites

On-Line Resources for Broadcasters



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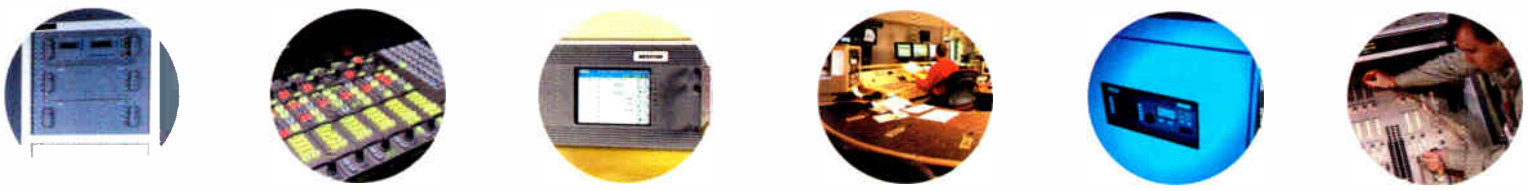

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HARRIS

Maintenance Guide

by Gary Minker

Line Sweeping as a Cost-Effective Maintenance Item

[LAKE WORTH, Florida] There is a nagging question Mr. Three Piece Suit is going to ask you because your engineering budget is an expense to him and not a tool as valuable as the sales staff.

It might even be this is partly your fault.

THE MEMO

TIME: 16:52.47

TO: Chief Fix-It-When-It-Breaks

SUBJECT: Is this Line Sweeping thing you asked for an effective tool as a maintenance item? If so, why wasn't it a regular planned for expense as part of your last budget? What are we going to get in return for this *expense*? Let me know by 16:59:59 today or we'll just forget the whole thing, and maybe your department too.

Do you smell the smoke yet? Is it coming from your ears or the front office? You might surmise that there are a couple of problems brewing here.

FAILURE TO COMMUNICATE

In previous articles, we touched on the possibility that you need to be a bit more proactive in your communication with the Suit up front.

In his mind, Engineering usually is not a valuable tool because you geeks sit back there cleaning your pocket protectors, show up when stuff breaks, speak to no one in understandable sentences, and then skulk back to your inner sanctum where all those weird meters and rosin smoke plumes live. This segregates you from the rest of the tribe – and most importantly Mr. Suit.

When you last talked with the guy you should have assured him things such as Line Sweeping *will* be included as a regular expensed Maintenance line item starting next year. Unfortunately, even if you did, he may have conveniently forgotten that thought.

COMMUNICATION NECESSARY

It is critical to consistently – and as kindly as possible – remind the Suit and the rest of the staff that while you and your staff (if it exists) may be different, you are people, too, and your department is a part of the solution and not the problem (unlike those clucks in programming).

However, you still are on the block for the memo. OK, here is the help you need. The question is pretty direct. Is Line Sweeping a cost effective tool as a maintenance item? This is best answered through consideration of the following documentable questions:

1. Did you receive a booklet of proof of performance on your antenna system when it was installed?

2. Why should you save your line sweeping reports?

3. What are the pros and cons of testing; why test?

4. Do you really like to be off the air?

DEVELOPING THE RIGHT RESPONSE

Did you receive a booklet of "proof of performance" data on your antenna system when it was installed?

When your system was built, a data booklet with the system drawings and the factory test data on the antenna at the test range was supplied. (You did have that new antler range-tested, right?) Also attached is the test data from when you installed the system, and the factory or your other favorite Line Sweeper came out and tested the system for you. (You did have it swept when it was installed, right?)

This booklet of data is your system Bible, and it must be updated like a clean bill of health every year or your job could expire. Mr. Suit needs to know about this very impressive compilation of letters charts and graphs – the EKG of the system – and that without a current report, all bets are off because that nice shiny Watt meter is always the last thing to know that you are having a system problem and the on-air jock is the first.

You should try to get Mr. Suit to see that you understand what the report says – in five minutes or less due to GM ADHD deficiencies – and you are really on the ball.

SYSTEM DOCUMENTATION

Why should you save your Line Sweeping Reports?

This is the CYA (cover your "posterior") portion of the drill with Mr. Suit. You were the happy and lucky recipient of a great Line Sweeping adventure when your system was put in 17 years ago, yet you have not had the system tested since then. Mr. Suit wants to know why not – and *why now*?

You could tell him that this was an oversight. Of course, you may well be looking for a job in about five minutes. Or, you can tell him that it is now the industry recommendation that such things be conducted annually.

Alternatively, you could note that from your intensive involvement in the new standards, and as part of your self-avowed continuing education, the practice and art of Line Sweeping has come to your attention. Having saved the initial report in the station files, it is high time to have a new one this Sunday night during the maintenance window in order to avoid catastrophic damage from a sudden creeping failure.

BENEFITTING FROM DOCUMENTATION

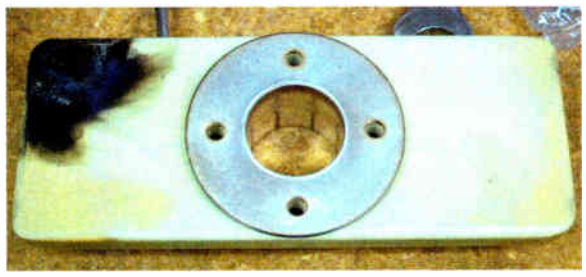
What are the pros and cons of performing these tests?

This gets easy. First the cons: Without continuing maintenance, things at the transmitter site get really really loud, and then they get really, really quiet.

Indeed, after the fire trucks leave from extinguishing the fire that started in the grassy field and woods next to your tower from the flaming molten metal and plastic shroud parts dripping from your previously good old antenna, the GM will hold you are up for the "silence is golden" award and the ensuing tens of thousands of dollars that the repairs will cost, which will immediately precede your being fired for losing your crystal ball (and your gross negligence and obvious incompetence).

The proactive stance in order to avoid these things is to make the case that the most frequent cause of antenna and line failure is not lightning, but actually the slow and methodical mechanical wear of the bullet joints.

These joints which include the actual fingers themselves and most importantly the watch band springs, wear down and make silver dust which is highly conductive; the now bare joints, which often consist of dissimilar metals of brass, stainless steel, and beryllium/copper, eventually fade to fatal.



This is not what you want to see, but often is the result of maintenance-free operation.

The silver coatings wear off or pit from the thermal expansion and contraction every 24 hours for years at a time and – oops! – you have smoke. This smoke often comes from the high resistances that develop in these bare metal joints from the lack of silver and/or the arc path that develops from the silver and other metals dust that has landed on the next lower insulator in the system.

Line Sweeping can see these joint failures. In many cases you will see the corrupted insulator that the conductive metal dust has landed on or the small carbon path that has started to burn the surface of the next lower insulator. The eventual generation of high heat, smoke and toxic Fluorine gas, which is also highly corrosive, spells the end of anything in the system with which it comes in contact, including your lungs.

What is going on up there?

Line Sweeping will also let you know if your antenna tuning has slipped due to any of a number of problems on the tower. A "favorite" is when some goof mounts another antenna in your aperture without telling you.

Other things that *do* happen: a giant buzzard bends your elements; slot covers rot off and wet minerals splash on the gas barrier face, porcelain insulator/centering pins, and the ensuing arcing in the antenna sets the gas barrier on fire; or the three wraps of magic tape dried out and your slug slipped a few inches.

By bringing in your favorite Line Sweeper you can usually catch these things before they turn in to a problem.

TO AIR OR TO ERR

This one is the family favorite of all time: **Do you really like to be off the air?**

Even with off-the-air insurance and a back up facility, is the expense and grief really worth it if you are burnt to the ground? I have heard of only one instance where the station made out on the insurance claim, otherwise the off-the-air part is pretty bad.

This is where Mr. Suit gets to realistically question your competency and could actually have a point there. As I have said before: there should be no space, thing, place or procedure that you do not touch at least one time per year in your plant. If you blow this point you are up for the Engineering Darwin Award – and face it, rightly so.

SHARING THE CREDIT

All in all, here is where you tactfully turn the tables. It should not be a stretch to get Mr. Suit to agree with you that the idea of Line Sweeping that he just came up with is really a great idea to secure his job, and that you will get right on it.

Even if the reverse psychology does not work with him, he will have to agree with you that in the interest of everyone keeping their jobs this is a necessary expenditure and the station and the owners are best served by the annualization of this activity.

By the way, when all else fails and you truly have problems integrating engineering into the main stream of the station society, designate a readily accessible drawer in your desk (or bowl on the desk) as the community candy drawer and you will be amazed at who drops by for a nice visit and chat.

Be sure it has good stuff in it like chocolate and Gummy Worms. Instill a policy that, "if you take candy, you bring candy" and be prepared to stock it occasionally with more good stuff. Suddenly you and yours will be more popular than the promotions guy or gal!

Owner of Radio Works R.F. Consulting in Lake Worth, FL, Gary Minker has analyzed hundreds of transmission systems. He can be contacted at gary@radioworksrfconsulting.com

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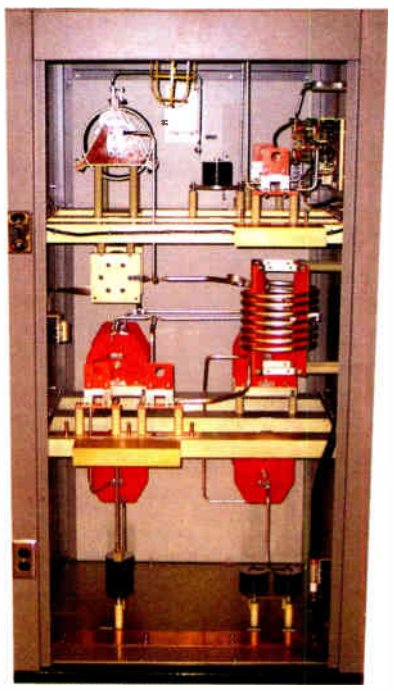

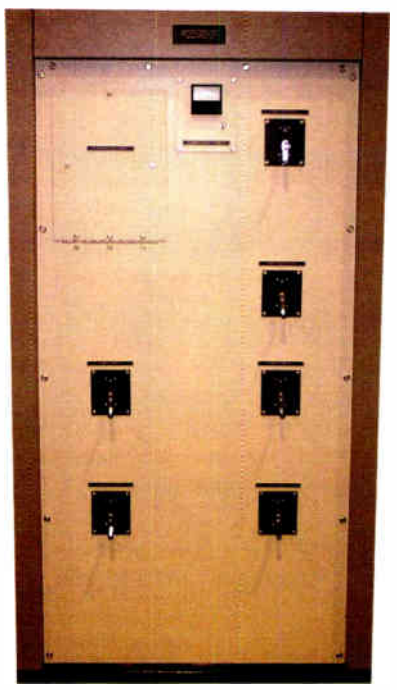

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Operations Guide

by Bob Burnham

How to Syndicate Your Own Radio Show

[SOUTHFIELD, Michigan] There are two notable concepts that helped small AM broadcasters to survive from the 1980s to now.

One is at the very core of how radio works (from a business sense) since its inception: selling air time. (Selling brokered time to individuals and hosts who would like to host their own program is a "survival" technique slightly different from traditional spot sales.)

The other was their decision to carry highly rated syndicated programming, such as Rush Limbaugh, and operate the station in an automated mode, thus cutting operating costs to the bone.

AN IDEA FROM BROKERED RADIO

For most of the 1990s, I was Chief Engineer for WCAR-AM, one of the pioneer stations that sold air time in one-hour blocks to a large client list. The first all-talk station in Detroit, WCAR acquired the call letters in the 1970s.

The station also "owned" its own programs and sold spots on those shows in the traditional manner. They even allowed the Chief Engineer (that would be me) to do his own show for many of those years.

While many other stand-alone AM's were going out of business, General Manager Jack Bailey and WCAR's long-time owner, Walter Wolpin, were able operate the station profitably for many years with its unique format.

My hat is off to Jack, who had a knack not only for broadcast sales, but surrounding himself with a good core group of on-staff people. Many of these people would become good friends.

The author and WCAR General Manager Jack Bailey at the grill during one of WCAR's promotional events.

The station is now owned by a very dedicated religious group, and still maintains some of the same programming on the weekend. And why not!? It helps pay the bills.

A NON-FORMAT FORMAT

Some of the programming we aired while Mr. Wolpin owned the station was less-than-professional, hodge-podge, ethnic and/or foreign language. However, it served audiences that would otherwise not have been served, for many years prior to the widespread availability of the Internet.

As part of the brokered "package" the station usually supplied a board operator, and of course, the host was required to sign a contract binding them to all station policies and FCC Rules and Regulations.

Some of the programs were very, very good. We were especially proud of our own station-owned programs produced by the paid staff. In fact, one of the incentives for keeping good people on-staff was to allow them to host their own program.

The most successful shows thrived on this station for twenty years or more as the hosts successfully sold their own spots which offset the cost of their "block" as well as putting some extra cash in their pocket. Many had their own business underwrite the cost. A number of the hosts eventually moved on to work at very large stations. They essentially started their careers by "buying" their time. Still others came and went.

A BUSINESS OPPORTUNITY

Then a dimly glowing light bulb appeared over my head. My thought was: if this basic business model can work on a local station, why would it not work on a nationally syndicated show?

The fact is it *can*, and it became the basis for one of the services my own business would eventually offer.

If someone is knowledgable, entertaining and somehow, has the "knack" for hosting a show – and the financial resources to make it possible – those are reasons enough why they *should* be on the radio in the first place. Of course, they may not have a background in broadcasting and have the appropriate technical training.

Nevertheless, if they are paying for their time, they should not need to be concerned about running their board, watching levels, running the right spots at the right time, running bumper music or other drops or features and keeping a finger near the "Dump" button, should one of their callers utter the wrong words.

Since many of the programs are talk shows, the host and sometimes co-host need to be focused on program *content* and – yes – on being the host! After all, talk radio is a bit more demanding to produce than a music-oriented show.

Over the years, I have produced a few shows at clients' places of business. I did the technical set-ups for dozens of remote broadcasts for various stations including many fairly elaborate set-ups from Detroit's North American International Auto Show. The station PD and I became so-called "experts" at learning how to plan some of these more complex remote events.

DEVELOPING A PLAN

Then I was introduced to Lowell Homburger of Abernat, Roxben & Boggs through a chance network project that went nowhere due to a variety of personnel and funding problems. Over a period of the next several months, after comparing our almost identical programming and management philosophies, Lowell and I shared ideas about how to make our package of services work.

My background contributes to the service technical, logistics, practical and programming applications as well as specialized mail-order marketing experience. Lowell adds sales and marketing, business management as well as many common areas of broadcast programming. In other words, every service someone could expect a traditional radio station to provide we are able to offer completely in-house.

We worked on several joint projects, including distributing pre-recorded programming and radio station construction.

Lowell Homberger at one of the studio projects.

In 1998, we launched our first nationally syndicated "live" broadcast offerings – two full-time call-in talk shows – from what would eventually become known as "Broadcast Center 1," a modest facility constructed and managed by yours truly.

FULL SERVICE

As part of the services (as it turns out) a great deal of time is spent coaching and encouraging the hosts about all aspects of their program. Newcomers to broadcasting usually do not have a clear understanding as to how the business end works – especially how the *syndication* business works, so we find ourselves spending some time educating people about radio.

In the course of our activities, we have found out that not everyone is cut out for traditional radio and some of our efforts end up being wasted as the host (or client) decides that being on the radio is going to take more effort than they are willing to invest, either in terms of time or financial resources.

Others decide they can "do it all" on their own. Those types of broadcasters, more often than not, end up as lifetime staples of brokered radio, which can be a dead-end road. Their shows may amount to little more than "info-mercials" with zero listenership. They provide outlets for the hosts' ego and revenue for the radio station selling them time – and nothing more.

There is nothing wrong with that, but that is not what this article is about, and not the type of host with whom I prefer to work.

BUILDING A SHOW

How can you take a radio person who comes from a small market and make him or her "good enough" to air in a top 10 or 20 market? The answer is of course, you cannot! At least, you cannot do it right away, but if the show is unique enough, yet has enough appeal, combined with slick production values, it can build over time.

In the meantime, enough medium and small markets can add up to a respectable cume, at least enough to sustain the program while it is in the growing stage.

I would like to think we specialize in helping these types of broadcasters. Not everyone who comes to us with a show idea is accepted as a client. We look for people with good, solid shows, a "knack" to host shows, the right attitude and the ability to manage the show from a business standpoint.

An equally important attribute of the ideal syndication candidate is that person who has enough dollars behind them to make it happen. The cost of launching it and "operating" a radio show can be significant. The start-up dollars need to be sufficient to allow for the period of time it takes until the show becomes self-sustaining and ultimately profitable!

TECH SIDE

Meanwhile, the technical aspects of the syndication process still need attention. Those complexities of what it "takes" to air a show from a technical standpoint to make it suitable for airing nationally is just one of the areas I specialize in.

Is it actually possible to "do it all" yourself? If you are an experienced broadcaster with a background in programming, sales, engineering, marketing and making people comfortable, you can probably make it all happen yourself. However, in the process, you will run into the same trials and tribulations we have worked through during the past several years.

If you plan to design and build your own "Master Control," and originate 100% of your program from your location, here are a few basic things you will need:

1. A highly accurate means of keeping track of the time.

2. At least one ISDN line installed by your local phone company.

3. If you expect to take calls on the air, at least three dial-up phone lines.

4. A broadcast delay.

5. A means to manage the air sound primarily in terms of peaks and gain riding (AGC).

6. A broadcast console and equipment to manage all of the above.

Telephone and audio control units.

7. At least two high quality microphones (I suggest an EV RE-20 or a Shure SM-7), and a good monitor system (speakers, high quality headphones for each person on the air).

8. At least one alternate source of audio to play back and record. This can be any combination of Mini Disc, CD players or a computer-based system.

(Continued on Page 30)

Operations Guide

by Bob Burnham

– Continued From Page 28 –

9. A computer with Internet access. If a computer is used for audio, it is preferable to have a separate computer for general usage.

10. A comfortable environment in which to set up all of the above, which may include a certain type of broadcast furniture, office chairs, acoustic treatment to the room itself, etc.

Syndication Master Control at BRC

This modest list, however, can easily total up to and beyond $25,000, and that is at the low end of the range.

Not mentioned is having personnel available with enough knowledge to select specific equipment models suitable for such a project.

For example, many of the stations you will want to carry your show may use various means of automating their programming. They will be more inclined to carry your show if you provide cueing that is compatible with their systems so they do not have to pay the salary of an extra local board operator to baby-sit your show.

Some broadcast vendors can be helpful in this regard. Not all, however, have specific knowledge to accomplish such a specialized endeavor. Your local station engineer may or may not have specific knowledge in this area.

MAKE SURE IT IS COMFORTABLE

The importance of having everything comfortable and at arms reach for the host cannot be over-emphasized.

In the case of a music show, the host may want to run his or her own board or at least have some immediate control over managing the various elements of the show. With a talk show with live callers, the importance of a delay system is crucial.

Suppose you *do not* want to build your own Master Control, but prefer just sitting in a convenient location as just the host, and letting the Network master control or production studio at a remote location handle all the logistics?

If this is the case, your equipment needs are fairly minimal: You can accomplish this technical feat with an ISDN connection connected to a suitable codec, along with a microphone and your favorite pair of headphones. Keeping your computer handy for communications is also advisable. That is all you need.

Suppose your host wants to do the show from his beach front property? In this case, the callers can be screened at Master Control and your board operator/producer/screener can communicate with you over an Internet "chat" room as well as over the Talk Back system built in to the broadcast audio link over the ISDN line. The host will hear the audio from your callers over your ISDN return.

BUILD IT OR RENT IT?

Some networks will have this service available at all times for their paid network hosts. If you want to "own" your own show, you may have to arrange for these services for a pre-determined fee. An entirely separate entity may actually provide the satellite uplink on a rental basis.

You have to weigh the cost of these services against the extensive costs and headaches of building your own Master Control.

Yes, the costs can indeed start to add up quickly, but having people involved in your show who have experience in this very specialized area, in the long run, will save you from making very expensive mistakes, and trying to "re-invent the wheel."

Keeping the business end of the radio show from collapsing (along with the host's own sanity) are areas on which many clients need a fair amount of coaching. If they have business management experience, it may be helpful, but not all that much! Radio – particularly *syndicated* radio – is a business completely unlike any other business.

The big question is how soon one can start to see a return on the investment in the show? How long before revenue from advertising sold begins to accumulate? How does the whole thing work? And what about controlling that automation at all your affiliate stations?

I will attempt to shed some light on these and other areas in an upcoming article. In the meantime, if you already have your own local show and cannot wait to have some burning question answered, you can certainly contact me.

Bob Burnham operates BRC Broadcast Services in Detroit, MI, offering a variety of services for people who want to do radio shows, build radio stations or listen to old-time radio shows. Reach him at: bburnham@specshoward.edu

Field Guide

by Chuck Conrad

Sharp Ears – the Fanfare FT-1AP

[CHALK HILL, Texas] Sometimes you discover something that is "expensive, but worth it." The Fanfare FT-1AP Reference Quality Translator Receiver is one of those things.

At $1,649, it is a little pricey, but this is no consumer grade tuner. I am sure even the pickiest "golden ear" will want one once they hear it – it is that good. And it is not that expensive when compared with other purpose-built translator receivers.

REACHING OUT TO LISTENERS

KZQX-LP (www.kzqx.com) is a 74 watt noncommercial community broadcaster licensed to Chalk Hill, an unincorporated neighborhood about 10.5 air miles from downtown Longview, Texas. It features a music heavy format of Great American Standards, which means that audio quality is important to the station.

The station gives good coverage for the 10,000 or so residents who live around the south side of Lake Cherokee and vicinity, but as with many small stations, as people drive to work, school, shopping, etc, that ten miles or so stretches the station's coverage beyond its abilities.

A couple of years ago, some friends of the station applied for construction permits to rebroadcast this community radio station in Longview and Kilgore. To almost everyone's surprise, the FCC granted them.

STRAINING FOR THE SIGNAL

Now came the challenge of actually building them. Translators in the non-reserved band are required to get their signal off the air. An existing tower location had been chosen in Longview, but reception was not always as reliable as desired: the desired signal – no powerhouse – was 104.7, another station on 104.5 can also be received in this location and an LPFM was coming on 104.9.

We used a Winegard FM (10 dB gain) antenna mounted about 50 feet up the tower, feeding a well respected translator receiver. The single bay transmitting antenna was mounted another 65 feet or so above the receive antenna on the same tower.

After installing the receiver, we got a nice stereo signal. But with the transmitter on, the RF field swamped the front end of the receiver. Inserting a 10 dB pad on the antenna input brought reasonable Signal to Noise results in mono, and "nearly acceptable most of the time" results in stereo. The problem is "most of the time" does not cut it.

Some hand made filters were ordered to try blocking the offending transmitter signal. They helped, but did not cure the problem. As a result, we ran the station in mono until we could find a better solution.

A DIFFERENT RECEIVER

Then somebody suggested we try a Fanfare receiver. I called the factory, and found them to be more than helpful. Within a couple of days I had a receiver in hand to evaluate.

When you first open the shipping container, you realize this is not an ordinary product. As tuners go, it is massively built, weighing in at 16 pounds. The Fanfare people do not seem to be bothered if you open the unit up to see what makes the wheels go 'round. You will not void your three year warranty, but you will find very high quality construction throughout. You even get a pair of white gloves to use, if so inclined.

The unit has a variety of outputs; including stereo balanced XLR's and two pairs of line level unbalanced stereo RCA jacks. Even the RCA jacks are extremely high quality gold-plated chassis mount design. They are quite unlike the cheesy PC board mounted jacks you will find on most of today's equipment. Better yet, the power cord is a standard IEC type that is easily replaceable. No wall-warts!

WELL THOUGHT OUT FEATURES

A convenient BNC Composite (MPX) output with its own level control is on the rear panel. A thoughtful touch is the presence of a knob on the control shaft – much better than a tiny pot behind a hole in the chassis. Matching levels with your transmitter is a piece of cake, even when the unit is tightly packed into a rack with poor access to the rear.

The composite output has a relay connected to it, operated by Fanfare's "Carrier Sense" circuit. It will mute the composite output if the signal drops below the 10 uV (20 dBf) level for more than 120 seconds. (A low cost upgrade allows the user to adjust the desired mute level however they desire.)

At the same time the output is muting, an auxiliary BNC connector provides 12 volts to activate a transmitter control relay for either instant or delayed shut down. (Carrier drop outs, if they occur, are usually for a short time, so running dead air for a few minutes to see if the situation clears up might be more desirable than a total loss of signal.) This will keep your translator legal.

MISSION ACCOMPLISHED

So how did it work? Very well, thanks. The change-over to the Fanfare receiver only took a few minutes. The FT-1AP's super sharp filters gave us the desired signal and none of the first adjacent. We are now able to run the station in stereo all the time. We did not need the 10 dB pad to keep the front end from being swamped by the transmitter.

It has been super stable and reliable. I like things that do not require a lot of hands on attention. In fact, I liked this enough that I convinced the translator owners to purchase another one for the Kilgore station. They donated the original receivers to the LP station, which now has two really good EAS receivers.

I love it when a plan works out.

Chuck Conrad is the General Manager of KZQX. You can contact him at 104.7@kzqx.com

Tech Tip

by Richard Rudman

An Easier Way To Use Shrink Tubing

[BURBANK, California] Few things look nicer than wiring that has been done carefully and neatly, and properly dressed with the right size shrink tubing.

A GOOD HABIT

For these reasons, it always has been my habit to use shrink tubing to serve up wire ends of individually jacketed shielded pairs connected to punch blocks. I like to use 3/16" shrink over the drain wire and a larger piece to hold everything in place depending on the jacket diameter of the pair.

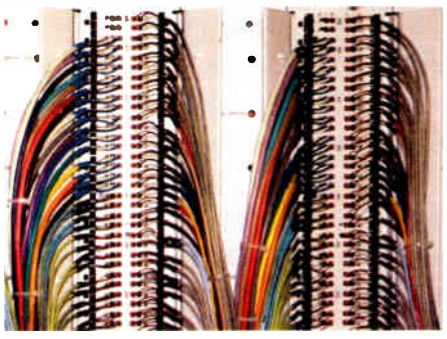
In addition to making it much easier to see that the leads are in the right place and seated properly, it also makes it a lot easier to locate each end of the wires—especially, if you use color coded shrink tubing.

Of course, as I surveyed the finished job, no matter how carefully I tried to cut the pieces, it always seemed to look uneven. There had to be a better way to cut the shrink tubing, so they would all be the same length.

AN EASIER WAY

It finally occurred to me after all these years that it would make a lot of sense to use an ordinary office paper cutter to precut uniform pieces of shrink tubing.

You can hold several longer lengths together and cut them together, or slice uniform pieces off a roll as in the picture below. The built-in ruler on the paper cutter makes it easy to decide upon a "standard" length and cut as many uniform pieces as necessary.

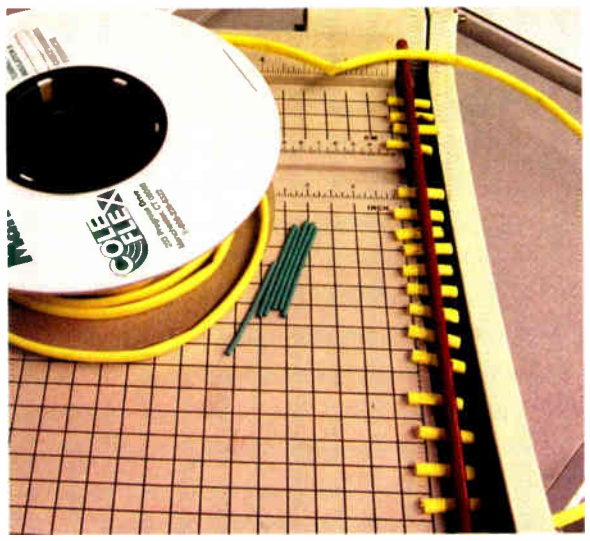


Shrink tubing helps to make a clean installation.

The trick is to make sure you get clean cuts on paper cutters. One method I have tried is to force or pull the blade close to the stationary cutting surface as you bring the blade down. The standard OSHA safety caution applies: Make sure your fingers never get in the way.

One challenge is that most office paper cutters usually have seen better days. They exhibit some play in the blade and/or the blade is not factory sharp. Either or both conditions can result in flattening the work rather than cutting it. For the convenience you get, you might consider buying your own paper cutter, especially if you do a lot of wiring.

By the way, another time and trouble-saving trick is to have and use a good hot air blower. Yes, some of you have already requisitioned the wife's hair dryer – but a professional machine will not only develop the heat faster but also focus the hot air on a smaller area, making your work easier, and your fingers cooler.



Carefully using a paper cutter can help make shrink tubing look uniform.

A long time radio engineer and past President of the SBE, Richard Rudman is still active in the Los Angeles market, handling projects large and small at his company, Remote Possibilities. Contact Richard at: rar01@earthlink.net

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FCC Focus

by Bruce Eisen

Proper Contact with the FCC

Sometimes, getting information from the FCC is easy; www.fcc.gov has more information than ever before. But it always seems the one item you desperately need is missing. Bruce Eisen helps explain ways to get what you need.

[WASHINGTON, D.C.] It is useful to make an appropriate inquiry as to status on many kinds of applications so that you can determine a time frame and perhaps even a likely outcome. It does not take a genius to develop the kinds of questions that can be asked. The more difficult part may be to locate the staff person with direct responsibility over the application.

FINDING THE RIGHT CONTACT

A good communications attorney can be a valuable asset when you are trying to get information. He will know how to find the correct Commission Staff to contact and, as we discussed last time, the right way to make contact, so as to avoid problems such as ex parte contacts.

However, there is no reason a broadcast applicant or its authorized employee cannot make most sorts of contact themselves. The need for an attorney may, in some cases, be truly helpful. But the garden variety status inquiry is something that almost anyone can initiate if they do not get obnoxious about it.

The best approach is to simply and as clearly as possible ask what is likely to happen to the application and when action can be expected.

THE RIGHT CALLER

There may be a problem, however. Some – but not all – FCC staffers prefer not to discuss a case with the applicant and would much rather be in touch with the attorney, or even to station engineers if the matter is technical in nature. After a few seconds on the phone it will become apparent how the staff person feels about you as the inquirer.

Of course, there are FCC staff who would rather discuss a problem with the applicant instead of the hired gun. Therefore, perhaps not surprisingly, I have seen clients do better with their own direct contacts than I have on certain cases. Maybe some staff feel that a lawyer's superficial request for information is not as sincere and deeply felt as the applicant's own request for an update.

Sometimes, a telephone call to the relevant Bureau or Division can quickly result in the name and telephone number of the person to call. There is, however, even a better way to get the information you need. I would suggest a liberal use of the FCC's website at www.fcc.gov to determine the likely staff person responsible for an application.

All FCC staff persons have an email address, and the receptionist in each Bureau and/or Division should be able to provide that email address easily.

With that in mind, anyone can frame a concise question to the staff person identifying your interest in the application, the file number of the application, and what is included in the proposal. A simple "can you provide the status of the application?" should result in a timely response that will prove helpful to your operational plans.

THE PROPER, CAREFUL APPROACH

Besides the question of who should initiate the contact, there is always the issue of the way in which the inquiry should be made.

FCC staff is largely comprised of well meaning, hard working civil servants. But they are human beings with the same tendencies that we all have. Some can get their backs up pretty easily, especially if they feel you are pressing them for a grant or putting them on the defensive.

The best way to confront a difficult staff person is to be as dispassionate as possible. After all, you really are after a simple answer: "How is my application doing?"

If you were thinking of acting as an advocate, you should know hard luck stories rarely work. The best follow-up question to a disappointing staff response is probably: "Is there anything else you need from us, and is there anything I can do to move this along?" Never, never threaten to go to the next level of decision makers, or to argue a contentious point.

True, in some cases, it may be necessary to approach an official with authority over the staff person or even to contact a Congressman or Senator. But on the first approach for a status update, all you want are the facts – nothing more. Turn it into an argument and your application just might get "deep-sixed."

THE NEXT STEP

If the answer you get from the staffer proves insufficient or does not satisfy you, you might consider contacting an FCC attorney to advocate your position from a slightly different slant. But one way or the other, the agency owes you a status update (notice, I did not say grant) and you have every reason to try to obtain what may prove to be crucial information to your future plans.

Here are some important numbers or addresses to think about.

Mass Media Bureau Chief – (202) 418-2700

You can be directed to the right office for consideration of your problem.

AM and FM Application Status – (202) 418-2730

Do not expect much here. Just a "pending or granted" response is likely.

FCC Phone Book - www.fcc.gov/fcc-bin/findpeople.pl

Really important, once you learn who has your application.

Bruce Eisen, of Kaye, Scholer, has been a communications attorney for some 20 years. If you have a question regarding the FCC Rules and Regulations, send them to Bruce at beisen@kayescholer.com

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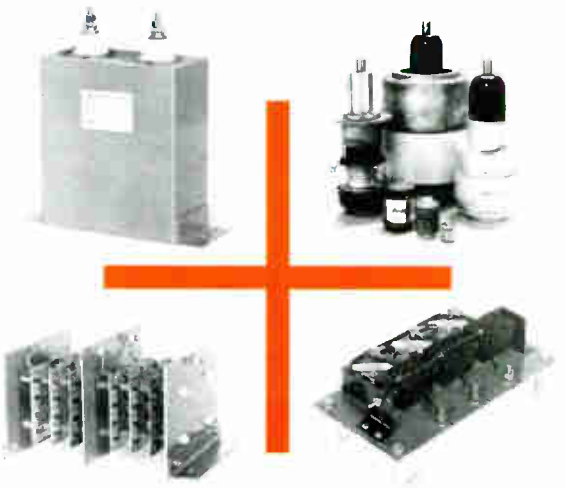

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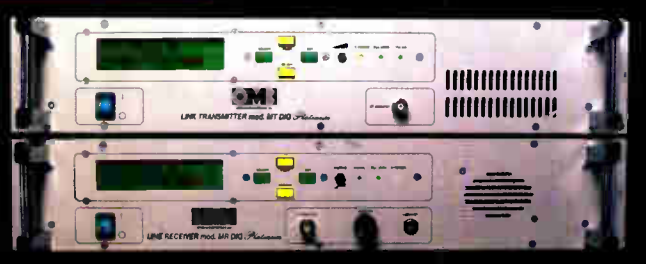

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Hilmer Swanson

1932-2005

by Dan Dickey

Hilmer I. Swanson died on July 21 at age 72 in Quincy, Il. Swanson worked for Harris Corp. for 35 years before retiring in 1999. He is perhaps best known for his work in high efficiency AM transmitters. He pioneered the pulse duration modulation (PDM) system followed by progressive series modulation (PSM) and most recently digital amplitude modulation which Harris markets under the moniker "DX."

Swanson began his career in radio at the U.S. Army Radio Signal School. Following his military service he received a Bachelor of Science in Engineering degree from Valparaiso Technical Institute and a Master of Science degree from Iowa State University. Swanson worked for Collins Radio in Cedar Rapids, IA and Dallas, TX before joining Gates Radio, which later became Harris.

MASTER OF AM

At Harris, Swanson worked primarily on the design of AM transmitters. His interest in improving the efficiency of AM transmitters led to a series of patents on various types of high efficiency modulation. The first commercial implementation was the PDM system, which has been utilized in many different transmitters including the MW-5, MW-10, MW-50, VP-100 and SW-100.

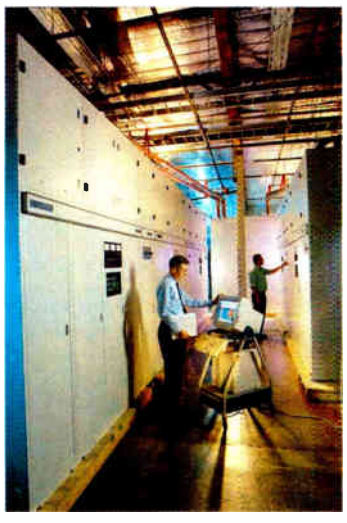
The MW-1 implementation of Swanson's PSM system was highly successful. Further improvements in PDM technology led to the polyphase PDM system employed in the SX-1 through SX-5 and later in the Gates-1 through Gates-5 series.

Still believing further improvements in efficiency were possible, Swanson pioneered the development of the digital amplitude modulation (DX) system. These transmitters were revolutionary in that they employed no high-level modulator at all yet achieved very high efficiency. The DX technology has been deployed in the US and around the world at power levels ranging from 10 kW to 2,000 kW.

ENDURING WORK

Remarkably, nearly all AM transmitters produced in the U.S. and in several other countries over the last quarter century are based in some way on Swanson's pioneering work. After many of his patents expired, the technology remained commercially viable and in production.

Even though PDM was invented in the era of vacuum tube technology it was adapted to solid-state with the same power and cost saving benefits. The digital AM system in the DX transmitters made it feasible to produce transmitters that eliminated the use of vacuum tubes altogether in the AM broadcast band.



Hilmer Swanson checking the operation of a DX-1000. (TPO: one million Watts)

Swanson received numerous corporate and industry awards. He was a Harris Fellow, the highest honor that the company bestows on its employees. He received the NAB Engineering Achievement Award in 1990. He was awarded 27 patents in the U.S. and other countries. He was a life member of the Sigma Xi, Science Honor Fraternity.

Swanson was also an honorary member of the Society of Broadcast Engineers and a life member of IEEE. Harris created a scholarship in Swanson's name at the John Wood Community College for the study of radio broadcast technology.

ADMIRED MENTOR

"I first met Hilmer in 1973 when I went to work for the Gates Radio division of Harris as a young engineer," said Geoff Mendenhall. "Hilmer had a quiet manner and was a man of few words, but when he did speak he had everyone's undivided attention. What he had to say was always relevant and important to the task at hand.

"Hilmer was a tremendous technical resource and mentor to all of us. When we ran into a particularly challenging technical problem, we could always depend on Hilmer for a simple, but elegant solution. He was always willing to travel anywhere in the world to solve a technical problem in the field and in doing so, he become a radio engineering legend around the world," Mendenhall added. "I will miss my friend, mentor, and colleague. He is now part of Radio History."

"Hilmer was a 'gentleman farmer' and we used to joke about what new invention Hilmer came up with while riding his tractor in the fields behind his home," Mendenhall recalled. "He was an environmentalist who raised his own crops organically and experimented with solar energy for his home."

Hilmer was my mentor right after I graduated from engineering school. As I look back now I cannot believe the good fortune it was to work for him every day for several years. Many of us watched him work and were awed by his continuous output of cutting edge ideas and designs year after year.

At the time it seemed daunting to try to live up to the standard that he set for other engineers until I finally realized that task was beyond me. His influence on radio technology and business would be difficult to overestimate.

Hilmer had a really interesting sense of humor and a wonderful family. Since retiring, he and his wife, Carolyn, have performed missionary work in Palau, Chili and Estonia by putting Christian AM radio stations on the air. Memorial contributions may be made to St. James Radio Broadcast or to his latest project, the Estonia AM Radio Project.

Some information provided via the Hansen-Spear Funeral Home in Quincy, IL.

Dan Dickey is VP Engineering, Continental Electronics Corp., Dallas, Texas.

Radio History

by Clay Freinwald CPBE

Another Short Trip Back to 1953

Let's jump into the Wayback Machine with Clay for this third installment of his musings over the pages of an old Radio & Television News Magazine - Volume 50, Number 3, published in September 1953. How much of this do you remember?

[SEATTLE, Washington] Turning the pages of an old car magazine is like visiting an antique car museum. Ah ... the memories! For me this great old publication has the same effect for those of us that have been in this business for more years than we wish to admit.

Philco – Now there was a name. They had a two page spread in this issue showing a bunch of test equipment. Whereas I was never in the Radio-TV service business – except when invited to dinner with the provision that I bring my tool box and tube tester – I was not aware that Philco made so many different instruments. Field strength meters; tube testers, scopes etc.

Most of these gizmo's were designed for the TV service man who was going to need a battery of test gear to tackle what was about to transform the "radio shop" into something a whole lot bigger. If you ever looked inside one of the early TV sets, not only were there boatloads of tubes, but there were adjustments everywhere that created an industry! They had a mail-in coupon to receive a free booklet; I wonder what would happen if this were mailed in today?

LATE NEWS FROM 1953

On page 24 is a column full of news of the industry in 1953. Here are some highlights:

• Sprague Electric Company is building a new plant, seven miles from West Jefferson NC; 250 will be employed there in Sprague's seventh plant.

• RCA Victor has purchased land in Findlay, Ohio and will build a plant for the manufacture of electronic component parts for radio and TV home receivers.

• Standard Transformer and Chicago Transformer have been consolidated under the name of Chicago Standard.

Next is an ad for Radio-Television Training Association. Offered is another coupon, for a booklet that will show how a person can make "Big money in Television." The school offered a free round trip to New York as part of its course.

GET READY NOW!

One segment sounds interesting: "FCC Coaching Course!" "Prepares you at home for our FCC license. The best jobs in TV and Radio require and FCC License." Boy did that change!

Many of us remember "burning the books" to study for their First Class License. I was lucky, I guess; I got mine between my Junior and Senior year of High School. It was a lot of work back in those days. Then the FCC decided that it no longer mattered and issued us all a General something or other that we could use while telling others how hard it used to be.

Talk about changes; on page 26 is an ad for Brush Electronics. A picture shows a fellow seated in front of what appears to be a rack of black crackle steel paneled Amateur Radio equipment. Complete with a "bug" on the table.

On his head is a pair of the good old bakelite headphones. Some of the text reads: "Acoustically – you'll enjoy the high fidelity and smooth frequency response which gives you all the lows and crisp clean highs." Can you just imagine the expression on the face of one of today's air talent if they were to walk into a studio and find a pair of Brush Clevites with which to monitor the air? Talk about a Kodak moment!

Brush bragged about how these "cans" were capacitive in nature requiring modest driving voltages working on high or low impedance circuits.

Today's headphones not only provide a seal around the persons hear, but they have to – this to avoid feedback due to the volume levels used today. I recall walking into a rock station in the 80's that used a Crown D-150 just for the headsets! I would bet most of the users of these good old Brush headsets had their hearing intact into their later years.

ROUND THINGS

Page 30 contains an ad for Pickering Professional Audio Equipment, a company specializing in phone cartridge related equipment. For those of you that missed the days of phonograph records, a cartridge in this day was the gizmo that held the needle that turned the "wiggles" in the record grove into electrical signals.

Pickering also offered Tone Arms, Pre-amps and various equalizers. It is interesting to recall that there was not a universal EQ standard for records back then, therefore it was common for stations to have EQ switches on their turntables to permit proper playback response.

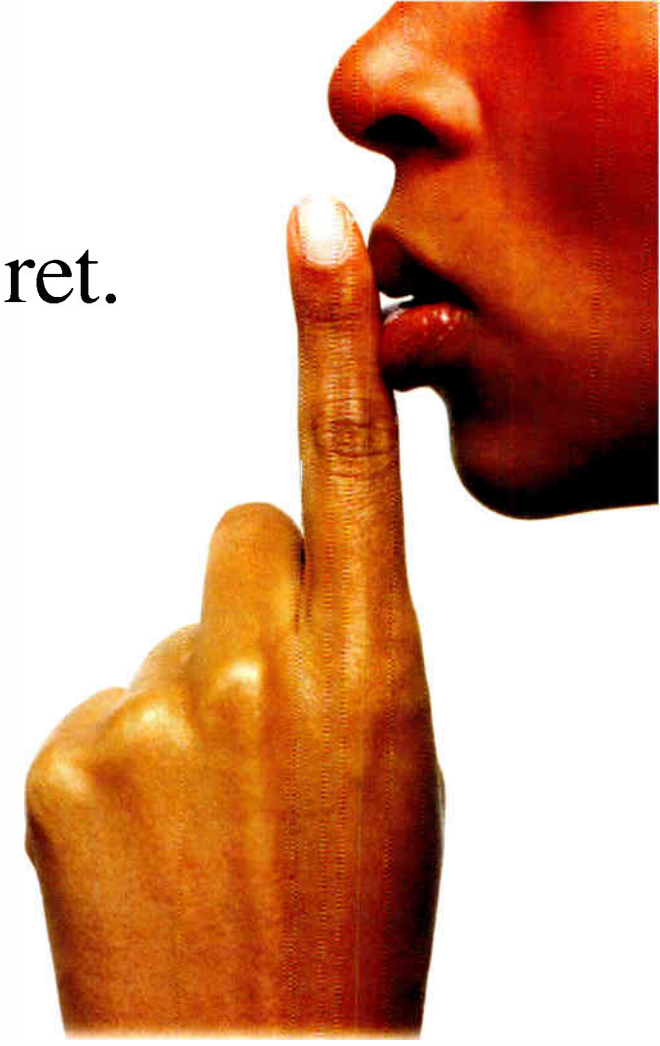
Pickering's model 410 provided a 3-position switch for LP, AES and 78 RPM recordings. Today AES means Digital Audio, as in AES/EBU. Back then, AES simply meant another EQ curve. This reminds me of another name: remember Gray equalizers?

GE produced a very popular line of turntable cartridges (remember the VR-II). These were pretty low impedance and via the now famous 602C passive equalizer (also provided with a EQ switch) the turntable could be plugged directly into a 150 ohm microphone input. But I digress....

Till next time – try to recall what "scritch scritch" sounded like.

Clay enjoys reflecting the history of broadcasting and how some things have changed over the years, while other things have not changed at all. Contact him at K7CR@wolfenet.com

Our client list is secret.



Every day, more than 750 broadcasters rely on TWOx12 twelve-line phone systems to insure their critical talk radio programming. Two advanced digital hybrids deliver the best caller audio possible, thanks to our famous Digital Dynamic EQ. Status Symbols visual call management (a Telos exclusive) helps producers screen calls easily, without guesswork.

Planning a big, consolidated build-out? Consolidate your phones as well with Series 2101, the world's only multi-studio talkshow system. Series 2101 lets you expand your facility's call capacity when needed — allows control of up to 96 callers and 32 studios. Not only that, Series 2101 uses high-quality digital phone lines to deliver caller audio that's next-room clear (and help reduce Telco wiring, too).

At Telos, we're all about choices. Take our Desktop Director (right); it works with TWOx12 and Series 2101 systems, can be expanded to control up to four hybrids or up to 24 lines when used with Series 2101, and has a built-in handset, speakerphone and headset jack. Or, choose the new Call Controller (left) and "bring your own phone" for screening... even works with wireless phonesets.

ONE-x-Six is perhaps the world's most popular auto-nulling multi-line phone system. Also the world's most affordable! Like all Telos talkshow systems, ONE-x-Six integrates with our optional Assistant Producer software to allow fast, intuitive remote screening via LAN or WAN connections.

Naturally, we are obligated to protect the identity of clients who use Telos talkshow systems. We would no doubt get a Stern warning from any user whose name we revealed.

But rather than Rush to superlatives, let us just be Frank'n get to the point. When you're ready for the world's best talkshow system, the answer is Clear; it's as easy as ABC. Whether your station is located in Salem or Susquehanna, Telos has a broadcast phone system just right for you. Why, the possibilities approach Infinity.

In our eyes, reliability is King. After all, if there's a failure, you can Kiss your ratings goodbye. You need your phone system to be a Citadel of Mega reliability. Not to Mix metaphors, but you need something Hot, Lite on the pocketbook, and full of Power. Really, it's Radio One-oh-one.

And unlike gear with tech as dated as an old Bonneville, Telos talkshow systems undergo constant improvement. With us, it's a never-ending Saga of advancement.

Telos. Striving for Greater Media through advanced technology.

(And don't worry... we'll keep your secret.)

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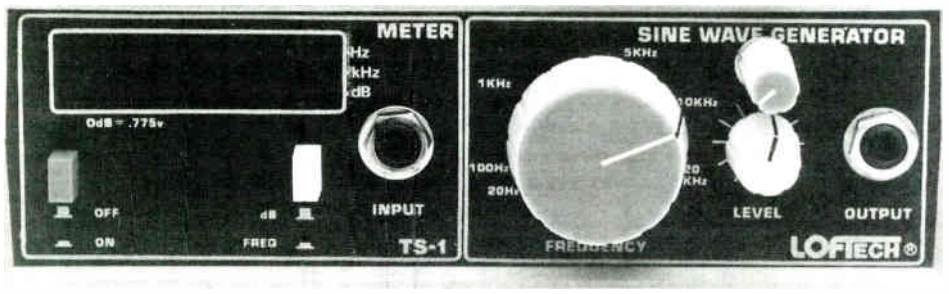
Tool Guide

Test, Tools, Tips and Applications

Goldline Model TS-1 Audio Test Set



The Goldline TS-1 is a three-function audio test set comprised of a low distortion oscillator, frequency counter and dB meter all contained in one unit.

The panel display is a four-digit LED, and the input and output connectors are 1/4" phone jack (TSR).

The unit requires 115 VAC, and the optional battery pack allows the unit to be taken into the field with an attached rechargeable Gel-Cell battery.

Size (W x H x D) is 7-7/8" x 2-5/8" x 7", and weight is 2 lbs. The TS-1 case material is a high impact ABS, with front and rear panels of painted aluminum.

The Low Distortion Oscillator

This is a current controlled, state-variable true sine wave oscillator incorporating a fast AGC circuit. Distortion components are typically 0.1% (2nd) and 0.05% (3rd), which are low order and not audible, making the TS-1 useful in making listening tests where a function generator would generate undesirable, audible side effects. Full frequency sweeps can be made from 20Hz - 20kHz in a single range; the TS-1 unit exhibits no amplitude changes over the entire frequency range.

- Frequency range: 10 Hz - 30 kHz
- Accuracy: ± 0.1 dB from 20 Hz - 20 kHz.
- Output impedance: 50 ohm unbalanced. (Optional balanced available.)
- Adjustable output level: -70 dBv to +18 dBv (reference 0.775V)
- Distortion: < 0.3% THD
- Maximum output level: +18 dBv @ 2k ohm or greater, +16.5 dBm @ 600 ohms.

The Frequency Counter

The frequency counter is internally connected to the internal oscillator and displays the oscillator frequency until a signal is plugged into the input connector. It then displays the frequency of the input signal. This unique combination allows absolute precision in setting frequencies.

- Frequency response: 1 Hz - 99.99 kHz
- Input impedance: > 100k ohms (electronically balanced).
- Input level: -40 dBv to +24 dBv (reference 0.775V)

The dB Meter

The dB meter is a wideband average responding AC voltmeter. The circuit output is converted to dB for display. Direct reading dB greatly simplifies alignment procedures.

- Meter Range: -50 dBv to +24 dBv (ref. 0.775V)
- Accuracy: ±0.1 dB from 20 Hz - 20 kHz @ 0 dBv ±1.5 dB from 20 Hz - 20 kHz @ 50 dBv
- Adjustable zero reference: -10 dBv to +8 dBv (rear panel adjustment)

The TS-1 Rack Mount Version

The TS-1 is also available in a TS1RMX rack mount version, featuring electronically balanced, isolated input and output XLRs mounted on both front and rear panels, with an input impedance of 100k ohms.

The meter range is -70 dBv to +24 dBv ref: (0.775V), and the output level is -60 dBv to +24 dBv ref: (0.775V).

View the entire line of Goldline Products at:
www.gold-line.com

Consultant Guide

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The routing switcher gets a new twist.

(About five twists per inch, actually.)

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

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

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

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

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

Livewire

< · · · > 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.

ENCO SYSTEMS INC

Scott Studios

radio systems

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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.

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.

"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.

AXIA
A TELOS COMPANY

Gear Guide: Telephone Audio & Control Phone Codecs & ISDN

Broadcast Electronics

Marti GX-500 – Remote Mixer

www.bdcast.com • 217-224-9600

Talk about bang-for-the-buck! The versatile Marti GX-500 has features generally found on only larger, higher-priced mixers. Four mic and two auxiliary inputs, four headphone jacks, a mic/line auxiliary output and complete mixing facilities are presented on easy-to-use controls. The GX-500 is capable of two telephone connections ‹one for the main program and one for communications.

It can be operated using the external AC power supply or the included, long-life (five-to-seven hours) rechargeable batteries Other features are a peak limiter, a squelch/mute switch, an internal tone generator and an off-air monitor input. A plastic protective case is also included. Remotes have never been easier.

Broadcast Tools

Tiny Tools TT-1 – Telephone Line Coupler

www.broadcasttools.com • 360-854-9559

The tiny TOOLS TT-1 is more than just an ordinary telephone line coupler. The TT-1 is a rack-able, compact telephone line powered auto-answer and auto-disconnect hybrid/coupler.

The TT-1 utilizes dual-hybrid transformers providing full duplex audio at a plain old coupler price. They provide a rear panel multi-turn hybrid NULL trimmer to allow the user to achieve approximately 20 db separation figures. Additional TT-1 features: front panel line seize button; call drop button; auto-answer/monitor-TAP switch; audio mute switch; off-hook and ring indicators.

A rear panel RJ-11 is provide for connection to a POTS line along with a second RJ-11 loop-thru jack that may be configured to disconnect attached devices when the TT-1 goes off-hook. Screw terminals are provided for balanced send and caller audio; remote optically isolated seize and drop inputs and the SPDT off-hook dry relay contacts. The TT-1 may be rack mounted

CircuitWerkes

TelTap – Telephone Coupler

www.circuitwerkes.com • 352-335-6555

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

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

Comrex

STAC – Telephone Access Center

www.comrex.com • 800-237-1776

STAC (Studio Telephone Access Center) from Comrex puts you in control of your talk shows, call-ins and phoners with great sound, ease of operation and scalable configuration.

STAC incorporates a high-performance dual digital hybrid with automatic level control. A compact, rack-mounting mainframe houses the hybrids, the multi-line controller and all telephone and audio connections. STAC is available in either six-line or 12-line configurations.

Each STAC comes with an attractive, ergonomic control surface (with handset) which offers two operational modes for either Studio/Producer operation or Screener Mode. STAC will accommodate use of up to four control surfaces per mainframe.

The integrated STAC IP Call Screening and Control software features new updated functionality includes a flexible configuration GUI and Line Clustering for sharing lines between up to 12 STAC mainframes.

Conex

FJ-700 – 4-Channel Remote Mixer

www.conex-electro.com • 360-734-4323

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

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

Henry Engineering

MixMinus – Telephone Hybrid

www.henryeng.com • 626-355-3656

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

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

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

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

Gear Guide: Telephone Audio & Control
Phone Codecs & ISDN

Inovonics

PBX – Phone Line Manager

www.inovon.com • 831-458-0552

The Inovonics PBX

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

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

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

JK Audio

InnKeeper 2 – Digital Hybrid

www.jkaudio.com • 800-552-8346


The InnKeeper 2

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

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

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

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

Sine Systems

TAS-1 – Time and Temp Delivery System

www.sinesystems.com • 615-228-3500

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

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

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

Telos

TWOx12 – Talkshow System

www.telos-systems.com • 216-241-7225


Telos TWOx12

Telos TWOx12 is the self-contained 12-line broadcast phone system with two all-digital hybrids for high-quality conferencing. It features Telos' legendary Adaptive Cancellation and Digital Dynamic Equalization technology, as well as an exceptionally advanced auto-nulling capability to make callers sound next-room clear.

TWOx12 is the world's only broadcast telephone system that works with digital or analog Telco lines, or a combination of both. TWOx12 plugs right into ISDN BRI phone lines, taking advantage of the decreased noise and distortion, better audio levels, and clearer caller audio that only a digital connection can provide (as well as eliminating the Telco A/D-D/A process in your studio).

Use it now with POTS lines; use it with digital phone lines when you're ready. You can even split the TWOx12 into two systems for use in two studios simultaneously. To help make your talk shows smooth, fast and easy, they have equipped TWOx12 with tons of special features to make producers' and talents' lives easier.

Telos

Call Controller – Call Screen & On-Air Control

www.telos-systems.com • 216-241-7225

The Telos Call Controller; a simplified and cost effective option for call screening and on-air control. The Call Controller connects to the TWOx12 or the 2101 in the same way as the Desktop Director. It uses an external, user provided, telephone for call screening and studio telephone operation. Simply connect the Call Controller to the TWOx12 or 2101, plug in any compatible analog telephone and you're on your way.

Like all Telos control options for the TWOx12 or 2101, the Call Controller has large buttons and intuitive Status Symbols to keep track of line and hybrid status, and whether a caller has been screened. Convenient keyboard shortcuts may be used to switch between on-air control, and screener modes. There are additional keyboard short-cuts permit full support of the TWOx12's, new version 3.0 split modes (dual studios).

Tieline

Commander G3 – Audio Over IP

www.tieline.com • 800-780-4750

Tieline will introduce a fourth network platform to the Commander G3 delivering high quality low delay 7-15 kHz mono/stereo audio over IP, Wi-Fi, ADSL and wired IP networks.

Broadcasters will be able to plug into a standard local area network (LAN) or ADSL service and even tap into a wireless hotspot to deliver instant, high quality remote broadcasts. This will make the new Commander and iMix G3 codec platform the first to deliver 7-15 kHz over POTS, ISDN, GSM and IP networks.

Up to 20 kHz linear audio over high bandwidth LAN and IP networks will also be offered to suit full time studio-to-transmitter links and provide uncompromised audio for maximum post processing quality. Tieline has built a worldwide reputation for staying connected over broadcast links and offers unparalleled flexibility with remote control.

Service Guide: Radio Equipment Products and Services

Service Guide: Radio Equipment Products and Services

Final Stage

Send your information for publication to: **radio@rconnect.com**

Radio Guide Ads: August -2005

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Phasetek - 27	www.phasetekinc.com
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Tieline - 5	www.tieline.com
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2005 Radio Guide Event Calendar

List your radio or broadcast events, meetings and conventions here.

Email your information to:
radio@rconnect.net

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

SEA-CON 2005
September 15 – Boeing Museum of Fight , Seattle
www.sea-con.org

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

33rd Annual SBE Chapter 22 Broadcast Expo
September 28 – Verona, NY – www.www.sbe22.org

Audio Engineering Society (AES) Convention
Oct 7-10 – New York, NY – www.aes.org

Madison 2005 Broadcasters Clinic
Oct 11-13 – Madison, WI – www.wi-broadcasters.org

SBE National and 2nd Annual Engineering Expo
Oct 19-20 – Grapvine, TX – www.bee2005.org

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

Boscon 2005 Boston SBE Regional Convention
Oct 25-26 – Marlborough. MA – www.bos-con.org

Collegiate Broadcasters Inc. (CBI)
October 27-30 – Hyatt Regency, New Orleans, LA
www.collegebroadcasters.org

SBE Chapter 16 Regional Convention
October – Seattle – www.broadcast.net/~sbe16

Pennsylvania Assoc. of Broadcasters Eng. Conf.
November 3 – Hershey, PA – www.pab.com

CAB-2005 Canadian Assoc. of Broadcasters
November 6-8 – Winnipeg – www.cab-acr.ca

Sales Manager

Sales Manager for international AM antenna systems company with a successful 40 year track record. Requires proven sales ability, team leadership, good communication skills, and technical knowledge.

Great opportunity to sell broadcast and other RF systems while expanding a domestic and worldwide sales organization. Excellent compensation and benefits.

Email Resume to Lawrence Behr CEO
lbwireless@lbagroup.com.

Chief Engineer

Morris Communications Company, LLC owner of Columbia River Media Group, based in Wenatchee, WA, has an immediate opening for a Radio Chief Engineer. We are looking for another great engineer for the Morris Team.

This isn't small market radio. It's radio in a small market, and we take a big market attitude. We'll spend money on repairs, we'll spend money for upgrades. No more paper clips and rubber bands. We'll actually give you a repair budget.

You don't have to be a Chief yet. This position is a great one for an assistant engineer who is looking to move on in their career. We'll train you if you don't know something, and we'll give you all the resources you need to get the job done. You should have a good level of experience as a radio engineer, and formal electronics training, and you've got to have a great attitude and high standards for the product. We've got a total of 3 FM and 2 AM stations in the Wenatchee area.

Wenatchee is a great area, and the cost of living is among the best in the nation. It's a clean, attractive community with a great quality of life. The staff and management are the best in the region.

In return for your commitment and hard work, you'll be paid a great salary, outstanding benefits, and a 401(K) program the company will pay into.

Submit your resume' to Jay White,
Corporate Director of Engineering,
jay.white@morris.com.
Morris is an Equal Opportunity Employer.

www.radiopapers.net

White Papers • Technical Reports
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Why wait to read the latest equipment technology and application white papers when you can retrieve them on-line right now.

Our new website: **www.radiopapers.net** brings you white papers and technical information from the entire radio industry.

Rather than pick and choose a few for you to read, **Radio Guide** provides you with a complete industry listing, so you can decide what you need – and what to read.

You can even sign up for email contact when new white papers are released by industry manufacturers and consultants. – *Radio Guide* –

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Every Automation Company says they do Voice Tracking, WANcasting, Satellite Feeds. But does everyone listen to what your station really needs?

- ✓ Professional automation software starting at $495
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- ✓ On-line purchasing
- ✓ 24/7/365 support

Sure we know automation, but our expertise just starts there.

What Solutions Are You Looking For?

"Prophet's software is the best-hands down, it runs great and sounds great."

Bill Freeman
Department Chair
WDCC-Central Carolina Community College

You asked, we listened.

We designed NexGen101 to be easy to install and learn, by simplifying the user interface, streamlining the install set-up, and limiting the functions. Run your station for $495!

Don't sacrifice reliability and ease of use by purchasing unknown, unproven and unreliable radio automation software. Our software is trusted by over 2,000 radio stations worldwide.

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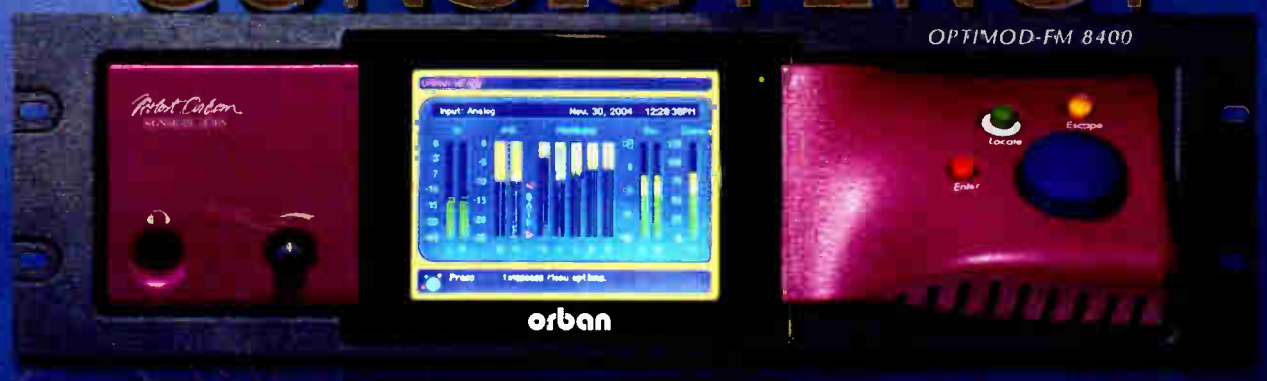

THAT BRANDS YOUR SOUND

When you budget for a top-of-the-line FM audio processor, you want assurance that your investment will pay off with real, measurable benefits. Optimod-FM 8400 *Signature Series* is the latest version of the 8400—a processor that's helped build audiences and ratings at thousands of stations worldwide. In the #1-billing market in the U.S.—Los Angeles—Optimod dominates overwhelmingly. And many small and medium market stations love the fact that their 8400s give them that major market sound

orban/cti

www.orban.com

The all-digital 8400 offers unbeatable consistency from source to source.

Optimod-FM 8400 *Signature Series*

Consistency, in terms of both tonal balance and loudness, is what makes a radio station's programming flow, giving it the polished, produced sound that says "big-time" to its audience.

By using a very slight delay (typically 19 ms or less depending on the final limiter setting used), the 8400 *Sig* actually "looks ahead" in time to make intelligent decisions about how to process your audio. It also knows the difference between speech and music and adapts its processing accordingly. This innovative technology yields an ideal balance between voice and music—music is loud and punchy, while speech is immaculately clean. Meanwhile, your signature sound always stays locked in, branding your audio with a consistency that pays off every second of every broadcast day.

For more information on complete end to end digital radio solutions including the Orban Optimod-FM 8400 Signature Series call us today at 1-800-622-0022.

www.Broadcast.Harris.com

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