Radio Guide

Radio Technology for Engineers and Managers

June 2005

Quality Studio Furniture
Doing it In House and On Budget

Inside Radio Guide

"This is about doing it yourself. Why do it yourself? Sometimes you have to. Sometimes you want to. For a different client, it turned out to be a little of both reasons.

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We found several creative ways to deal with equipment costs, but I was not going to budge on the furniture." – *Bill Bordeaux*

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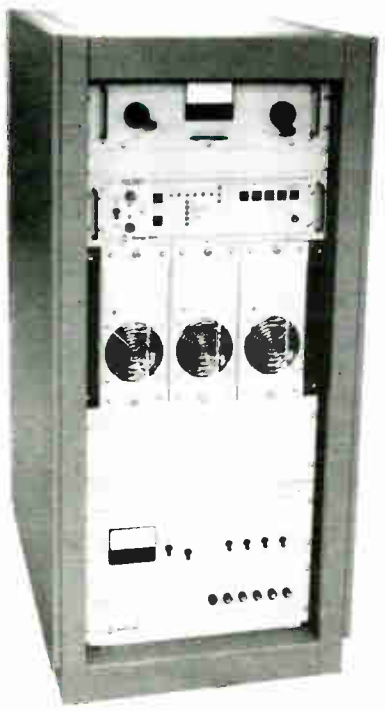

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Radio Guide

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Volume 13 – Issue 6

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

Cover Photo: KZOZ-FM studio, San Luis Obispo CA, owned by American General Media. Courtesy of Bill Bordeaux.

Radio Waves

by Barry Mishkind – Editor

Building Something Together

Few occasions make a station engineer happier or prouder than when a new studio or transmitter facility is built, turned on, and works as planned.

Of course, it does not always work out that way. Some projects end inches short of disaster.

Sometimes the problem is an impossible schedule; a GM's directive: "Be out of the old site and operating from the new site by next Monday." There seems only one priority – not paying rent on two places for more than two days.

Or, miscommunication between consultant and local engineer leads to components that do not fit in place. A key piece of gear fails to operate as expected, or is delivered late. The result is a crew sitting around, unable to finish the project.

THE DIFFICULT WE DO RIGHT AWAY

At some point, most every project seems impossible to get done right, on time and on budget. But, like the Enterprise's Mr. Scott, somehow the engineer manages to scramble through the Jeffries' tubes and insert the dilithium crystals just in time to prevent the Klingons from destroying everything.

Oops – wrong story! The project actually is accomplished through the skill and teamwork of professional broadcast engineers – as displayed by Bill Bordeaux (Page 4) and his crew building attractive, efficient studios without huge costs.

Similar skills are required to understand and implement new technologies like digital audio and digital transmission, as well as maintain existing plants.

THE IMPOSSIBLE TAKES A LITTLE LONGER

Acquiring knowledge and skill comes from exposure to and influence of experts. We encourage you to read Ron Rackley's (Page 8) and Barry McLarnon's (Page 10) articles with a view to how they will help you do your job.

And those are just a few of the valuable resources you are holding in your hand. The dilithium crystals are extra. – *RG* –

Facility Guide

by Bill Bordeaux

Great Looking Studio Furniture Without Breaking the Bank

[SAN LUIS OBISPO, California] Sometime we are lucky enough to be handed a blank check and told to "go build new studios." It does not happen often, but when it does it can be a very cool thing.

"GO DO IT"

I actually had this happen. When consulting one station's owners, they made it clear they wanted a showpiece. They inquired about the type of equipment I would recommend to make it happen.

I surprised them when I told them that the real bones of the studio – the real "*wow*" factor – is the furniture. The equipment is critical to the operation, but even the sexiest equipment will look crummy sitting on plywood supported by two sawhorses. To my delight, they agreed completely.

That being said, we enlisted a local craftsman to build custom furniture out of oak. It had a hand rubbed finish that was out of this world; it was like "butter." The equipment was ensconced in luxury and the studio, complete with gentle track lighting had all the *wow* you could want.

"OH, WOW!" TO "OH, NO!"

Fast-forward five years. The station's business plan did not work out and the whole thing went belly-up. (Perhaps we spent too much on the *wow*?) Anyway, it turned out I was the last one out of the building after pulling the plug on the transmitter and shutting off all the breakers. I closed and locked the doors on the now dark and empty lobby, then handed my keys to the "suit" and walked away.

Some months later I was invited back into the dark shell of the radio station to assist the new owners in removing the equipment and furnishings.

They had chosen to run a "lean, mean station" from a smaller location and would need less than half of what we were moving out. So, I consulted with several parties in the area and found buyers interested in some of the excess equipment.

The furniture was legendary among local broadcasters, and we found it to be in demand. Among the offers I passed along was a typical one from a bargain hunter, offering pennies on the dollar for the handsome furniture. The owners rejected the offer and kept the beautiful oak tables, racks and custom turntable cabinets.

Outside. Covered. With a tarp.

Months went by and when fall turned to winter, the rains blew the tarps off and the furniture began its slow journey to the dumpster. What a shame!

MAKING THE CHOICES

However, this story is not about that furniture. This is about doing it yourself. Why do it yourself? Sometimes you have to. Sometimes you want to. For a different client, it turned out to be a little of both reasons.

We were building new studios in a new building, and so were able to start with a blank piece of paper. After designing the project, and submitting the proposal, we were met with hardy handshakes and the mandate to build the new studios with *half* of the required budget.

We found several creative ways to deal with equipment costs, but I was not going to budge on the furniture.

I knew we could not afford custom oak, but at the same time we really should not have to settle for premade kitchen counter tops, complete with splashguard. Instead, I felt we really wanted the latest solid surface material for the tops to resist scratches and stains as well as to give the counters a feeling of mass. The furniture had to be high enough for stand up, or sit-down with a "drafting" type seat.

We also wanted to keep as much equipment off the tops as possible. No imposing equipment "turret" to get in the way and make the rooms feel small. Plenty of rack space for equipment and lots of room for spreading out the daily paper when ripping off the news stories.

VALUE COMPONENTS

The answer was to save money by buying prefabricated base cabinets from the local home improvement store. The idea was to build a framework around them, cover it with plywood and then trade out part of the cost of the countertop material.

So if you are ready to put down that soldering iron for a nail gun, here we go! Start with this list:

Tools Required:

- Miter Saw
- Circular Saw
- Hammer
- Nail Gun
- Tape Measure
- Favorite Drill
- Drills

Materials:

- 3/4" Plywood for Top (construction grade)
- 3/4" Birch Plywood for Frame
- Pre-Fabricated kitchen "Base" cabinets from your local Home Improvement Store.
- Wood Screws
- Wood Glue
- Wood Putty
- Finishing Nails
- Various Lengths of Rack Channel

Other Important Considerations:

- A bunch of friends who are handy with tools.
- Several Pizza Deliveries

PUTTING IT TOGETHER

The project required studio furniture for six live on-air studios and two production studios. In gathering the materials necessary, we cleaned out the stock at several local home improvement stores.

These are all base cabinets, of the type that would normally be used in a kitchen. The doors are usually an extra expense when buying these types of cabinets.

For our purpose, this was great because "we don't need no stinkin' doors." The cabinets do come with the parts and hardware for sliding drawers. We opted to use a few to make a custom CD storage drawer, but the rest were not needed.

KITCHEN CABINETS TO RACKS

The base cabinets are 21" wide units. The measurement is taken from outside to outside of the material. The interior measurement is about 19-3/8." We sandwiched 1/8" shim material under the rack channels on both sides of the cabinet.

With the shim in place, the rack channel measured out to an almost perfect 19-1/8" distance in which to mount equipment.

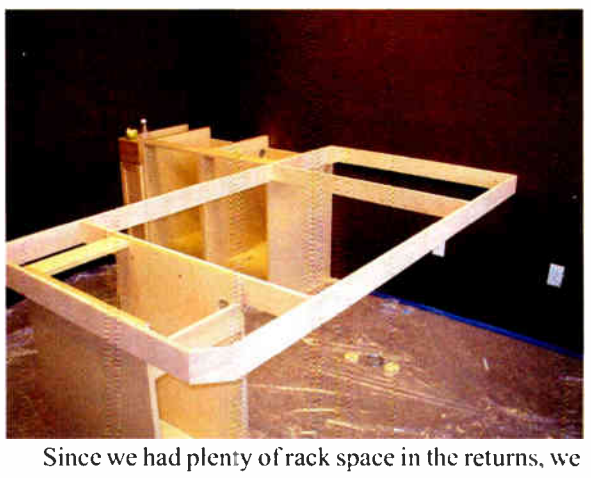
The height of the base cabinets is perfect for a stand up console configuration; alternatively, seating can be provided with "drafting" style chairs.

The base cabinets serve as the supports on which the tabletop framework will be attached. The framework consists of 4" strips of 3/4" Birch plywood. The Birch ply was selected due to its relatively low cost and its ability to take most stains and finishes.

The plywood was ripped into 4" strips with a circular saw. We used a piece of 1" x 4" pine clamped to the plywood as a guide or "fence" to insure a smooth and straight cut from the circular saw.

The base cabinets were removed from their packing and assembled using not only the screws provided by the manufacturer, but with wood glue as well to insure an strong, long lasting structure.

Several cabinets were screwed together to provide multiple racks under the "return" (the counter top going down the length of the wall at the side of the jock). One of the base cabinets is used to support the end of the counter top that sticks out into the room.



Since we had plenty of rack space in the returns, we chose a slightly smaller cabinet as the end support. This support would also double as an enclosure for a subwoofer that would supply the bottom-end sound for the rooms. A pair of small near-field monitor speakers would be mounted to the sides of the mixing console for a compact, yet full range audio monitoring system.

(Continued on Page 6)

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Facility Guide

by Bill Bordeaux

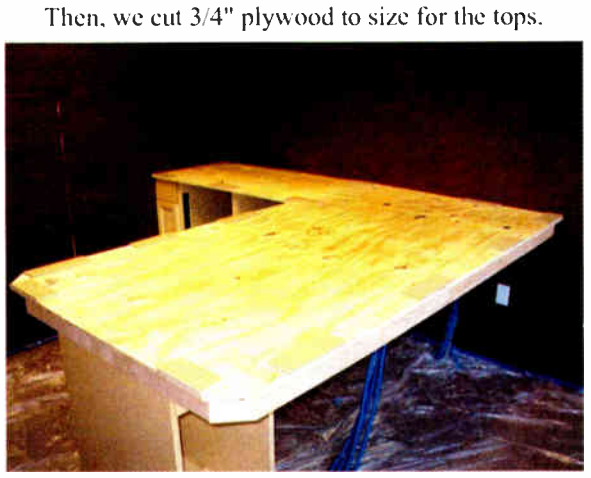
Continued from Page 4

INTO THE STUDIOS

Once the cabinets were built, they were placed in the rooms and where necessary secured to the walls with long lag bolts.

The 3/4" ply strips were then cut to length, fitted, nailed and glued to the sides of the cabinet and walls to form the frame of the table. With the high strength of the plywood and the relatively short lengths of the frame pieces, the table will be able to support a very high load.

Then, we cut 3/4" plywood to size for the tops.



For this project, we were able to contract with a local counter top guy to install solid surface material over the top of our plywood base. I have always hated plastic laminate counter tops (aka Formica®). Most look nice to start out with but after a few years the moldings start peeling off and the surface gets scratched and stained.

Even a low-end solid surface (Corian®-like) material was better in my mind. The smooth rounded corners and silky feel of this sort of surface was a bonus. After installing the plywood tops, and gluing and screwing them to the frame pieces, the countertop guys came in and made patterns of the countertops with thin strips of wood veneer. They took the patterns back to their shop and cut the pieces of material to match the tops we had installed.

A week or so later, they carted in large slabs of solid surface and laid them in place in the studios.

Several of the countertops required multiple pieces of material, which had to be glued together after they were in place. The special jig and glue material they used resulted in invisible seams. Even though the counter top material is strong, it is a plastic resin material that can be easily cut with a hole saw using a blade made for metal.

We pre-placed the consoles and other items that were going to be on the tabletops to be sure everything fit as expected. It was then an easy matter to cut holes for access cables, MIC jacks and headphone pods.

FINISHED PRODUCT

Three years later, the studios look almost as they did on the first day when the jocks walked in saying "Wow! I promise not to "f" up *these* studios!"

The layout has proven itself, even with format changes and the inevitable revolving door of morning "personalities." It has been a simple matter to service and upgrade equipment in the racks.

We have had the occasion to install similar pre-built "broadcast" furniture at several locations, and found it to be of good quality and well thought out. Some times though, a local custom cabinetmaker can be a great asset during new construction or remodel.

Even if you cannot quite arrange for a cabinetmaker to finish off the project, by visiting your local home improvement store, using some ingenuity and lots of pizza you can achieve some very satisfying results. Bottom line: Average cost of furniture for these studios was well below $1,000 each, including labor and materials.

Bill Bordeaux, a contract engineer based in San Luis Obispo, CA, is famous for finding cost effective solutions for his clients. Email him at bill@stationengineer.com

Let our readers know about your latest studio construction projects.

Email: editor@radio-guide.com

The Worst I've Ever Seen

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

Tower fences are important. They protect you and the public from hot towers, and the station from liability. Have you checked your fences lately? Be objective – would an FCC Enforcement Specialist be impressed by what he found at your transmitter site?

A remote transmitter site being far from the studio does not provide an excuse for bad fencing according to the FCC. Those fences need to be regularly checked, secure and locked.

If your entire site is enclosed by a fence, do not forget to check the perimeter carefully for those little holes made by locals who like to walk their dogs, ride bikes, or play in the tower field.

Safety first!

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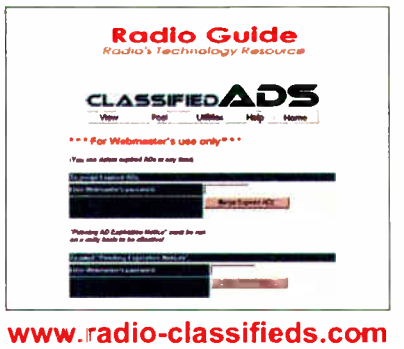

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DA Q&A

By Ron Rackley, P.E.

Mutual Impedance

[SARASOTA, Florida] **Question: Why is it that our antenna system has to switch between different matching networks at the center tower for Non-Directional (ND) daytime and Directional (DA) nighttime operation?**

Answer: The different networks are required because the base impedance of the tower differs between day and night due to mutual coupling, which causes the tower resistance and reactance to depend on and react to the currents that flow in the other towers.

For ND operation, the other towers of the array are detuned, and the tower that is driven has essentially the same impedance that it would have if they were not there. When the DA is in use, the towers each have operating impedances that depend on the phases and ratios of the various tower currents within the array.

SELF IMPEDANCE

Impedance is simply how we express a ratio of voltage to current. The self impedance of a ND tower defines what voltage will appear across its base when a given current is driven into it.

The matching network, simply stated, is a "black box" that takes in energy from the transmission line in the correct voltage-to-current ratio (50 volts for every ampere in the case of 50-ohm line) and then uses it to impose the necessary voltage across the tower base to drive the correct current into it.

When there are no other towers nearby, or when nearby towers are detuned (to be electrically "invisible"), the voltage across the tower base is due solely to the current that is driven into it – the ratio of which defines its "self impedance."

MUTUAL IMPEDANCE

In a DA, the situation is more complicated. When two towers are side-by-side, the current in one also induces a voltage in the other one. The ratio of the voltage in one tower to the other tower's current that causes it, is the "mutual impedance" between the two towers.

Because RF currents and voltages alternate cyclically and are not necessarily in phase, self and mutual impedances are complex numbers, which have both resistive and reactive components.

The currents that are necessary to produce the required radiation pattern shape are driven into the tower bases, but each base voltage is the sum of the voltage due to its own current (through its self impedance) and the voltages induced in it from the currents that are driven into the other towers (through their mutual impedances). This is why the impedances differ from the ND mode when towers are used for DA operation.

OPERATING IMPEDANCE

The ratio of the summed voltage to the current in each tower of an array is known as its "operating impedance."

In general, the towers of DA systems operate with ratios and phases that are different from one another – meaning that their operating impedances are different as well. This causes the power that is fed into a directional antenna system to divide unequally between its towers.

Sometimes the power division is dramatically unequal, with some towers requiring that little or no power be fed to them and, in some cases, with towers that even feed power back into the phasor (in the case of "negative towers").

The feeder system must be capable of delivering the required tower currents into these impedances with networks that match them to the transmission lines, except for rare cases where intentionally mismatched transmission lines are used as part of the overall power division and phasing scheme.

MUTUAL COUPLING

Mutual coupling has a lot to do with why directional antenna phasors can be so complicated to adjust.

In addition to making the power division unequal – which causes some phasor controls to be less sensitive than others – mutual coupling causes the impedances of all of the towers in an array to change with every parameter adjustment. This means that all of the parameters change to some extent or another even with the simple adjustment of *one* control.

A caution for those caring for antenna systems: while the match of the ND antenna tuning unit can be safely adjusted by itself if the need arises, one must be careful, though, to not disturb the settings of the DA network. It is easy to upset the overall "balance" of the internal operating conditions of the entire system – leading to incorrect parameters, mismatched transmission lines, and improper transmitter loading.

Ron Rackley finds directional antennas fascinating, and is happy to share his thoughts. However, due to his existing commitments and travel schedule, he regrets being unable to reply personally. If you have suggestions for future topics, please send them to editor@radio-guide.com

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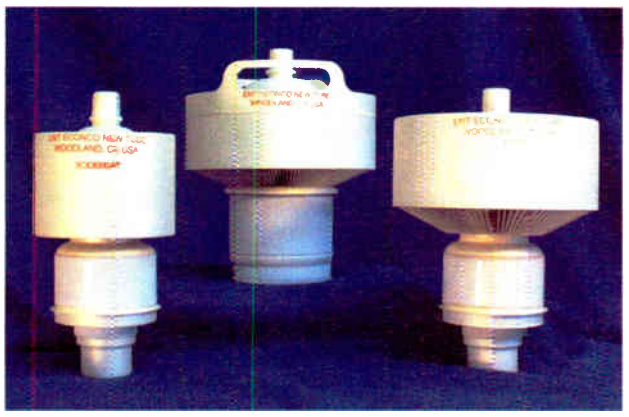

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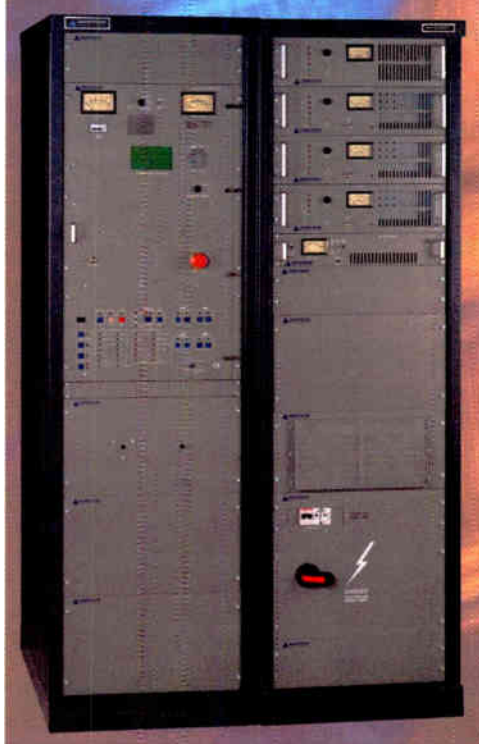

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Transmission Guide

by Barry McLarnon, P.E.

Part 2: Neighborly Relations in the IBOC Era

This is the second part of a look by Barry McLarnon into some of the issues confronting the industry as more stations "light up" their IBOC facilities. With more and more "neighbors" on the band extending their "elbows," it is important to understand what will this do to coverage – and to neighborly relations.

[OTTAWA, Ontario, Canada] Interference is in the eye of the beholder, and different people will have differing levels of tolerance for various types of impairments to an audio program. Is there a way for stations to quantify any additional interference caused by IBOC operations and, if possible, predict where and how it will impact them?

SOMEONE IS ON THE PORCH

Not surprisingly, the performance of modern FM receivers, when faced with interfering signals on first adjacent channels, is all over the map. In addition to wide variations in the quality of IF filtering that is needed to reject such interference, we have the complication that many receivers have a problem with their stereo demodulators, as explained in last month's discussion (***Radio Guide***, May 2005).

The NAB tests of 28 receivers showed that the onset of interference from first-adjacents occurred at D/U ratios ranging from about -12.5 dB to 30.5 dB, with a median value of 0 dB. If these results can be extrapolated to FM receivers in general, it means that a bit more than half of them can tolerate first adjacent interference up to the FCC protection level of 6 dB.

Some receivers can tolerate up to 25 dB higher interference levels than this; the receivers falling into this category are mainly automotive, plus a few component systems. On the other hand, many receivers, especially in the personal/portable categories, have a huge shortfall in performance, and can be expected to fall apart badly if the interference approaches the protection level.

MORE THAN BEFORE

Now, if we add IBOC to the mix, things really get interesting! A first adjacent station that goes IBOC is now generating a digital sideband (with a total power of -23 dBc) that is a source of co-channel interference to the desired station.

In terms of the desired signal power, if the analog portion of the interference is at 6 dB D/U, then the co-channel digital interference is at 29 dB D/U. The question is, does this make the overall interference significantly worse?

Clearly, this depends on the individual receiver characteristics. Recall from last month that the median D/U ratio at which co-channel interference became noticeable was 34 dB. If we assume that co-channel digital interference has roughly the same annoyance level as analog interference at the same power level, then the digital interference should be noticeable with the majority of receivers at 29 dB D/U.

This will only be true, however, if it is not swamped by the analog first adjacent interference. So, the interference from the digital sideband will be significant in the more "bulletproof" receivers, but it will be buried under analog interference in the low-end receivers. In other words, the presence of IBOC tends to level off the top end of performance; those receivers that were capable of excellent performance at the protected contour D/U of 6 dB now deliver mediocre SNR.

The real problem, however, is when we venture further out and experience lower D/U ratios. Most car radios and some high end component systems were designed to give good reception in the fringe areas outside protected contours, but this may now be all for naught, since rising co-channel digital interference from first adjacent IBOC stations destroy this reception.

As mentioned previously, iBiquity determined 30 dB WQP SNR to be the approximate "tune-out" threshold. In **Tables 1& 2**, SNR measurements of less than 33 dB have been highlighted to draw attention to cases where the SNR is approaching this threshold, or is below it.

HOW THE RECEIVERS FUNCTION

The Sony receiver is a clear example of a low end receiver; with analog first adjacent interference at the 6 dB protection level, it does not deliver adequate SNR, and it is only marginally usable even at 16 dB D/U. Adding IBOC to the interfering signal makes no difference in this case.

The Technics receiver does not fare very much better, as it is just barely usable at 6 dB D/U. When IBOC is added at this D/U ratio, the noise floor increases by 1-2 dB, so this is an example of the middle ground where the analog and digital interference make approximately equal contributions. As far as component receivers go, this receiver seems more middle of the road than high end.

It is with the car receivers that we really see the impact that first adjacent IBOC can have. At 6 dB D/U, both receivers initially deliver very good SNR, especially when the external noise is not added. When the interference becomes IBOC, however, it is quite a different story: the SNR now becomes perilously close to the "tune-out" threshold.

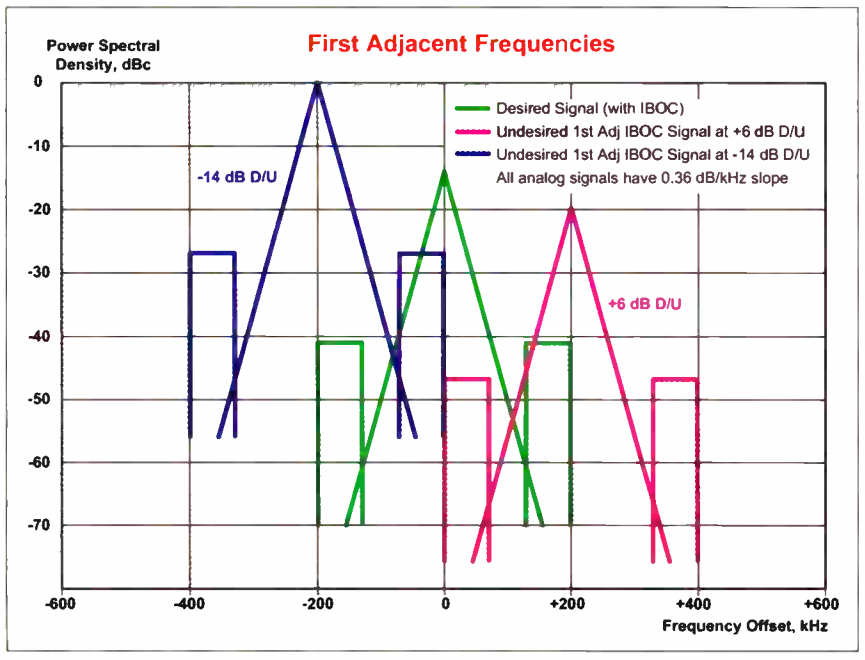
If we go to a reception area where the D/U is lower than 6 dB, the SNR quickly drops below this threshold, and reception becomes extremely noisy. The Delphi receiver in particular is a good representative of the "bulletproof" class, delivering good SNR even at -14 dB D/U when IBOC is turned off. It is evident that at this D/U ratio, the receiver has blended to mono in order to maintain its SNR, but this tactic is not enough to rescue the reception when IBOC is turned on.

		Delphi Auto		Pioneer Auto		Technics Hi-Fi		Sony Portable	
D/U, dB	Added Noise	IBOC Off	IBOC On	IBOC Off	IBOC On	IBOC Off	IBOC On	IBOC Off	IBOC On
+16	Off	55.1	42.7	53.6	41.7	41.0	39.4	31.8	31.3
	On	43.4	40.1	42.5	39.3	39.4	38.0	31.2	30.8
+6	Off	55.1	32.9	53.6	32.0	30.6	29.4	21.8	21.3
	On	43.4	32.5	42.6	31.6	30.7	29.2	21.7	21.3
-4	Off	54.7	23.1	53.5	22.2	18.3	14.7	5.7	4.7
	On	43.4	22.9	42.2	22.1	18.1	14.7	5.7	4.7
-14	Off	47.5	25.1	40.6	16.4	2.0	1.8	1.2	0.9
	On	45.2	23.5	31.8	16.3	1.9	1.8	1.2	0.9
-24	Off	10.2	3.1	21.0	4.7	1.6	0.5	0.2	0
	On	7.1	3.1	19.5	4.7	1.6	0.6	0.1	0

Table 1: Measured SNR of iBiquity Test Receivers with First Adjacent Interference

LOOKING AT THE AVAILABLE DATA

The receiver test results from iBiquity are very limited in scope, but they do illustrate the problem quite nicely. The results of the first adjacent interference tests are summarized in **Table 1**. Separate tests were done for upper and lower adjacents, but to keep the data more manageable, I have averaged the upper and lower results for each case.



Although interference tests are normally done without added noise in order to assess the effects of interference alone, iBiquity also repeated each test with a fairly high amount of noise added to the desired signal, claiming that this more accurately represents real world reception conditions. There is some justification for this, but the amount of noise added is more representative of dense urban reception conditions, and not of quieter suburban/rural locations.

The results with no added noise are thus a better representation of the latter conditions. In any case, both sets of results are shown in the tables, though they have little bearing on our conclusions about the effects of interference.

SECOND-ADJACENT CONSIDERATIONS

For second-adjacent analog interference, we once again see a huge range of performance in modern receivers. The NAB data for 28 receivers shows interference occurring at D/U ratios ranging from -71.5 dB to -8 dB, with a median value of -30.5 dB. Most, but not all, of the car receivers could cope with second adjacent interference at the FCC protection level of -40 dB, but only half of the component receivers, and none of the others, could accomplish this feat.

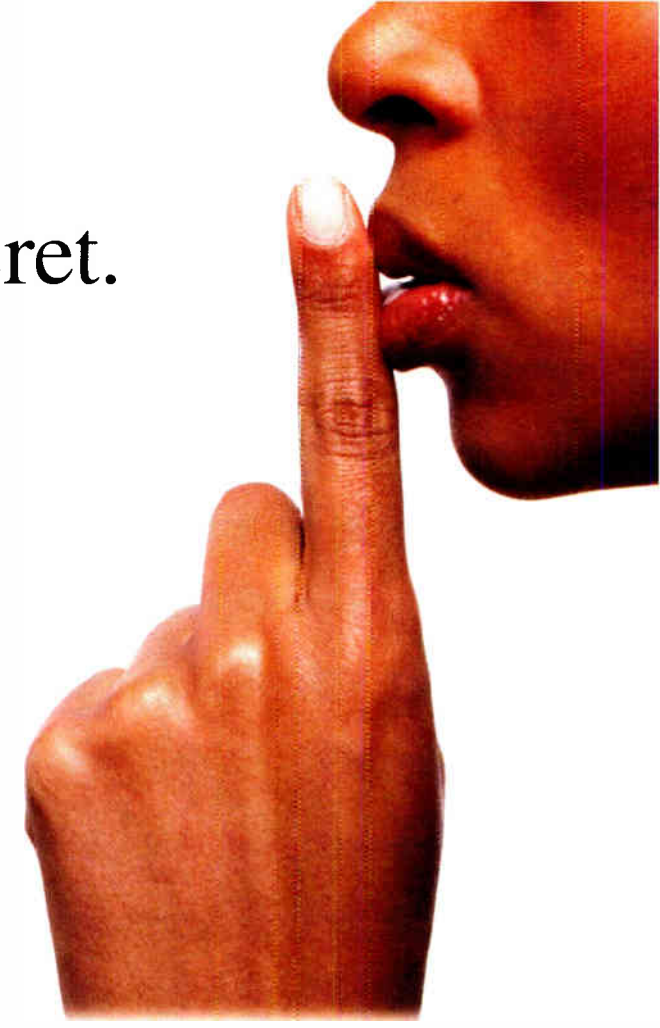
In real world situations where the interference actually reaches this level, reception problems must be rampant! Clearly, -40 dB D/U does not offer adequate protection for the majority of today's FM receivers. The -20 dB D/U that applies to noncomms and cross-border situations is much more realistic.

When IBOC is added to a second adjacent signal, a new source of digital interference appears on the first adjacent channel. Whether or not this adds significantly to the overall interference level is again very dependent on the selectivity characteristics of a particular receiver.

Let us assume a receiver's filters provide 23 dB more attenuation at the center of the second adjacent channel than at the center of the first adjacent. This would put the analog and digital interference at roughly the same power levels, so they presumably would make similar contributions in determining the receiver's SNR. If the filters roll off more slowly than this, then the analog interference will tend to dominate, and the addition of IBOC to the interfering will have relatively little impact.

(Continued on Page 12)

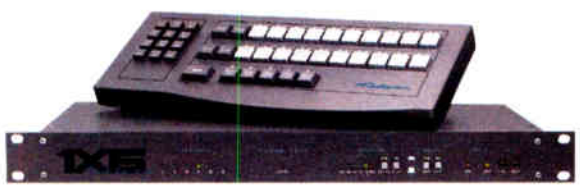
Our client list is secret.



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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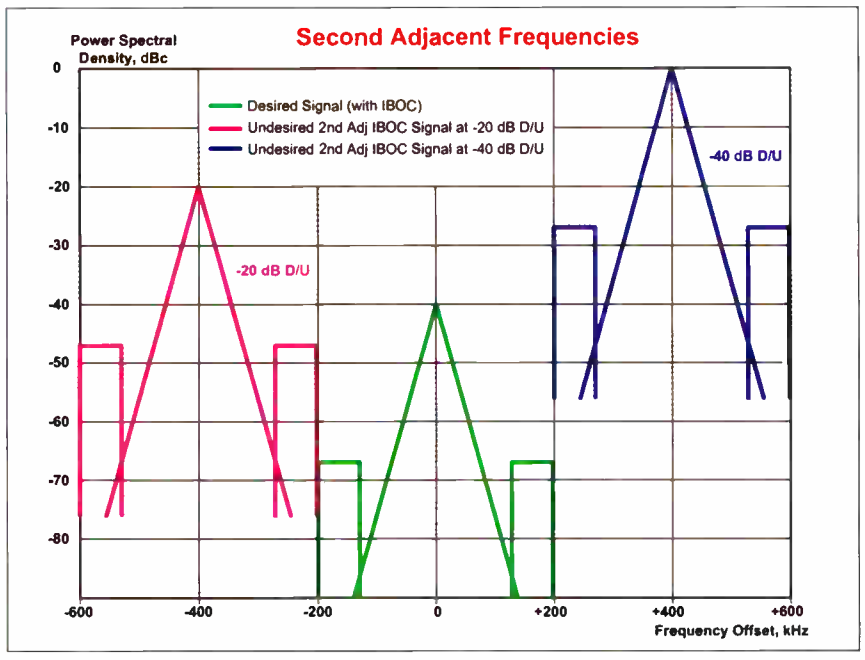
Transmission Guide

by Barry McLarnon, P.E.

– Continued from Page 10 –

If they roll off more steeply, on the other hand, then the opposite will be true, and IBOC will have a proportionately greater impact.



AND MORE DATA

Once again we turn to the iBiquity test results, but some disappointment awaits. In the first adjacent tests discussed above, the D/U ratios went in 10 dB steps from -24 dB to +16 dB, a 40 dB range that brackets the protection level of 6 dB. For inexplicable reasons, this same approach was not followed in the second adjacent tests; instead, the tests covered only a 20 dB range, from -40 dB to -20 dB.

Given the huge range in second adjacent performance seen in the 1999 FM receiver tests (which were readily available when the IBOC receiver tests were being planned), this is an inexcusable oversight. The results are summarized in **Table 2**.

drop in SNR at this D/U when IBOC is turned on, indicating that the analog and digital interference make roughly equal contributions to the total. There will be some higher D/U, therefore, where the presence of IBOC could make the difference between acceptable quality and "tune out."

Finally, we have the car receivers, which are still "bullet-proof" at -40 dB D/U, IBOC or not. These receivers are probably similar to the best of those tested by the NAB, which did not show significant interference until the second adjacent D/U dropped below -70 dB.

Consider the fact, however, that second adjacent IBOC at -70 dB D/U puts a digital sideband on the first adjacent at -47 dB D/U. The best receivers can deal with -14 dB D/U on a first adjacent, but it is unlikely that any can survive -47 dB, even allowing for the fact that the digital sideband is on the far side of the first adjacent channel rather than being centered on it.

One can make an educated guess, therefore, about those missing results for D/U < -40 dB that were not provided by iBiquity. As the D/U drops further, the SNR without IBOC will also drop, but remain usable down to around -70 dB; on the other hand, somewhere around -50 dB, the presence of IBOC will start to degrade the SNR badly, and around -60 dB, reception will be destroyed completely.

The situation is therefore much the same as for the first adjacent interference case: the superior receivers that are capable of delivering good reception with interference levels equivalent to those generally found outside of protected contours may lose that capability when the interfering stations run IBOC.

		Delphi Auto		Pioneer Auto		Technics Hi-Fi		Sony Portable	
D/U, dB	Added Noise	IBOC Off	IBOC On	IBOC Off	IBOC On	IBOC Off	IBOC On	IBOC Off	IBOC On
-20	Off	52.8	52.8	50.4	50.3	52.3	51.6	23.2	19.4
	On	43.2	43.2	41.8	41.8	42.5	42.4	23.2	19.4
-25	Off	48.3	48.3	46.9	46.9	49.4	47.6	10.0	3.9
	On	42.6	42.6	41.6	41.6	42.2	41.7	9.9	3.9
-30	Off	45.0	45.0	44.5	44.5	45.3	38.5	3.9	2.0
	On	42.3	42.2	41.6	41.7	41.4	37.1	3.9	2.1
-35	Off	45.1	45.2	45.9	46.4	40.2	21.3	1.2	1.4
	On	44.1	44.1	44.8	45.2	38.5	21.6	1.2	1.4
-40	Off	46.8	46.8	47.3	47.3	34.9	4.4	2.2	1.5
	On	46.4	46.4	46.9	46.9	34.3	4.3	2.2	1.5

Table 2: Measured SNR of iBiquity Test Receivers with Second Adjacent Interference

It can be seen that the receivers fall into three distinct categories (the Good, the Bad, and the Ugly?), but only the Technics receiver is characterized well by these tests. It does, however, provide a dramatic example of the potential impact of IBOC on second adjacents in certain situations. With no IBOC, this receiver delivers good SNR at -20 dB D/U, and it remains adequate down to -40 dB D/U. With IBOC on, however, we see some significant impact at -30 dB, and at -35 dB, the SNR plunges well below the "tune-out" threshold. At -40 dB, it is blown out of the water by the digital interference.

Evidently, the Technics receiver is one of those in which the difference between first and second adjacent channel rejection is well in excess of 23 dB, so the digital component of the interference is dominant.

The picture is less clear for the Sony receiver, since it failed to deliver a usable SNR even at -20 dB with analog interference. It is significant, however, that there is a 4 dB

REALLY WIDEBAND EFFECTS

The NAB receiver tests with third adjacent analog signals showed interference occurring at D/U ratios ranging from -67 dB to -18 dB, with a median value of -40 dB. These results are somewhat better than for second-adjacents, but they still show that half of the receivers will have impacts on their SNRs ranging from minor to debilitating at the nominal protection level of -40 dB D/U.

There are no third-adjacent IBOC interference results available from iBiquity. However, the same relationship as outlined in the previous section would apply: we would expect that adding IBOC would increase the interference levels significantly only if the receiver has much superior rejection (of the order of 23 dB or more) of third-adjacents compared with second-adjacents.

An examination of the NAB data shows only one receiver (a personal portable) where this condition applies. Thus there may be some isolated instances where IBOC on third-adjacents causes increased interference, but it is not likely to be a common problem.

THE FUTURE FOR FM

FM coverage is a messy business, and it is about to get messier. The coverage of many stations is interference-limited in some way, but you cannot define a station's coverage without specifying the characteristics of the receiver used. When the interference includes IBOC, coverage will inevitably suffer, but again, the extent of the impact depends very much on the receiver. The likely impact may be briefly summarized as follows:

• Many receivers are very poor performers (only about one-third of FM receivers currently in use fall into the component or automotive categories that generally offer superior performance), and will fail to work when adjacent channel interference comes anywhere close to the nominal FCC protection ratios.

These receivers will be the *least* impacted by IBOC, since their coverage area is typically already severely restricted by analog interference. Many of them will, however, be negatively affected by IBOC on the desired station, which will manifest itself as a higher noise floor throughout the receiver's coverage area, possibly aggravated in certain areas where the use of separate transmitting antennas causes the received digital signal to be at more than the nominal -20 dBc level. The use of the extended hybrid IBOC modes will raise the noise floor even further for these susceptible receivers.

• The biggest impact of IBOC interference will be felt by the users with the best receivers, which are mainly car radios, along with some high end component receivers. The impact will mainly be felt at adjacent channel interference levels that normally occur outside of protected contours.

In other words, stations that currently enjoy fringe area coverage outside of these contours, thanks to the superior performance of these receivers, stand to lose much of it when hybrid IBOC prevails. The situation is even worse for some stations with grandfathered superpower FM stations on first- or second-adjacents that run IBOC, since the loss of coverage will be largely inside the nominal protected contour.

• Receivers that occupy a middle ground of quality, such that they are just good enough to deliver adequate SNR at the protection levels, may suffer a significant impact from IBOC stations, particularly on second-adjacents. This is a consequence of the disparity between the protection levels and the IBOC signal.

There is a 46 dB difference between the protection levels for first and second adjacents (for commercial stations), but there is only a 23 dB difference between signal levels on those channels from an IBOC station on a second adjacent. Many receivers that can tolerate the analog interference will thus be overwhelmed by the digital interference, and this could happen well inside the protected contour.

Obviously, every FM station's interference situation is a little different; when IBOC is widely deployed, some will emerge relatively unscathed, and others will be big losers. One hopes this rocky transition to the digital era will be worth all the pain. Next time, we will take a closer look at what AM IBOC has in store for us.

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

The routing switcher gets a new twist.

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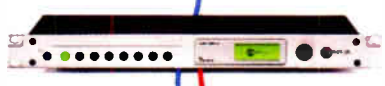

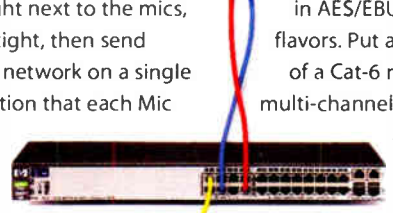

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Facility Focus

by Barry Mishkind

Digital Transmission Effects: The Mom and Pop Next Door

[HOWELL, Michigan] According to a recent study, some IBOC transmissions are especially likely to cause severe interference to adjacent stations.

How this will impact stations, especially Class A FM stations and their service areas, is not fully clear as yet, although Barry McLarnon's figures (see Page 10) should at least cause owners and engineers to pay attention as the IBOC rollout continues.

Stations with grandfathered super power (stations permitted to use more power and/or height than the normal limit for their class) stations on their first- and second-adjacent channels, might see significant interference within their primary coverage contours. WHMI, in Howell, MI is a good example of stations in this situation.

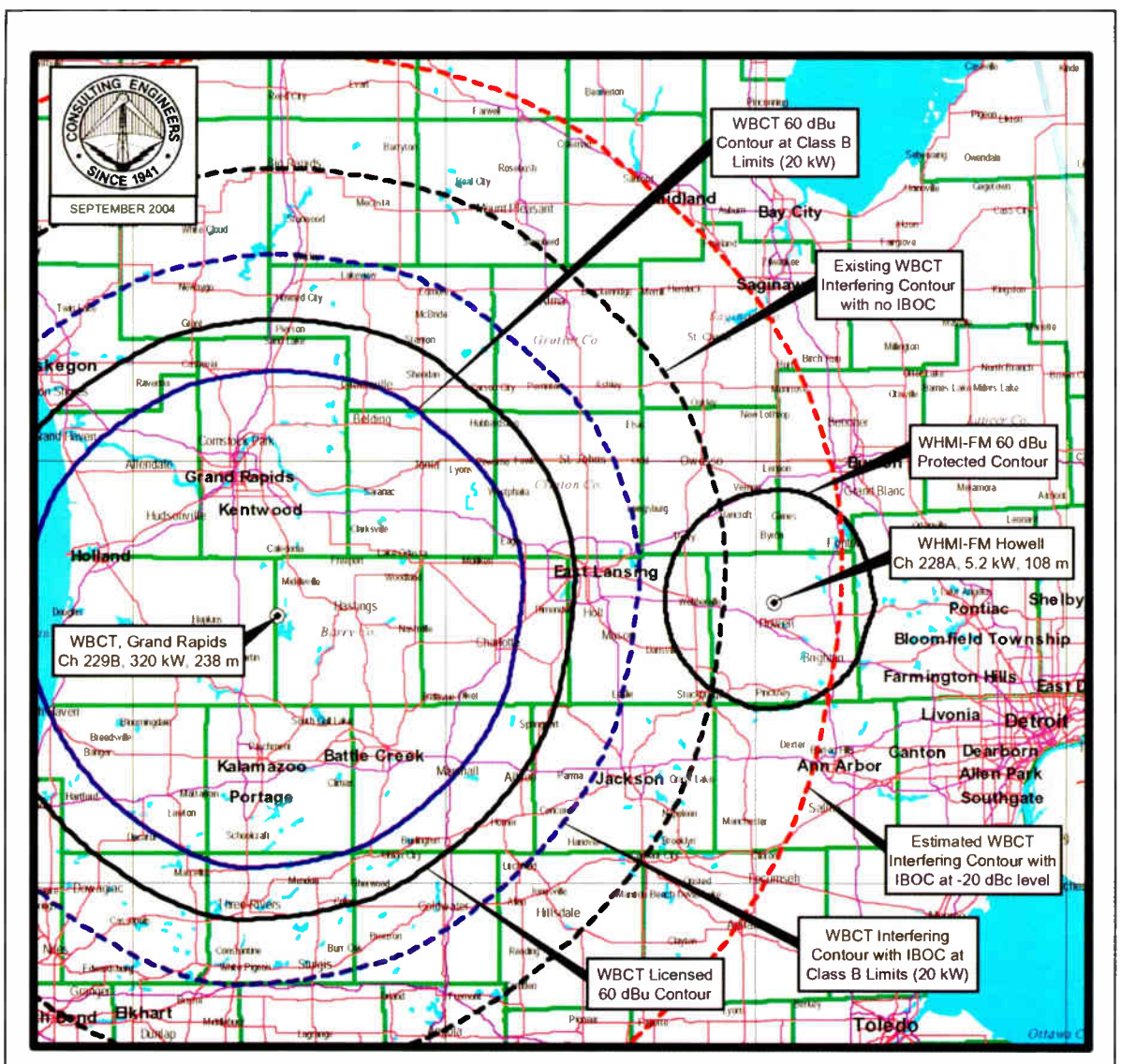
REAL LIFE EXAMPLES

Greg Jablonski, WHMI's President and General Manager, has for some time been trying to increase awareness of the first adjacent FM IBOC interference problem at the FCC and in the broadcast community. He feels "the problem is systemic, occurring in ten states in Zones I and IA, adversely affecting at least the 189 stations identified in the study, and maybe more."

With a 320 kW neighbor (WBCT) on its first adjacent channel, WHMI currently receives analog interfering contour overlap over 26.3% of the area inside its protected contour. According to the study, when WBCT commences IBOC operation, the overlap will increase to 87.4%, including the WHMI transmitter site.

Part of the problem is WBCT has a grandfathered analog signal (320 kW/780' HAAT) that operates 12 dB above Class B limits and is the most "overpowered" FM station in the country outside of California. Its potent co-channel 3.2 kW IBOC signal will likely deliver quite a severe blow to WHMI's coverage, according to the study.

Furthermore, another 188 potential "victim" stations first-adjacent to super powered stations have been identified; at least 14 of them are predicted to have an interfering contour overlap over their *entire "protected" service area*. The effect upon local service may be substantial; already some reports from the field indicate "normally powered" stations in some markets are experiencing degraded reception from their first-adjacent neighbors.



The various contours, including those expected should WBCT initiate IBOC operation.

WHY THERE IS CONCERN

WHMI is described by Jablonski as highly rated, and "as an intensely local station (there are no other stations in the county), programmed to super-serve Livingston County, Michigan and its 180,000 residents. In fact, WHMI's longtime slogan is 'Livingston County's Own.'" It is local and live 24/7/365, and with a commitment to news demonstrated by its newsroom, equipped with four workstations, plus an air booth.

Buzz Elliot in the WHMI Control Room

This year, WHMI has already received the Michigan Association of Broadcasters Medium Market "Station of the Year" award and the Class III "Award for General Excellence" from the Michigan Associated Press. According to Jablonski, "WHMI's belief in localism and community involvement has been at the core of the station's success."

WHMI President Greg Jablonski with the "Station of the Year" Award from the MAB. Inset: WHMI's Wall of Honor, displaying awards to the station.

Since 1989, WHMI has been a real mom and pop operation: live, local, and involved. The Jablonski's, Greg and Marcia, along with their 20 employees, continue to focus on serving Livingston County. It is their hope, as Greg says, "that the FCC will act – before it's too late – to eliminate the imminent interference that could greatly diminish a strong local voice that serves its community."

BACKING DATA

Jablonski says the study done by the consulting engineering firm of duTreil, Lundin & Rackley in October, 2004 can be viewed along with other filings of The Livingston Radio Company at the FCC's ECFS website, under Proceeding 99-325.

Since there are likely to be additional effects from second-adjacent as well as co-channel situations, WHMI's proposed solution is for the FCC to require grandfathered super power stations to begin operations at or below Class limits as a prerequisite to IBOC operation. Additional studies may identify other situations, even among "normally powered" stations where interference could be encountered.

In a recent letter to the Commission, Jablonski points out that "Digital technology shows promise to improve radio broadcasting as a whole. But ... there is no justification for allowing stations that have been grandfathered at extra high power or height in the analog world to carry over that grandfathering into the new digital environment at the expense of other stations." – *Radio Guide* –

Control Freaks

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SRC-32

The SRC-32 is a computer interface to the real world. Connection through an RS-232 or RS-422 serial port the SRC-32 can notify your PC software program that any of 32 -optically isolated inputs has been opened or closed and allow your software to control eight SPDT, 1-amp relays and an additional 24 open collector outputs. Communication with the SRC-32 can be accomplished via short burst type ASCII or binary commands from your PC (computer mode). Also, two units can be operated in a standalone mode (master/slave mode) to form a "Relay extension cord," with 32-channels of control in each direction. The unit can communicate using RS422 or RS232, at data rates up to 38400. The SRC-32 may be expanded to 128 inputs x 128 outputs. Optional external Ethernet capabilities may be added with the SP-1. The optional USB-RS-232 adapter may be added for USB operation.

GPI-32

The GPI-32 interfaces 32 optically isolated inputs to a RS-232 or USB port. The GPI-32 is equipped with both dual plug-in Euroblock connectors and two independent DB-37 connectors that may be interfaced directly to the DB-37 connectors located on the StarGuide II/III relay cards. Additional features; dual RS-232 connectors, one for daisy-chaining multiple units on the same legacy serial port and a DB-9 to interface to our USB adapter; LED indicators for power and input activity; twin power connectors allowing up to four units to be driven off of one power transformer. The GPI-32 is powered by a surge protected internal power supply. The optional RM-3 may be added for rack mount applications.

SRC-8 III

The SRC-8 III is a computer interface to the real world. Connection through an RS-232 or RS-422 serial port the SRC-8 III can notify your PC software program that any of 8 opto-isolated inputs have been opened or closed and allows your software to control eight SPDT, 1-amp relays. Communication with the SRC-8 III can be accomplished via short "burst" type ASCII or binary commands from your PC (computer mode). Also, two units can be operated in a standalone mode (master/slave mode) to form a "Relay extension cord," with 8-channels of control in each direction. The unit can communicate using RS-232 or RS-422, at data rates up to 38400. The SRC-8 III may be expanded to 32 inputs x 32 outputs. Optional external Ethernet capabilities may be added with the SP-1. The SRC-8 III may be set on a desktop, mounted on a wall or up to three units mounted on the RA-1, Rack-Able mounting shelf.

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 users 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 string per relay. Communication with the SRC-2(x) is accomplished via short "burst" type ASCII commands from the users 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.

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Maintenance Guide

by Jeff Welton

Prepare *Before* Lightning Strikes

Spring showers often give way to summer lightning season. The display can be awesome, and many people love to watch. But the radio engineer's anxiety level does tend to increase as the storm closes in on his transmission site! Jeff Welton offers a checklist to strengthen your site's protection against lightning.

[HACKETT'S COVE, Nova Scotia, Canada] It is 3:00 AM, Tuesday morning; you have been in bed for two hours now. It has been an interesting day, to say the least.

A FUN DAY

Starting at about 9:00, you got to fix a defective hard drive controller in the main audio server, diagnose and repair a remote control system IC failure on the mountain site, rebuild a lost isocoupler at another transmitter side (which had taken down a satellite feed), and by robbing a power supply from the receptionist's computer, brought the automation system back from the dead.

By the time you parked in your driveway it was past midnight. Dinner was in the microwave, the wife and the kids were in bed and it looks like you might be in the doghouse. As you go to bed, you think this day could not have been much worse, and you are sure glad it is over.

But the cell phone rings yet again, and it looks like the day is not over after all. This time it is the remote control for the Talk-AM station; the readings on the remote are not making any sense at all, so it looks like that nap you just had might be it for a while.

Opening the door to the transmitter building, you are greeting by the smell of ozone and burning rubber that tells you this might take a while. The transmitter is down and just about every alarm tally on it is lit. Better yet, smoke is rising from the processor. As you assess the damage and see what can be patched together to get a signal out before morning drive begins in a couple of hours – yes, this is cue for the GM call to find out what is happening!

Sound familiar? Just about everything described above could easily have been caused by lightning or lightning related surges.

FOCUSED DISCUSSION

In discussing lightning and its effects upon radio facilities, the problem is not so much what to write as what *not* to write. There is a veritable plethora of articles and research on lightning protection, covering virtually all aspects of the concept.

However, most of these are written to cover all possible scenarios, providing data overload that may not apply to specific situations. In looking for information specific to radio stations (without an excess of non-applicable information), I am going to turn to a recent thread on the BROADCAST list server (http://www.radiolists.net).

I will borrow from a message I posted during that thread and build on some of the points mentioned, as well as adding a few new ideas. Hopefully, the implementation of these basics will help to prevent you from witnessing the awesome damage an uncontrolled strike can cause.

EACH SITE IS DIFFERENT

First, let me emphasize that lightning protection is by no means an exact science. The layout of every site is different and the susceptibility to lightning varies widely; a site in Florida, for example, will invest thousands more dollars in protection than will a site in Maine.

In addition, solid state transmitters will tend to cutback or reduce power much more quickly than tube transmitters, as the devices are much more susceptible to lightning damage. Frequently, these cutbacks are witnessed more while a storm is approaching or leaving the area than while it is directly overhead. This ties into lightning protection in that, although these cutbacks are not caused by lightning, they are directly related.

Without going into too much detail, here is a list of what I would like to see at a site when I am inspecting it. We will start at the antenna, with no particular order of priority:

A LIGHTNING DAMAGE PREVENTION CHECKLIST

1. It all starts with a good ground system: four rods around the tower base, spaced so that the distance between them is twice the length of an individual rod. These rods should always be bonded to a copper strap or the heaviest gauge wire possible. No clamps, all ground connections should be CAD welded or Sil-Phos'd (Silver Phosphate) out here.

2. If the tower has an insulated base, set the ball gaps to the proper distance. Typically, this will mean 1/8 to 1/4 inch. Usually, due to weather and various insects, a closer spacing is not feasible.

3. The guy wire insulators need proper preventive maintenance. Old, dirty ones arc, cracked ones absorb moisture and become conductors. Either effectively top loads the tower, putting a capacitive load on the transmitter. If this is a big problem, static dissipaters may help (your mileage may vary, I have had half a dozen engineers tell me how great they are and one say they did not help at all). This is a direct cause of the "near storm" cutbacks mentioned above.

A guy wire insulator that should be replaced.

4. There should be another ball gap in the ATU output, set as close as possible. The horn gaps that come on most ATU's are better than nothing, but have a less predictable arcing voltage.

Carbon balls are best, as material does not transfer from one ball to the other when an arc occurs. These are available fairly economically and can be bought with threaded holes so they can be screwed onto common threaded stock.

You can roll your own for less than $200. Note that this should be done for all tower types, including unipoles.

Remember, even on grounded towers, a lot of strike energy can come down the antenna feed line, rather than through the actual tower structure itself – and it will be higher if antenna joints are loose or corroded.

5. Place a static drain at the ATU output. I like to see a discrete choke here, although a bifilar on the tower lighting is better than nothing. With respect to the static drain choke – if it looks like the one on the right, it is not doing much good.

An Ex-Static Drain Choke

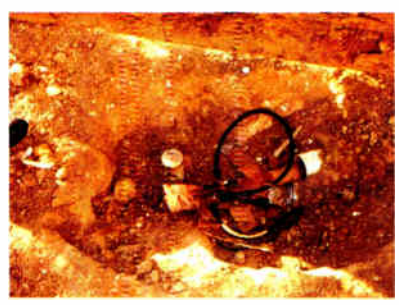
6. I suggest a series capacitor in the ATU. This will block DC from heading back to the transmitter and force it to ground through the static drain as the tower ionizes in the period before a strike.

7. Bury the coax underground, if at all possible. It must be under the ground radials to be effective, but burying the coax helps lightning energy to bleed off into the ground system on its way back to the transmitter (obviously this is more important the farther away from the tower the transmitter building is located). If burying is not feasible, consider weather proof grounding kits on the coax shield every 20 feet or so.

AT THE TRANSMITTER BUILDING

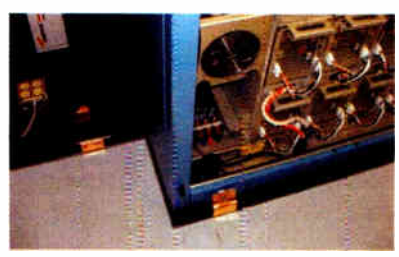
8. Connect the Coax shield to ground at the point where it enters the transmitter building. A bulkhead panel for all coaxes going to the tower is a good idea (Polyphaser and other companies sell them – or home brew one, as shown here) to keep all shields at the same potential.

9. Ensure there is a well-established site ground. Again, ground rods should be installed at a spacing of two times their length around the building with a two-inch strap connecting them. If you are going to install a ChemRod, do it where the coax comes out of the building – this is your reference ground point.



10. Ferrites should be on all coax cables (although this usually is not feasible for 3-1/8" or larger, due to toroid cost) between the equipment and the point where the coax leaves the building. If the phaser is in the transmitter building, put a ferrite on the coax from the transmitter to the phaser and one on each of the antenna feeds before they leave the building.

11. The transmitter building should have a single point ground. One ground conductor should run from each piece of equipment to the reference ground point at the bulk-



This is the most common thing I see at older sites. Not normally a big problem - unless you are leaning on the transmitter when that big strike hits the tower.

(Continued on Page 18)

Maintenance Guide

by Jeff Welton

Continued from Page 16

head panel. In larger buildings, use a "tree" design, with each piece of equipment in a room grounded to a common point for the room, then an individual strap from each room to the reference ground point.

Note that unless transmitters have an insulated ground stud wired to the coax output point (shameless plug: any Nautel built since 1990 does) then the ground should attach to the equipment near the coax connection. Grounding the bottom creates a possible path for current flow through the equipment rack if you do not get all the energy off the coax shield before it hits the transmitter.

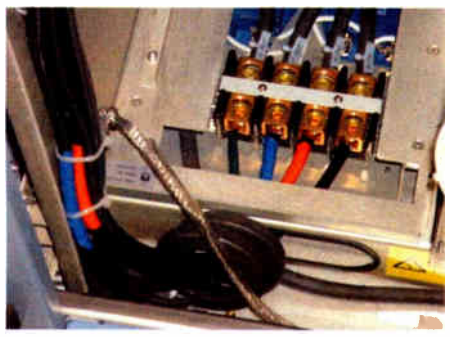
AC WIRING

12. AC line protection. A shunt type Metal Oxide Varistor is the minimum recommendation here. Series types offer even more protection. It is crucial that protectors have a heavy strap to the reference ground and that the connections to the AC mains are as short as possible, and the wiring is as large as can fit in the provided terminations.

The goal here is to minimize the inductance of the path through the surge protector to ground.

13. Use ferrites on all AC cords or wiring to *all* equipment. This includes your processor, your remote control, your STL and your transmitter.

For equipment with heavy wiring, make sure all wires plus a ground pass through a toroid – that is, three phases plus ground through *one* toroid, not one for each wire.



This helps to maximize inductance that lightning energy sees on its way to the equipment from the AC entrance, and makes the lower inductance run through the surge protector look like a much better path to ground (you did use the shortest possible run of heavy gauge wire for the surge protector, right?)

UPS

14. Because radio stations today use many more highly susceptible components in the air chain, these should all be on UPS systems, even if there are AC protectors. Ideally, they will be on "true UPSs," which take the incoming AC, convert it to DC to keep the batteries charged and operate full time on the batteries.

Other UPSs switch to the battery supply when the AC fails, but normally operate on the AC supply. These can be more susceptible to power surges, as well as causing issues with some equipment on the transition from mains to battery power.

A list of transmitter site equipment that should be considered for UPS connection would include: satellite receivers, ISDN equipment, FM exciters, remote controls, all processing equipment – effectively anything that is used to deliver the on-air product.

The same holds true at the studio – if it is used to get the audio to air, it should be protected. The GM's desktop might be considered less of a priority, at least on the "mission critical" list.

FINAL THOUGHTS

A couple of notes: frequently it will be necessary to compromise, based on cost or site considerations. Consulting with your equipment manufacturer will help you choose the best compromises.

Secondly, if you install ferrites and they get hot, you have a ground loop (too many grounds) or a bad ground connection somewhere. A hot ferrite means that the current through the feed and return are not equal. A current imbalance translates into a voltage potential, which can be an equipment killer.

Finally, make sure the ground from the pole pig(s) is/are bonded to the reference ground ring *outside* the building. Do the same with telephone grounds. Power and telephone company crews are usually happy to do this, as it helps protect their gear, too.

Hopefully, by performing the above steps, you will be spared a good deal of the damage that can occur from a lightning strike and will be able to spend less of your free time at the studio or the site (and in the doghouse), making repairs that could have been avoided.

Jeff Welton is the senior Customer Support Technician at Nautel, Ltd. A veteran of many on-site trips to help customers, Jeff is always ready to help. Contact Jeff at jwelton@nautel.com

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Tieline Commander G3 Vs Telos Xport

Feature	Tieline Commander G3	Telos Xport
POTS to POTS connection	Yes	No - POTS to ISDN only
POTS Audio Delay	100 Miliseconds	>600 Miliseconds
Maximum POTS Audio Quality	15kHz	15kHz
Low bit rate audio quality over POTS	7kHz as low as 9.6kbps	Telephone quality below 16kbps
15kHz Bi-Directional Audio over POTS	Yes	No - 15kHz 1 way only
POTS Compatibility	Yes Comrex/Musicam	No
Intelligent Gain Control	IGC + AGC	AGC
Warranty	2 Years	1 Year
Expansion Ports	2	1
12 Volt DC portable power options	Yes	No
Simultanous duplex Comms and Talkback*	Yes	No
Remote Control Talent's audio Inputs	Yes	No
Stereo 15kHz over POTS*	Yes	No
Dual Mono 15khz POTS*	Yes	No
Bonded POTS* Up to 48kbps mono	Yes	No
Audio Over IP Codec to Codec *	Yes	No
Weight	4 lbs	7 lbs
Dimensions	8.5x8.5x2.9 inches	9.25x12.75x3.5 inches
GSM 7.5kHz Wireless *	Yes	No
ISDN Options	Mono, Stereo, J-Stereo	Mono
ISDN Algorithms	Mpeg Layer 2, G.722, G.711, Tieline Music	AAC+, AAC LD, G.722
15kHz stereo/dual mono over 1 x 64K channel	Yes	No
User Remote Profiles	98	30
Configurable Macro Function Options	Hundreds	No
User configurable program/monitoring/comms	built in 11 x 6 cross point audio router*	No
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** Refers to base MSRP without ISDN option for POTS Codecs and MSRP for Telos Xstream as of 4/1/2005. The Telos logo, Zephyr, Zephyr Xstream, Zephyr Xport are all registered trademarks of TLS Corporation. © 2004. aacPlus (TM) Coding Technologies. Comrex, Musicam and Telos and associated trademarks are property of their respective owners. Product specifications quoted from the manufacturer's manual listed on the website 5/11/2005 * Requires additional POTS, ISDN, GSM, IP modules for operation.

Studio Guide

by Mark Shander

A Microphone Matching Challenge

[PHOENIX, Arizona] Talk studios present special challenges when environments *can* be controlled, let alone when they cannot.

Add to that the way some studios are modified from their original configurations over time, and that some are configured with existing, recycled equipment. Creating a studio that sounds the way you really want can be a real challenge.

AN EXAMPLE

As an example, consider a Phoenix station I recently visited. This is an AM station, independently owned, with three talk studios and a control room: it sounds very professional over the air.

The control room is set up to originate talk programming or have a board operator who can participate in the programming. The board operator also controls IFB and talk-back for the talent, talk-back over mix-minus in case the phone guest needs to be prompted or cued, and access to the building paging system to alert the talk host pouring coffee in the kitchen that the break is almost over.

Two other studios are available for talk programming; each can be placed on the air live via microphone inputs on the master control console, or from the room's mix outputs, dialed up via audio router.

MULTI-PURPOSE

"Studio E," so named because it appears that an elephant has trampled through it is, in fact, the most popular studio in the station. It is where both morning and afternoon drive talent do their shows, and where the Mountain Dew button on the pop machine costs $2.50 because it is really dispensing Red Bull. That is correct – there is a soda vending machine in Studio E because it is also a prep room.

Studio E did not have two chairs that matched, let alone two microphones that sounded alike. From rough times on the road and the hands of people who cared little about the equipment this studio was in tough shape sonically and cosmetically.

The answer to dents and dings is a $3 windscreen. All the microphones are spray painted black (except one), and none of the capsules are the ones that came with the original microphone bodies.

NOT VERY PC

Why is this room so popular? It has character, and so does the programming created in it. Imagine a studio where you can let it all hang out (and unfortunately, some do!). The main talent microphone was once a Shure SM7. At one time the windscreen had been removed, the capsule poked with pins and paper clips and replaced.

The original capsule was damaged in a hand-rolled cigarette-related mishap (at least that is the story). The windscreen was soaked in water and when it eventually molded, it was replaced with a toilet paper roll's cardboard center. The effect was something like a shotgun microphone, and the talent liked it so well it was spray painted black gloss.

A blue stuffed Smurf was added to the Luxo microphone arm, holding the main talent microphone in a politically incorrect manner. (It is quite a spectacle to watch a serious discussion with the talent arguing with a caller through a Smurf's rear.)

A couple of Sennheisers also were mounted with stuffed characters in poor taste. One sounded warm and silky to my ears, while the other sounded boomy; I thought the second microphone had too much low end. Looking for the bass roll off ring, I saw it had been soldered or welded in position.

The tonal change culprits were preamp equalizers within reach of operators, clearly adjusted for someone's personal taste. Expecting these to be in a hands-off location, I asked if everyone was allowed to change the microphone EQ. They were not supposed to be touched, but it was known that the talent takes liberties to make themselves sound "phat."

DIFFERENT BUT THE SAME

The preamp EQ controls did have clearly marked positions, and as I listened to each of the microphones in the studio through a compressor, I realized the EQs and the compression on each microphone had been set up to make the microphones in the room sound similar. The two SM58s, two MD-421s and the SM7 all sounded very similar to one another.

The low end appeared to be shifted up to a common low-end frequency response the microphones share, and the upper end seemed to be much lower than any of them should have been capable of. One way or another, these seemingly mismatched microphones had been carefully tweaked until they closely matched one another, and it was difficult to hear a difference between one and another when they were set up "correctly."

Although this room was configured with microphones that had different tonal qualities, through audio processing and EQ, it was possible to find a common denominator as far as frequency response and gain was concerned, so the human ear could not discern a difference between microphones and they sounded like they matched.

Of course, looking at the microphones while Studio E has a show going on still makes you question how seriously you can take a program about war in another country while the host talks into a smurf!

Mark Shander has spent a good part of his life talking into various Smurfs. He can be contacted at mark@shander.com

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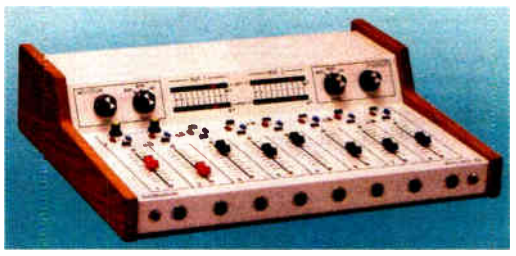

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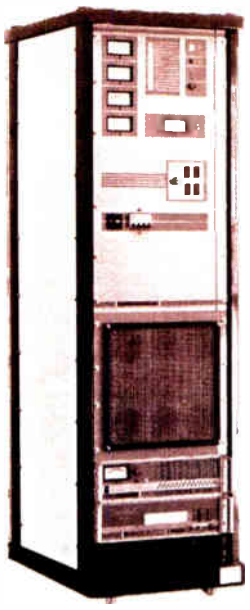

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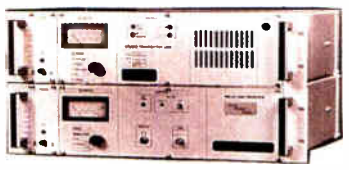

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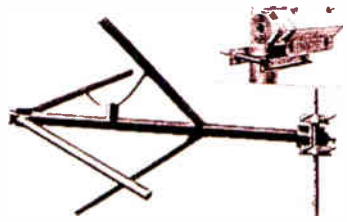

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A Non-Comm View

by John Devecka

The Right Tool for the Job

This is the sort of article engineers and advisors should read together. Most educational stations have limited resources, both in terms of manpower and equipment. John Devecka wants to help you see how, by planning together, even stations with part time engineers can handle technical problems effectively.

[BALTIMORE, Maryland] Everyone knows that the right tools make any job easier. You can prune trees with your Swiss Army knife, but it sure goes faster if you have a chainsaw.

In radio stations – even those that rely on a full time engineer – the right set of tools can prevent disaster, and allow even an inexperienced faculty advisor the chance to do some triage before the "real" engineer can arrive. (Of course that might give the engineer a coronary upon arrival, but we will assume you can avoid *that* kind of triage.)

HAVE *SOMETHING*

Every radio station should have a basic tool kit around, yet I am constantly amazed how many have no tools available at all.

In a pinch, any station operator/advisor should be able to make basic repairs or even do something as simple as hang up a poster without using duct tape (with all due respect to Red Green). This obviously should be a tool kit that is controlled and kept out of reach of non-authorized staffers.

Sure, you can call on the folks in the Physical Plant on campus for the big stuff. That is why you need a "*basic* tool kit." *In the ideal world*, a radio station tool kit would be a cross between a *Snap-On laden* auto shop, Sears' hardware department and an Electrical Engineering lab. In the real world, it is all going to fit into one little red toolbox and have to be achieved for a couple of hundred dollars.

Since you already are familiar with my long-standing refrain about befriending the IT department, use that knowledge and experience to befriend the Physical Plant staff too. Not so they will lend you their jackhammers (although that could be fun), but so they can be counted on to respond when you simply do not have the skills or the tools to do the job.

Of course, I assume most of the typical educational station staffers who might end up using the tool kit are better off staying away from any serious RF issues, and will call an engineer in for those.

That said, you need to be able to do basic things on your own. Calling Physical Plant for a hammer is just embarrassing; it is more so if you have to ask them to put in the nail with it too.

BASIC TOOL CHECKLIST

Take a trip to the local hardware store (or megalithic labyrinth home store) and get some basic tools. If your budget requires buying the cheap stuff from China, so be it, but look carefully at the quality and determine if it will meet your needs.

I have had cheap wrenches deform under pressure, so I tend to buy stronger tools (my preference is for Made In The USA tools, but they are getting hard to find and tend to be more expensive).

A large, but still portable toolbox is step one, depending on your budget and storage space. Then fill it with these basic tools:

• A pair (large and small) of **flat and Phillips screwdrivers** – ideally a set of different lengths, but a basic pair of large/small versions of each will probably cover you.

• A set of small **jewelers screwdrivers** – usually a kit of flat and Phillips styles

• A set of "S" or **angled screwdrivers** – again both heads – this will be critical in many computer chassis access points

• **Wire cutters** and **stripper tools** – get both, you will be happy you did.

• **Lineman's pliers** – they can cut, bend and hammer, even if they are not supposed to do so.

• Long **needle nose pliers** – get a couple of kinds if you can afford a set.

• A set of SAE and Metric **Crescent Wrenches** (smaller sizes, up to 3/4" and 19mm, will cover the most jobs you might tackle).

• A set of SAE and Metric **Allen Keys** (best are individual tools, they are easier to use than foldout units).

• A **hammer** – get a big one, if you want; you will feel better smashing stuff that you cannot fix.

• **Vise Grips** – get the real thing, I have broken too many fake ones to buy anything else now.

• **Soldering Iron** – not a cold heat one, a regular one – and flux and solder (usually all in one kit).

• A set of miniature **files** – takes the edges off stuff with ease, and cleans corrosion quickly.

If you can afford them, get insulated tools; they will cost more, but they may save you in a real pinch. Another alternative: a packaged tool set in a case, with the tools arranged in holders.

You might also consider getting a cordless drill/driver and a set of sockets or nut drivers, or both. Shrink tubing; micro-torches (or even a lighter); "third hand" wire holders; each of these will speed up work you need to do, whether it is pulling gear from a rack or building some furniture or fixing the old chairs you have in the station.

ELECTRONICS STUFF

The most important items – must-have items – pertain directly to station operations. These things should be in your tool kit even if you have to skip all the hardware tools to get them.

• **Multimeter** – even an inexpensive one – will save you time and trouble. This will allow you to check everything from your wall outlets to test points in equipment that is giving you fits. Best of all, they are available from a zillion sources at a zillion prices. The better you get, the more accurate, so figure on spending about $40 for a decent one.

For real fast checks on whether a power circuit is hot, an AC Sniffer (see page 28) will protect you from danger by clearly identifying when AC is present.

The Radio Guide VT-6 AC Sniffer

• **Tone Generator** – You *must* have one, end of discussion. The type is up to your budget; simple ones utilize a fixed tone, others feature a couple of selections. I prefer the Conex ToneJack as it offers a wide range of tones (1 Hz - 30 kHz) plus control of their output, storage of presets and other nifty things. It is small, easy to use and will save you when you need to figure out what is wrong with your console settings. It is about $200 on the street, and worth it.

Conex RX-11 ToneJack

• **Cable Continuity Testers** – I got mine from Whirlwind, but you can go wherever you want. Their QBox is a great multifunction tool that allows you to test cables with a built-in mic and speaker, as well as tone generation and other features. (See ***Radio Guide*** May-2005, Page 36)

Their basic Tester allows you to hook up a variety of common audio cables (XLR, 1/4", RCA) to get instant continuity tests and LEDs show pinouts. Figure $70-140 depending upon model. (http://www.whirlwindusa.com)

• **Audio Test CD** – You can get these from a million places, but for the basic $20, just get the NAB one. It gives you enough choices for tones, levels and channels to keep you busy chasing audio around the studio all day.

• **Adaptors** – Yes, you will need a big kit of adaptors. Go spend $100 or so on a pile of things that adapt male to female, as well as XLR, 1/4", and RCA types to each other. We are talking about a lot of adaptors, so get a storage case with drawers like you might use for nails and things.

At minimum, you want to get two each in both Male and Female version: XLR to 1/4" balanced, XLR to 1/4" unbalanced, XLR to RCA, 1/4" unbalanced to RCA, and some 1/8" splitters to convert 1/8" jacks to pairs of RCA or 1/4" connections.

Also, get loose versions of all of these connectors so that you can make your own cables in a pinch. More and more companies are offering solderless versions as well, for those that wish to avoid that burning finger smell.

In an ideal world you would get gold contact versions in metal chassis with strain reliefs attached, but if you have to get nothing but cheap plastic ones, at least you have something. If money is less of an issue, look into the crimp system that Canare offers, it makes stripping and connecting cables very easy and they offer very heavy-duty connectors. But it comes at a premium.

CABLES AND BATTERIES

• You should stock some spare **cable** too. Cable is cheap, so do not be stingy. Some basic four-conductor audio wire will see you through most situations. The most common brand, Belden, offers 8451 (two conductor) and 8723 (four conductor) on the street for about $15-$20/100 feet, which is fine for emergency work.

If you are doing something major, you can pre-determine which runs need two, four, or eight-conductor wire and buy the appropriate spools. For a quick cable, four-conductor is going to cover most needs, two-conductor will cover any emergency microphone cables you need to make.

• Yep, a simple thing like **batteries** can kill your day. We have got 9V, AA, AAA and C batteries in stuff around our station, so every so often I go to the local store with a sale and buy a ton of batteries. Try to replace batteries in any field gear that is going on a critical assignment, or put a spare set in with the gear – you will add years to your life!

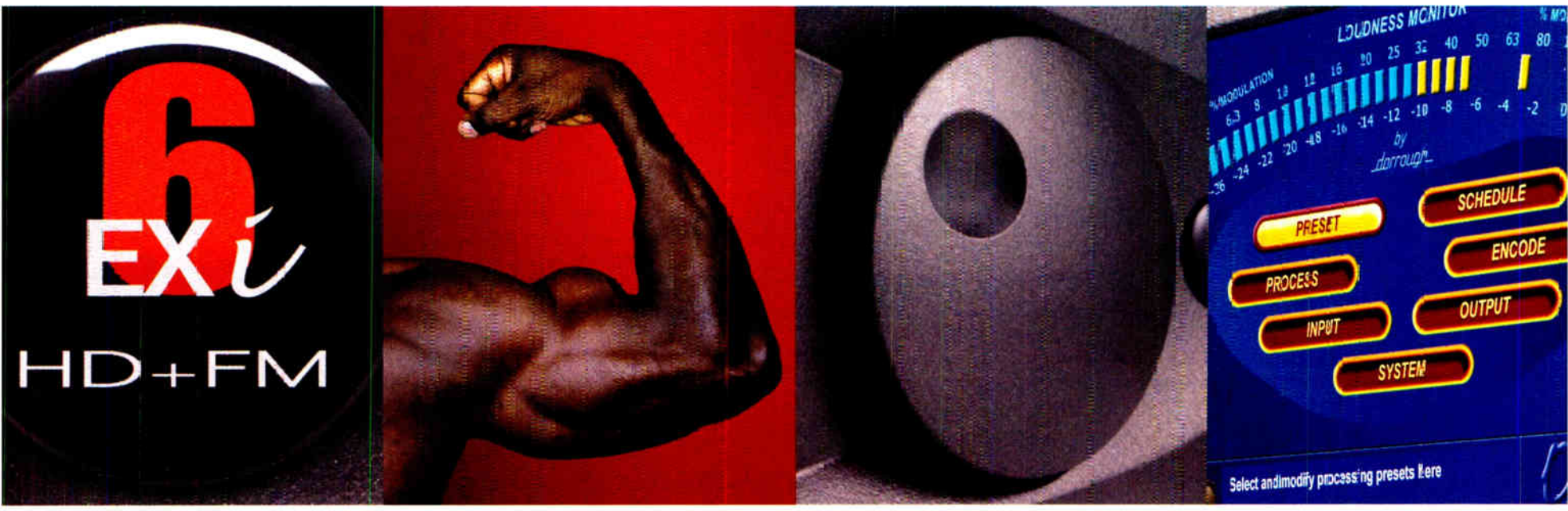
MISCELLANEOUS BITS

Small, but important items: get a can of **compressed air**, some long **wooden Q-tips** and **alcohol** (not the kind you hide in your desk) to do emergency cleaning and maintenance.

Then get a box of Sharpie **markers** with double tips (big/small) and a cheap **label maker** (Brother P-Touch or similar), a bag full of Rip-Tie reusable **tie wraps** as well as some of the plastic kind, a spool of **electrical tape**, and (really) **duct tape** (or, if you can find real black gaffers tape – buy it). You will be amazed how often these little things can save your event, or signal. For example, use the Sharpie to date the batteries you install, for a quick reminder when to change them.

I cannot stress enough how handy a real kit of the right tools can be for a station. Remember, I do not mean the dime store "tool kit" that bends when confronted with actual use. I mean real, correct, solid tools. Get these and you will be happy every day that you did. And you cannot say that about most things.

John Devecka is the Operations Manager of WLOY at Loyola College in Maryland. His little red toolbox is always underfoot because it is always open. If you think of other tools he missed, let him know at wloy@a loyola.edu



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Sound Guide

by Steve Church

Surround Cuisine for Newbies

Understanding the Choices

"You can't tell the players without a program!" This rings true as well for the many formats and flavors of audio being offer to consumers. Broadcasters need to know what is out there, so they are not left behind as the technology of recording and transmission continues to evolve.

[CLEVELAND, Ohio] There are things in life you do not know you need until you have experienced them, after which they become essential to good living. TV remote controls and Thai cuisine come to mind. Surround audio is another.

More than a few people had the surround transformative experience at the April NAB when they listened to it in our Acura SUV that was equipped with a prototype HDFM multichannel system. One group chief implored us to get the Acura *pronto* to his headquarters so his company's owners and programmers could share the pleasure – something like taking a friend to enjoy his first Thai restaurant dinner.

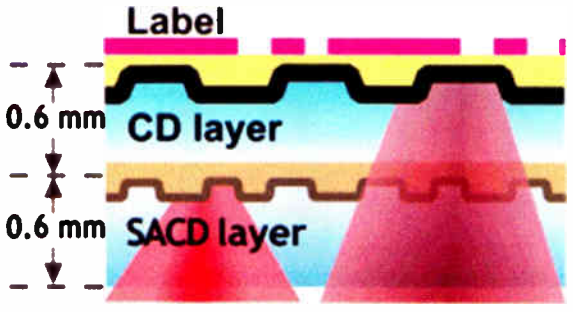
A surprising number of people to whom I spoke at the NAB had no idea that surround music was a practical reality and did not know there are a number of consumer delivery formats for it and thousands of discs already on the market.

To address this knowledge gap, here is a round-up of what is out there today and a preview of some things to come. Maybe you savvy engineering types already know all this stuff, but your GM and PD probably do not, so maybe you could pass this article to them when they hit you with a cold stare in response to your surround ranting.

SACD

The Super Audio CD is a joint invention of Sony and Philips, who also invented the original CD. More than 3,000 SACDs have been released worldwide so far. It uses what the inventors call "direct stream digital" or DSD to encode the audio.

This is a one-bit format at a very high sampling rate, 2.8224 MHz. Frequency response extends to 100 kHz (*not* a typo) and dynamic range is theoretically 120 dB. SACDs can be stereo-only or a surround/stereo combo, with most being the latter. Thus a hybrid multichannel disc would include all three audio formats: CD, SACD stereo, and SACD surround.



Hybrid SACD

Most new releases are in the "hybrid" format that has both a CD and SACD layer so that a disc can be used in both kinds of player. The lasers are able to focus on the layer they need and ignore the other. Most SACDs are now being released in this format so that consumers can play them both ways and retailers do not need to stock two versions.

Pink Floyd's *Dark Side of the Moon* 30th anniversary edition was released exclusively in hybrid SACD – there was no CD-only version available.

I bought mine in a very small airport record shop, which probably had no idea they were selling SACDs, so this strategy with retailers seems to be working.

DVD-AUDIO

While DVD-Video is all the rage, most people are not aware that there is also an audio format using "Digital Versatile Discs." DVDs have a lot more capacity than CDs, so they can be used to store audio in much higher resolution than CDs. They support sampling rates up to 192 kHz, but 5.1 surround tracks are usually provided at 96 kHz and 24-bits.

DVD-Audio players are not nearly as common as DVD-Video players, but there are quite a few of them out there from the likes of Pioneer, Denon, Yamaha, and Toshiba. Almost all are combo DVD-V and DVD-A players. You have to look carefully at the oval in the DVD logo to find the word "audio" along with the usual "video" to be sure the audio capability is included.

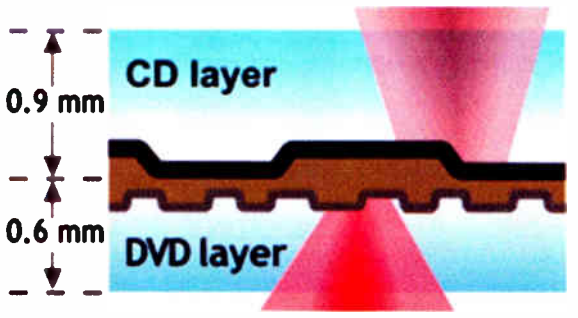
The high-resolution DVD-Audio tracks cannot be played on DVD-Video-only players. But DVD-A disc producers usually include compressed Dolby Digital or DTS tracks that *can* be played on run-of-the-mill DVD-Video gear.

The DVD-Audio format has a limited still picture capability and a menu scheme that lets you select tracks using a TV for display. Producers can mix DVD-A and normal DVD-V content, so you can have both hi-res sound and video clips on the same disc.

DUAL DISC

This is the newest format. Sony BMG Music Entertainment, the joint venture between Sony Corp. and Bertelsmann AG is leading the charge make this the next big thing, with support from a number of other major labels, including Universal, Warner, EMI, and 5.1 Entertainment.

These discs are a CD on one side and a DVD on the other. They are, in fact, two thin discs glued together. The DVD side can be DVD-A, DVD-V, or a combination of the two.



DualDisc

The idea is that consumers will value discs that have video and surround content in addition to the basic stereo CD, and that this will drive people away from MP3 downloads to disc purchases. "The CD is a fading technology that has lost some of its appeal," says Andrew Lack, the chief executive of Sony BMG and one of the most vocal proponents of DualDiscs. "We had to come up with a way to give consumers a compelling experience."

Mr. Lack says he envisions, "a day, possibly not too far from now, when all new music releases come out on DualDisc." As part of the big-bang introduction, Bruce Springsteen's *Devils & Dust* was released in this format – and only in this format – in early May.

Sony/BMG plans to release more than 40 DualDiscs this year, from classics like Miles Davis's *Kind of Blue* and AC/DC's *Back in Black*, to new releases like Jennifer Lopez's Rebirth.

A SLIGHT INCOMPATIBILITY

You might be thinking, "Why can't they just put both on the same side like SACD hybrids do?" The answer is: because they left it until too late. All DVD players now are programmed to look for the CD-layer of hybrids, so they would not see the DVD content.

Both Sony (oddly enough) and Pioneer have sent bulletins to their dealers concerning actual and possible problems with the DualDisc format. Typical CDs are 1.2mm thick while the DualDisc is 1.5mm thick, which is at the maximum specified by the CD "red book" standard.

The CD layer, at 0.9mm, is actually thinner than the standard as well. As a result, Philips' Intellectual Property & Standards Group did not grant DualDisc a license to use of the official Compact Disc logo. That is why some companies refer to the CD side as the "non-DVD" or "audio" side. It remains to be seen if player incompatibility will be a real world problem as sales ramp up.

As with SACD hybrids, record companies hope that record stores file the discs in with the regular stock rather than having a dedicated section. They hope that this will spur sales and that eventually they will not need to release CD-only versions.

DTS, MP3 AND DVD-VIDEO

DTS has its origins in cinema. But early on, before the other surround disc formats got underway, the DTS guys noticed that their compression system would allow 44.1 kHz-sampled 24-bit 5.1 surround to fit on a CD, since the total bitrate, 1.411 Mbps, is the same.

This compression scheme is a perceptual approach similar to Dolby Digital and MPEG, but has a high rate compared to the others, so is considered to be higher fidelity. Dolby Digital, as used for the audio tracks on DVD-Video discs, for example, operates at 384 kbps.

The DTS Entertainment division has released a number of discs in this format and many DVD-Video and universal players are able to handle them. Recently, the company has been including DVD-Audio tracks on their releases and they seem to be quite active in bringing new and interesting surround productions to market. Sting's *Brand New Day* and Queen's *A Night At The Opera* are examples of DTS recent releases.

MP3 Surround was introduced late last year and is catching on as an Internet download format. DIVX has adopted it as the preferred soundtrack codec for their TV file system. It uses a very efficient coding technique to provide surround at a very small bitrate increase over stereo. MPEG AAC has a discrete surround mode that is being adopted into some players. Microsoft has extended Windows Media Audio to multichannel and this is now standard in the latest Media Player versions.

While our topic here is audio, you cannot leave out DVD-Video discs as audio carriers. Almost all recent DVD-Vs have 5.1 surround audio tracks. Concerts and music clips are growing in popularity, partly because people with surround home theater set-ups enjoy the enhanced audio experience.

WATCH FOR THE COMING ATTRACTIONS

But DVD and all of its associated formats, like DVD-Audio and DualDisc, could soon have one foot on a banana peel and the other in the grave. The reason is that DVD,

(Continued on Page 28)

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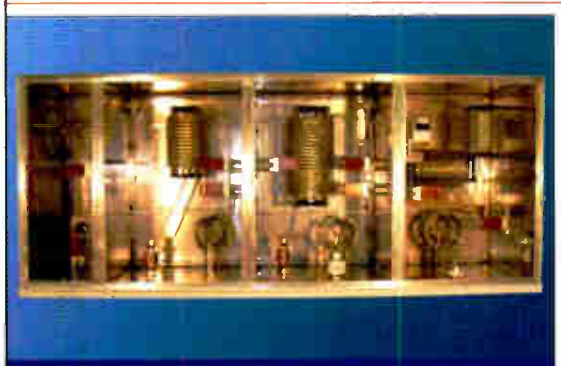

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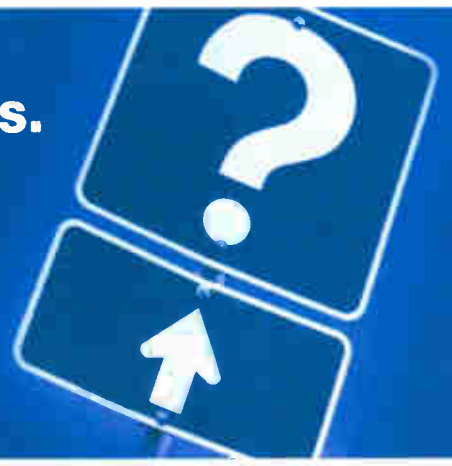

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Sound Guide

by Steve Church

Continued from Page 26

while a powerful format and currently the king of the AV world, cannot reproduce a movie in HDTV.

With digital TVs selling at 850,000 sets per month, the demand for high quality content in HDTV from early adopters will probably get vastly stronger in the next year or two.

There are two competing formats and a war brewing. Both of them, HD-DVD and Blu-ray, are based on blue lasers. Blue light has a shorter wavelength than the red light used in CD and DVD systems, allowing the laser beam to make a smaller spot on the disc surface. With each bit of data taking up less space on the disc, more data can be stored on a 4.7-inch disc.

HD-DVD discs can hold between 15 GB and 30 GB of data, depending on the variant of the format used, compared to current DVDs that can hold between 4.7 GB and 9.4 GB of data. The main backers of the HD-DVD format are NEC and Toshiba.

The competing format, Blu-ray, comes from a group of companies led by Sony and including Dell, Hewlett-Packard, Hitachi, LG Electronics, Panasonic, Mitsubishi, Philips, Pioneer, Samsung, Sharp, TDK, and Thomson Multimedia. Blu-ray discs can hold 25 GB-50 GB. They also include support for multi-layer, which should allow the storage capacity to be increased to 100 GB - 200 GB (25 GB per layer) in the future by adding more layers to the discs.

CONTENDERS FOR DOMINANCE

While Blu-ray has more backers and higher tech, there is still a chance HD-DVD will win this war. Hollywood movie studios prefer HD-DVD because they are cheaper to make and existing production lines can be easily converted to manufacture the discs. At NAB 2005, word leaked out that the proponents might be working out some kind of compromise, but it remains to be seen if this becomes reality.

Whichever way it goes, with such high capacity, these discs would allow lots of hi-def audio storage. So far the focus has been video, but no doubt some multichannel audio formats will eventually be announced.

A bit further down the road there is the Holographic Versatile Disc (HVD) . While Blu-ray and HD-DVD use the same laser, other inventors thought of combining the two lasers (red and blue), in a single ray. With this technology, on a DVD-sized disc, One Terabyte of data could be stored (20 times more than on a Blu-Ray disc).

WHERE'S THE MUSIC COMING FROM?

While there are a lot of new recordings being made intentionally for surround release, many discs are produced from tapes that were intended only for stereo delivery. Fortunately, multi-track recording goes back quite a long time and many of the original session tapes have been found in record company vaults and remastered to surround.

I have been amazed by some of the gems that have popped-up. For example, the surround versions of such classic pieces as Jan & Dean's *Surf City*, the Outsiders' *Time Won't Let Me*, Marvin Gaye's *Let's Get it On*, and the Beach Boys' *Wouldn't it be Nice* are surprisingly good. More modern multi-tracks from the likes of REM and the Eagles have been mixed to surround with stunning results.

On these latter, it seems that the performance had been caged up and waiting to break free, the surround version just feeling so natural and right for the expression of the music. *Dark Side of the Moon* is an aural masterpiece in surround, mixed from the 30-year-old 16-track master tape.

Impressive as the oldies are, new recordings made on digital workstations with 24-bit capability can be awesome – especially if the bass guitar is recorded via direct box. My current favorites are Spyro Gyra's *The Deep End* and Ray Charles' *Genius Loves Company*.

AND THE WINNER IS ...

Which of these formats is "best?" Which are getting the most attention in the marketplace and among record companies? Until the intro of DualDiscs, it was looking like SACD was winning. There are more of them in shops than DVD-A and word is that they are outselling DVD-A by a wide margin. The SACD hybrid format offers a benefit that was not matched by DVD-A.

DualDiscs solve this problem in a different way, but not all DualDiscs have DVD-A tracks – some have only videos and Dolby Digital surround audio tracks on the DVD side – the recent Springsteen release, for example.

With regard to fidelity, SACD and DVD-A have similar excellent quality, despite their very different technologies. One argument in favor of DVD-A is that most recordings are done in PCM and the DVD-A is capable of exact reproduction of the studio masters, while SACD requires a transcode from PCM to DSD.

Something similar happens at the other end, where most players convert DSD to PCM to simplify digital-to-analog conversion. Logically, it does not seem to make a lot of sense to sandwich the DSD layer between the PCM in and out interfaces. Nevertheless, it does not seem to be an impediment to good sound. With my player, a Pioneer 575A that plays both, and my ears, the SACD format has a very slight edge for some reason. Perhaps it is the result of a subtlety in how the D-A converter in the player handles the two signal input types.

The visual content on DVD-A is rarely interesting, so that feature is pretty meaningless. (One gotcha, though, is that a few discs *require* a TV display for playlist menu navigation and selection. I hate firing up the TV just for that. Indeed, I find the visuals to be a distraction to music enjoyment.) But, with my Pioneer player being universal, I buy and enjoy discs in both formats. The content drives the purchase, and I do not particularly care which format a disc is.

Since DualDiscs may have any combination of DVD-A, Dolby Digital, or DTS tracks on the DVD side, each has to be evaluated on a case-by-case basis. DVD-A is better than DTS, which is better than Dolby.

Unlike CDs, SACDs are not compatible with PC players and are not digitally rippable, so if you need to transfer them to your delivery system, you will need to dub them realtime from a player's analog outputs to an analog input converter of some kind.

While DVD-A tracks can be played on PCs equipped with DVD drives, the right software, and soundcard (Creative's top-end Audigy, for one), they have very tight copy protection and are also not directly rippable. However, there are tools to copy the DTS tracks, if any, to PC wav files.

SO WHAT'S GOING ON WITH CONSUMERS?

Surround music discs have not been mass-market big-sellers. A public awareness campaign for both SACD and DVD-A has been almost nonexistent and the average man-on-the-street has never heard of either. Nevertheless, you can walk into a Fry's, Tower Records, Best Buy, or J&R and find a few hundred discs in stock.

There is plenty of pop and rock, from Marvin Gaye to Santana to the Eagles to David Bowie to Sheryl Crow to Beck to Nine Inch Nails to Usher to Keane. There is enough of an enthusiast audience to keep the releases coming. Most of disc sales are online rather than in CD shops, it seems, though. You can choose from a few thousand titles on specialist web sites like Acousticsounds.com.

Surround breathes fresh air into older music and gives the new titles a chance to really impress. It is not an evolutionary change like from LP to CD, but a revolutionary change like from mono to stereo.

As Bob Woods, co-founder of the Telarc record label says of SACD multichannel, "Three-dimensional audio is capable of allowing the emotional content of a performance to reach a listener more than you can in stereo. Such as the reproduction of the actual thumbprint of an acoustic space, a truly accurate soundstage, and never having to hear performers/instruments/whatever layered behind another – each sound lives realistically in its own space. In short, this technology serves the music in a way that nothing else, so far anyway, can."

GOTTA FEEL IT

So why has it not caught-on in a big way? Back to this article's opening sentence: Because surround audio is experiential. You can talk about it all you want, but what is missing are places to go to hear what it is really all about. Those pathetic demo displays in Best Buy and Circuit City are pretty laughable and are not going to convince anybody. There really is not any way for most people to hear good systems and be turned-on by the tech.

And there is plenty of competition from other media stuff these days: MP3s and iPods, home media centers and music servers, high definition television, TiVos, digital cameras, satellite radio, better PCs, etc. There is only so much leisure a guy has time and attention for.

Nevertheless, daring audiophiles who have figured this stuff out are spreading the word slowly and surely. And a lot of people are installing surround audio systems for their TVs and getting exposed to surround via DVD films.

There is no question surround downloads are coming to the Internet and could well become very popular. Surround listening is also growing in cars. Acura is running full pages touting their surround audio systems, for example.

Radio is the wildcard in all this. Should our industry jump on surround and promote it the way we promoted stereo on FM; we would probably get surround discs going in a very big way. This would create a virtuous circle – as we broadcast more surround, record companies would be motivated to release more of it, which would give us more to broadcast.

On-air surround would bring renewed excitement and growth to both the recording and broadcasting industries. With a few thousand discs out there, we have enough material to get started now.

CEO of Telos-Omnia, Steve Church is a broadcast audio CODEC pioneer. His company's focus is helping broadcasters transmit exciting audio. Email Steve at schurch@telos-systems.com

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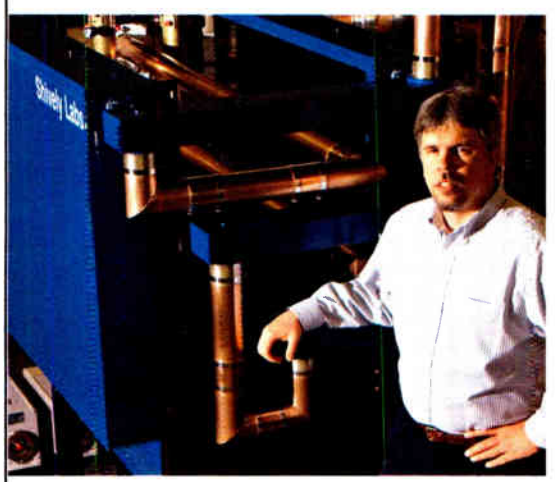

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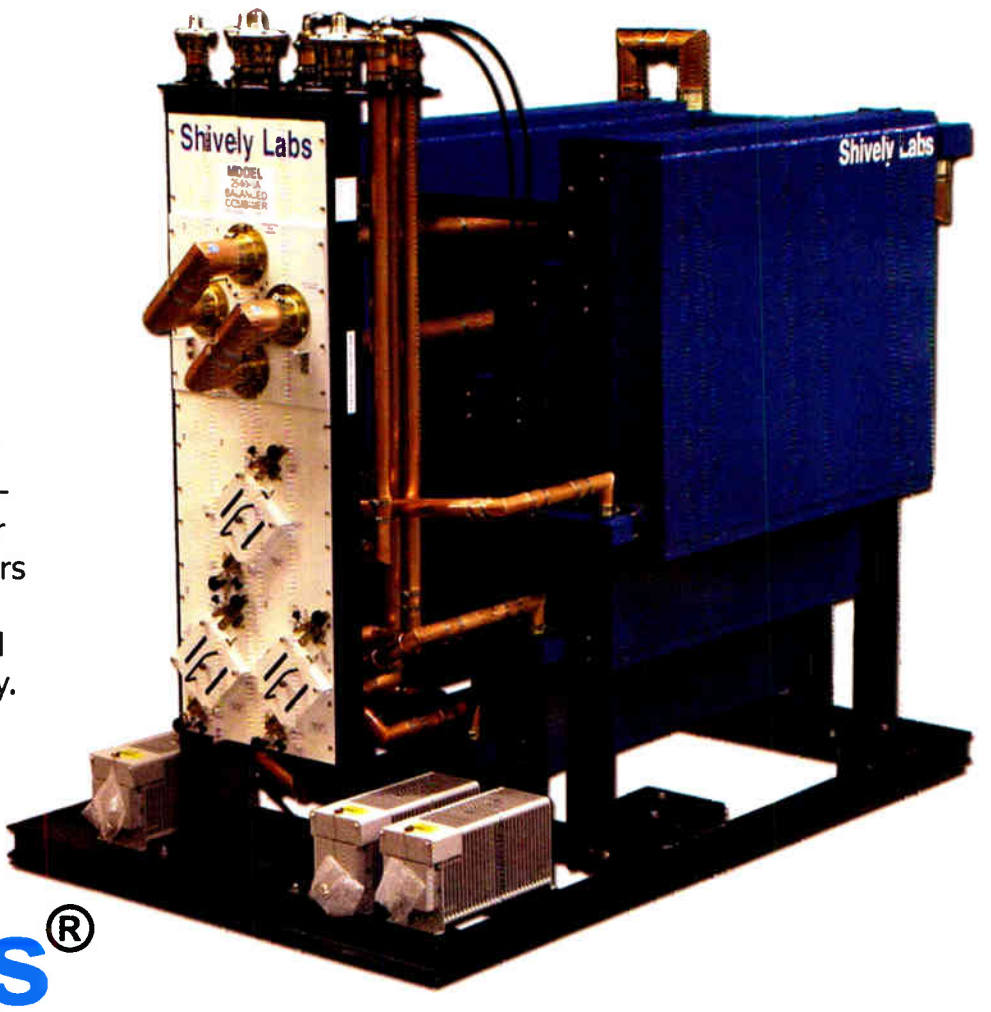

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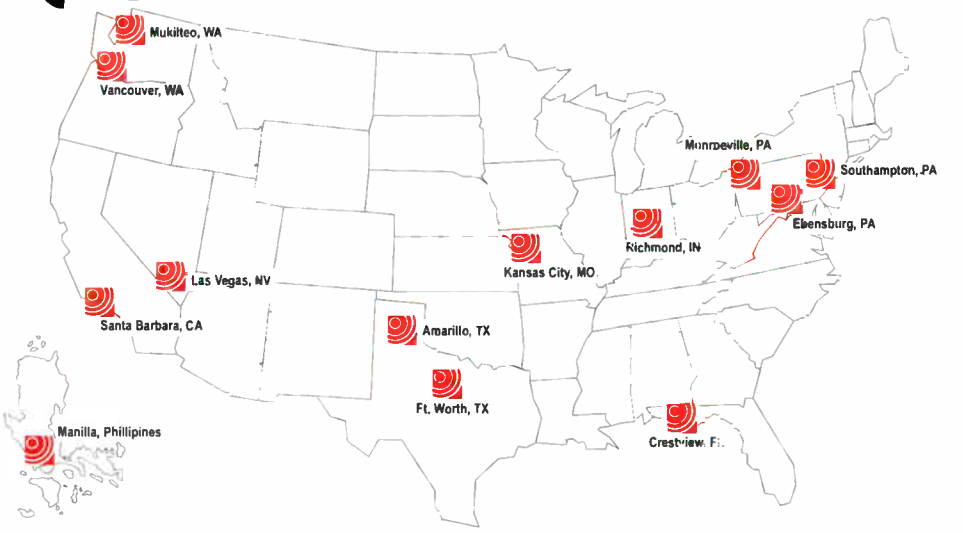

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Field Guide

By Charles Dube

Sencore's SPDATB Toolbox

A Digital Watchdog That Catches the Bits

[AMHERST, Massachusetts] Although digital audio has been around within the walls of WFCR's studios for several years now in the form of PC soundcards and DAT machines, it was the station's addition of an HD Radio service that made it clear that our diagnostic tools were in need of an upgrade.

SINE WAVES SQUARE OFF

For over a century the world of analog audio has been with us, exemplified by the needle vibrating in the groove of an LP record, recreating the original vibrations of the performance with tiny electronic vibrations. It is a world of easily measurable signal transients, electrons bouncing through the familiar mediums that we can recover into sound and images by common methods.

Analog audio can be converted easily enough to empirically determine certain aspects of its transmission: a cheap audio amplifier connected to a speaker lets us listen to a signal for level, distortion and tonal quality. We also may see the visual representation created by the oscilloscope, which allows us to view waveform characteristics such as frequency, noise and distortion,.

In the digital world, the signal is radically different; things are moving at speeds inherently much faster than anything we might perceive in analog. The extremely quick on and off pulses comprising the bitstream flood present a whole new dialogue of issues and definitions; distortion now can be the wrong state of change at a given moment of time – an "off" when there should have been an "on," or visa-versa.

Since this digital signal has no visible resemblance to the vibrations it purports to represent, the lack of authenticity between a particular digital "word" (representing a given signal's state at a microcosmic fraction of time) stored in a medium, and then recovered to be converted back to analog again, may not be at all perceptible to the ear with a cause that is easy to determine.

A BASIC DIGITAL ANALYZER

There are several flavors of digital decoders, generators and the like available, but what I was looking for was a veritable tool-kit; something rugged and portable for use in the studio and at the transmitter site that could tell me with some precision what I was looking at; some of the characteristics of a perplexing bitstream. The TerraSonde DATB-1 Digital Audio Toolbox (recently acquired by Sencore and renamed the SPDATB) meets that description with ease.

The SPDATB "Toolset" functions include a digital transparency test and a bitstream analyzer which shows voltage level, bit depth, and levels. Stuck bits and errors will be shown here if existent. The transparency test is very useful in determining the authenticity of a recording device's ability to record digital data without error or digital distortion.

The SPDATB is a welcome addition to the WFCR test bench.

Checking a digital audio workstation at unity gain, the validity of an ISDN, duplex STL, or other digitally encoded bitstream transmission (accomplished by recording on the far end and retransmitting back to the source) are other valuable uses for this test.

WHAT TO CHECK FOR

The delay of digital signals through signal processing devices can result in phase error that can be measured with a latency test. Jitter, a condition in which the timing of the digital signal is askew of its clock reference, can seriously degrade (or "smear") the quality of the digital audio through the signal path.

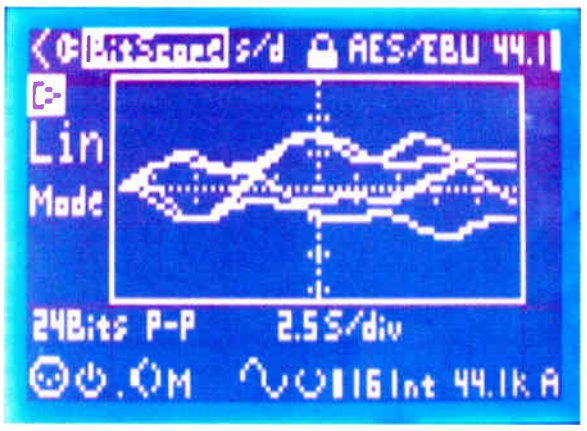
Measuring the signal at various interface points can help determine the location of problems created by mismatched cable, connector (interface jitter), or trouble in the output of a device that creates conversion jitter.

A digital signal generator is also your digital "function" generator replete with square waves, sine waves, white and pink noise, as well as Dolby 5.1 generic test signals. Known and accurate digital levels can be generated for use with various test functions described herein.

The SPDATB accepts AES/EBU, S/PDIF, Toslink (light)/ADAT, and can output in these formats as well. A 1/4" analog output can be set up as unbalanced stereo (i.e. headphones for monitoring) or as balanced mono. A built in speaker is used for monitoring digital audio without headphones and is menu selectable. Word clock and video input (for testing lock between a sync signal such as blackburst and associated digital audio) is accomplished though a BNC jack.

UNDERSTANDING THE DATA

With the SPDATB, I am able not only to translate a digital bitstream into analog audio to monitor my signal, but am given a great deal of information about the nature of what I am hearing as well. A bitscope function displays the digital signal in a manner much like that of an oscilloscope.



The Bitscope function here is showing a 44.1 kHz AES signal (each horizontal division representing 2.5 samples). Dynamics are indicated by the vertical expansion of the waveform (in this example, about 12 bits positive peak at a 24 bits full scale setting).

The bits P-P setting can be adjusted to amplify this signal immensely; for example, a 6 dB gain is achieved by setting the bitscope to a 23 bit FS resolution. The maximum amplification, 120 dB of gain, achieves a FS resolution of just 4 bits for viewing of very small details such as dither or converter noise.

In this mode one is able to actually listen for dither (the purposeful addition of noise [!] to enhance resolution and dynamic range), converter noise and verify phase between the left and right channels of an incoming stereo signal. A simple cable tester (utilizing a "Julian Dunn J-test" which outputs a special worst case signal and measures it) allows for quick checking of an AES or S/PDIF cable's ability to pass a signal without affecting it.

All of this comes in a sturdy metal package (an SPDATB falling off of a shelf and hitting one on the head will assure a "0" state of consciousness for a good length of time) with an easy to read LCD display. A self-contained rechargeable battery and power supply allows for portability and versatility. A foam-padded case for protection while the SPDATB is being transported is standard issue.

TESTING THE SYSTEM

At WFCR, although much of our current studio plant is analog, once the programming leaves the building it is mostly digital (aside from restoring analog for the analog transmitter).

The audio is converted to a 44.1 kHz bitstream at the beginning of our studio to transmitter (STL) link and stays digital (QAM to recovered AES) for the duration of our HD Radio chain. In the process of making its way from the link's receiver to IBOC and FM, several cables, digital signal processing and some rate conversion does occur.

The basic diagnostic tools contained within the SPDATB provide graphic displays of this bitstream which I can use to confirm proper operation of various stages. The Bitstream Indicator selection sports a sample rate counter, voltage meter, and word length and bit activity monitors.

Here a 44.1 kHz AES signal is confirmed as PCM with good "eye" and level characteristics. The dotted lines represent the changing states of bits in the digital word. In this case, the signal is utilizing almost all available bits indicating a fairly hot signal with little dynamics.

An "eye error" (pass/fail) indicator will be displayed should the digital signal's change of state become sluggish or insufficient due to conditions such as inadequate cabling capacitance.

THE DIGITAL WATCHDOG

One particularly useful feature in the SPDATB is the inclusion of the "Digital Watchdog," which allows one to select a period of time from one minute to 24 hours; the Watchdog will indicate when and if digital disruptions or errors have occurred within that time period.

This function is detailed enough to unearth one sample error in a 24 hour period. Problems caused by intermittent digital devices in the signal chain, or (as I found especially useful) disruptions in the studio to transmitter link's RF signal path, are acknowledged when the SPDATB is connected to the link's AES output, or even further downstream.

In this signal, we can see frequent disruptions caused by a poor cable connection. The line running horizontally across the top indicates elapsed time. The vertical bars in the display indicate errors times. The unlocked lock at the top shows the signal came unlocked at the end of the test period.

Using the graphic display, one can determine when the errors occurred during the sample period, which is certainly useful for troubleshooting regularly occurring interruptions like those caused by STL interference.

The Digital Watchdog will indicate excessive levels, lock trouble, data integrity, and bitphase errors. Knowing that intermittent failures never occur when the engineer's eyes are on a troubled device (quantum physics at work?), the Digital Watchdog takes on the burden of monitoring for failure over a chosen time frame, which can prove invaluable.

With the variety of functions available in one package, I am confident the SPDATB will save me time and aggravation in troubleshooting the growing number of digital signals residing in our plant, and doing so without having to resort to the nuisance of swapping out of boxes and cards.

Chief Engineer at WFCR, Amherst, MA, Charles Dube has worked at radio stations in Massachusetts and Connecticut for over 15 years. Contact Charles at cld@admin.umass.edu

Things You Need To Know

by Tom Taggart

Should Engineers Get Overtime pay?

[ATHENS, Ohio] I have known Paul for years. He worked for various companies before ending up as CE at a radio cluster on the other side of the state in River City.

We met recently at the regional Kiwanis convention. Paul looked tired, but he wanted to talk: "What a week! Yesterday our PD called me at 4:30 in the morning to tell me 'they've started the fertilizer plant, T-Rock is off.'"

A FEW THINGS TO DO

But let me start at the beginning. Paul nominally works from 8:30 to 5 each day; his two AM's and four FM's are all at different sites. He *had* two assistants: Scott did the IT work until he quit – to make twice as much at the University. Leslie sets up the remotes and does the station logs and EAS checks. But she is out on maternity leave. Paul's days just seem to get fuller than full.

Take Monday: staff meeting all morning, the copy machine died, then the sales' secretary just had to have her new Photo-Edit software installed. Naturally, the software crashed her computer. Paul got home at 7:30.

Tuesday started well, he worked on a construction budget and Power Point presentation for the board. The company bought a rural Class A (with a two-hop STL) and now wants to move it 15 miles – still reaching the City of License – but hitting more people.

AND THEN THE DAM BROKE

That night the part-timer called to announce water was running down the hall and into the main studio. Paul returned to work, shut off the water and bailed the place out while the plumber fixed things.

Wednesday was much worse: a weather front hit around 5:30, taking four stations off the air, with a fifth popping on and off. Repairs included tripped breakers at the AM, a fuse at one FM, then a dead STL-10 and a fried remote control. With power lines down all around, Paul finally locked the generator on and babysat it until 11:00 PM.

On Thursday Paul went to the big city for the presentation on the move, explaining projected costs, technical issues, so on. That went well; then the CEO announced he was looking at a three-station cluster and wanted to know how good their signals were. It was a long day – three hours up, all day there, then three hours back. At least Paul was taken to a great steakhouse for dinner.

FERTILIZER PLANTS AND RADIO

With a workload like this, I was almost afraid to ask Paul about "the fertilizer plant and T-Rock going off ..."

It turns out that for two decades, when the fertilizer plant in Saline starts up for the first time they send a nasty spike down the line. It typically blows out the surge protectors, fries the step-start circuit – and down goes the old three-phase Harris 5 kW.

After three hours of repairs and four hours of driving, Paul finally got to the studios by 11:00, only to be met by Brunehilda, the sales manager, yelling: "Well, it's nice to be able to come to work at noon, we have a remote starting in an hour." And off Paul went again, finally returning home around 7:00 PM.

With over 55 hours logged in just four days, I could see why Paul was frazzled.

"THERE OUGHTTA BE A LAW"

Then he got to the main issue on his mind. "Tom, this really is getting old," Paul said. "Don't I qualify for time and a half, or *something*? Even the plumber got time and a half for his work Tuesday evening. There oughtta to be a law ..."

I was happy to assure him there was such a law. The Department of Labor requires businesses in interstate commerce to pay the minimum wage as well as pay time and a half over forty hours a week. It is called the "Fair Labor Standards Act." All radio is deemed "interstate." But as with most laws, there are exceptions.

One exception is for small market radio and TV stations outside a Standard Metropolitan Statistical Area (SMSA – see http://www.bls.gov/lau/maps/stcbsa00.pdf). Some small SMSAs (under 100,000) also qualify as small markets. Otherwise overtime must be paid unless an individual's salary is more than $455 a week *and* they are either an executive, outside salesman, administrator or learned professional.

ANALYZING THE SITUATION

Although Paul nominally supervises two people, it is doubtful his "primary duty" is to manage the business as an executive.

Is the engineer a learned professional? To qualify, the Department of Labor requires you be in an occupation that has attained recognized professional status, requiring an advanced specialized academic degree as a standard prerequisite for entrance into the profession. This also is not Paul's situation.

However, Paul might be an administrator, whose primary duties must be office or non-manual work directly relating to general business operations. The GM might argue the engineer exercises discretion and independent judgment regarding important matters, and Paul cannot collect overtime.

More information can be found on the Department of Labor website: www.dol.gov.

Tom Taggart is an Ohio attorney who also owns two FM stations. Email: tpt@eurekanet.com

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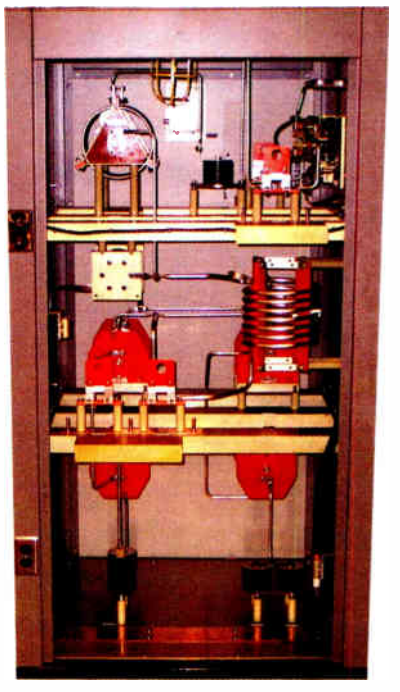

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Operations Guide

by Mike Pappas

Finding New Engineering Talent

[DENVER, Colorado] Every 18 months or so the various broadcasting email reflectors light up with a hue and cry about the lack of engineering interns or new engineers coming into radio broadcasting.

Various solutions are bandied about, including getting schools to generate curriculum to offer to potential students, getting the SBE involved, and a myriad of other solutions in an attempt to entice new engineering people into this profession. All of these fixes fail to address the real reason that broadcasting is unable to attract new engineering talent.

NO INTEREST

The problem is not schools (or the SBE for that matter) generating curriculum or students – it is the lack of interest in broadcast engineering. Let us face the issue squarely: the money is poor, the hours are long; keeping three, four, five, six, seven, even eight or more stations up and running in a cluster with major pressure to not spend any money is not much fun.

It is this sort of environment (where the key goal is to make those quarterly profit margins for Wall Street – no matter what), and the knowledge that if the cluster is split up or sold the engineer could be out of a job and on the street in a New York minute – even after working there for 20 years – that sucks the life right out of this profession.

A potential candidate for broadcast engineering only has to look at the life expectancy of a major market Chief Engineer during consolidation to see that the investment in education vs. the potential payback is poor. They would be much better off getting an IT/networking degree (there is gold in keeping those Windows machines running and virus free) and a job as an IT guru.

SOME SOLUTIONS

To keep KUVO stocked with engineering interns, I tap the Audio Engineering program at Denver University. I have a great relationship with the Department Chair. When I need a new engineering intern I call him up and he sends me the best student he has for an interview.

I have found that these students work hard and want to learn, as the recording industry is in worse shape than the radio industry (if that is possible) and working at KUVO beats flipping burgers or bagging groceries (although the starting pay is about the same), which is what the future holds for many of these graduates.

Do they know anything about RF when they show up? No, and they do not need to know about RF yet. They will learn it.

OJT

As with any job, learning by doing is the best way and I come from the "toss you in the deep end and you will quickly learn to swim – or go down like the Titanic" camp of teaching.

How do you give an intern an understanding of RF? Let them help install a new HD Transmitter. My intern really "got it" when he started to cut 3-1/8 inch hardline. He also learned about antennas when we swapped ours out five years ago.

Since we run all solid-state transmitters, the tube replacement tuning issue is pretty much out of the picture here, but my intern has observed the "tube dance" when the other FM guys at our site spent a whole day pounding their 20-year-old grounded-grid transmitter back into submission.

What is really important is using logical thought processes to diagnose problems, learning to ask questions, using your Rolodex effectively and documenting. You can quickly teach anything from SMD soldering, to building an entire plant when you have someone who would prefer an alternative career to asking folks if they want to supersize their fries.

One of the greatest things I have found with the kids from the DU Audio Engineering Program is – not only their desire to learn, incredible work ethic and great energy – their eyesight is much better than mine!

TEACHING MAKES A DIFFERENCE

It helps that we have a full performance/recording studio, do lots of live broadcasts, experiment in surround sound, are on the cutting edge of broadcasting technology on several fronts, get our pictures in the trade magazines and have really nice, state of the art toys with which to play. It keeps them interested.

Justin Peacock (L) and Joe Kloss prep a Neumann KU-100 stereo dummy head microphone for use as an ambiance microphone for a live remote at the 2004 Cinco De Mayo celebration.

After a couple of years, when they have worked their way up to the top scale I can pay them, I get them hooked up in the freelance television industry where, in two or three years, they can easily make more than four times as much as they would in the radio engineering business (low six figures), only work 20 days a month and are not on call 7-24/365.

Do you *really* want to know why there is a lack of new engineers in broadcasting? The industry needs only to look in the mirror.

Mike Pappas is the Chief Engineer of KUVO-FM in Denver, CO. His current intern has just taken a job building television remote trucks and he is looking for a new one. Send your resume and cover letter telling him why you want to be his intern to: mpappas@qwest.net

Tech Tips

by Bob Burnham

Punch Block Tips

[DETROIT, Michigan] The "66" style punch block has been a staple in broadcast studios for decades.

Once upon a time someone thought that by borrowing them from the telephone industry, we would save time and space constructing studios, rather than using those cumbersome barrier strips. They were right.

CONTORTIONS R US

But who among us has not spent hours with our bodies jammed inside studio furniture adding wires to a block bolted in a place apparently selected by a sadist (or some chiropractor's marketing agent)?

When designing and installing the many studios at Specs Howard School in Southfield, Michigan, there were three factors that I kept in mind:

1. Efficiency (and comfort) during the installation process, especially since for the most part, it was a one-man task for me.

2. Ease of maintenance, and adaptable to future changes.

3. Reliable, yet reasonable in cost.

A BETTER WAY

The most popular punch block version, manufactured by Siemon, can be mounted directly or with a mounting bracket that allows the wiring to be fed through the sides underneath the block. I strongly recommend using the bracket. Sheet metal screws can be used to secure the block to the bracket. The key here is the block is *removable* from the bracket.

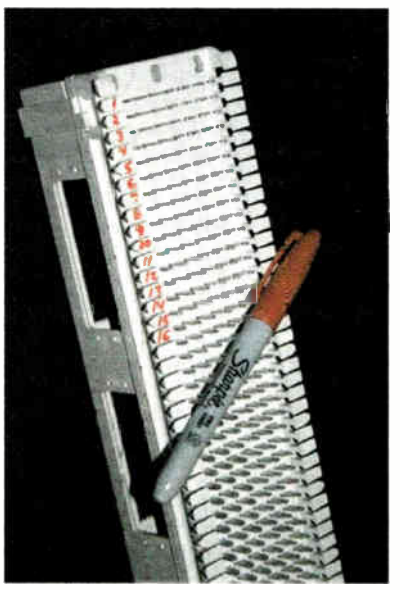
By leaving plenty of service loop for *all* cabling, the block can be physically removed and placed on a horizontal surface for future work.

Pre-wiring a block as much as possible is actually the most desirable way to it. Since studios often were in use the day before – or even the very day I planned a console upgrade – I had to make very efficient use of the time I spent in the studio. Many blocks were pre-wired on my desk or workbench before they even went into a studio.

Using a punch tool for an extended period is faster and much less stressful in a comfortable environment, or at least having the ability to punch it on a horizontal surface.

GOOD DOCUMENTATION AS YOU GO

With a brand new block, the *first* thing to do is to get out your Sharpie® and number the block on both sides – even if you know you are only going to use half the terminals.



It reduces the chance of making errors and makes it easier should any extra terminal connections be needed in the future.

Obviously, the next step is to prepare a wire chart identifying which wire goes to which punch block number. Some like to number the wires themselves, using various types of labels and/or shrink-wrap.

SOME ADDITIONAL TIPS

1. Punch grounds individually rather than tying them to an external strap. This minimizes the chances of ground loops, and if any occur it is very easy to lift grounds at the block.

2. Keep a second punch tool with a dull blade handy should the ground wires have a tendency to break during the wiring process; it is faster than trying to adjust the impact on the tool between punches.

3. Use block mounting brackets so that the cabling can be neatly routed *under* the block when mounted. A sheet metal screw at the top and bottom will secure the block to the mounting.

4. The surplus cable can be neatly bundled with cable ties and loosely hung nearby should the block need to be removed again. Use cable tie anchors secured with a small sheet metal screw to secure surplus cabling.

5. The Siemens part number for the standard "66" block is 66B3-50; the mounting bracket is S66-B6, These very low cost items should be available from your favorite supplier or broadcast vendor.

Planning ahead this way, you can build and wire punch blocks in such a way as to make things much easier for you on that day when you will need to work on them again.

Among his other projects, Bob Burnham maintains the facilities of the Specs Howard School of Broadcast Arts in Southfield, MI. Contact Bob at bburnham@specshoward.edu

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Consultant's View

by Laura Mizrahi

A Consulting Engineer Can Solve Problems

Stations (especially smaller or non-profit operations) sometimes resist engaging the services of a consulting engineering firm. Reasons range from cost issues to local engineering control. Laura Mizrahi describes how a consultant can help facilitate and guide applications before the FCC in the most cost effective and expedient fashion.

[MARLTON, New Jersey] Often, when filing for new or changed facilities, the question as to the necessity of utilizing a consulting engineer's expertise is raised, particularly with respect to what may be considered relatively straightforward, or uncomplicated, FCC filings.

WE CAN DO IT HERE

Many broadcast groups have in-house Directors of Engineering who have become proficient in utilizing software to "noodle out" the allocation study scenarios. There are also plenty of others who have knowledge of the FCC Rules and are able to assemble applications for their station or contract clients.

Where problems may occur is when there is a lack of knowledge as to how FCC Policy may come into play in a particular instance. Often, the Rules actually become just a starting point for consultants when evaluating a potential station upgrade or modification.

This is especially true in instances where unusual grandfathered situations exist (as in received or caused overlap), in the non-commercial vein, where Class D stations are involved or where a TV 6 interference agreement has been reached regarding a particular facility's operation.

STRONG RESOURCES

Most broadcasting consulting engineering firms handle a cross section of both commercial and non-commercial entities, both large and small. Therefore they review and peruse the FCC's Public Notices for new and evolving policy on a daily basis.

For instance, the 1991 Educational Information Corporation decision which permitted waiver of Section 73.509 (the non-commercial prohibited overlap portion of the Rules) to a limited extent, is a precedent regularly referred to in non-commercial applications where proposals may meet this criteria. Likewise, the FCC attorneys with which consultants coordinate their work are a good source of additional citations and precedents in the form of FCC letter rulings, many of which are not contained in the Public Notices.

It is particularly helpful when a consultant has an established reputation and working relationship with the processing engineers at the FCC. Good relationships of this nature are beneficial for a number of reasons.

One example would be in the ability to obtain direct input as to how a possible engineering proposal may be perceived and acted upon. Another would be assisting a client's pending application to move forward if it is languishing on the "back burner" due to a minor deviation from the exact letter of the Rules but which may otherwise be grantable from a current policy standpoint.

USING THE RESOURCES

For example, our firm recently prepared an Application for Construction Permit for an existing, full service Class C2 non-commercial FM station in which it was proposed to upgrade the station to Class C1 facilities and which included a waiver request of Section 73.509. By strict interpretation of the Rules, the proposal would not be permitted, but a number of precedents were cited (such as those noted above) which were deemed acceptable under current Commission policy and the application was ultimately granted.

In another case, a Class D station (which had formerly been involved in a share-time situation with another Class D facility) was faced with an imminent loss of its transmitter site when the share-time condition was deleted pursuant to the second station's request. Given the congested nature of the allocation picture in the portion of the country in which this station exists, the location of a new transmitter site was particularly sensitive.

An existing tower site was determined viable from an allocations standpoint. However, the proposed location would require a waiver of Section 73.512 of the Rules (regarding "special procedures applicable to Class D non-commercial educational stations") in that the proposed site change would result in a change of coverage area in excess of the maximum of 50% called for in this portion of the Rules.

A SOLUTION

Explaining the particulars of this unique set of circumstances to the FCC staff resulted in the preparation of a waiver request that included appropriate points (i.e., while the station did not currently cover 50% of its community of license the site change actually would enhance that coverage) that permitted the FCC staff to grant the application as proposed.

The bottom line is that broadcast engineering consultants do not just have access to, and knowledge of, the engineering software required to perform the necessary studies and showings involved in any application before the Commission. They also have the experience and ability to creatively assist their clients in ways that fall "outside of the box" of the strict interpretation of the Rules.

A good broadcast consulting engineer is able to do both of these things in order to provide comprehensive services and technical solutions to the most challenging broadcasting dilemmas.

Laura Mizrahi, Vice President of Communications Technologies, Inc., has been involved in broadcast consulting engineering for nearly 20 years. Questions relating to issues of a broadcast technical nature can be sent to lmizrahi@commtechrf.com.

Tool Guide

From the Radio Guide Tool Box

Forever Flashlights

Forever Flashlights: No Batteries – No bulbs

Excalibur's New Model H622 **Dynamo Forever Flashlight** is the latest in no-battery, no-bulb flashlight technology.

Just crank it for one minute to get up to 45 minutes of continuous, reliable light; this flashlight will never become dead.

Keep it at your transmitter sites, studios, remote relay sites, or in your storm emergency kits. The Forever Flashlight Dynamo stays ready whenever you need it. It uses no batteries and contains three LEDs.

You can even leave the flashlight unused at your most remote site – for years – and you will always have that all-important light when you need it most. The Dynamo Forever Flashlight will pay for itself by saving you the cost of batteries and bulbs.

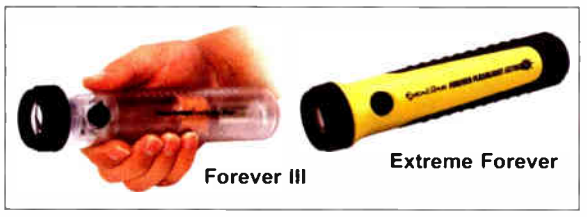
Model H622 Dynamo Flashlight

The Model H622 Dynamo Flashlight features:

- A super bright LED light.
- Low beam (one LED).
- High beam (three LEDs).
- Never needs batteries.
- Never needs bulbs.
- Heavy-duty, waterproof ABS plastic case with a non-slip rubber grip – 7" long.
- Visible for over a mile.
- Fold-away crank handle.

Dynamo units are stock items, and they usually ship within 24-48 hours. Pricing is $24.95 for one, with discounts for additional units.

Other flashlights are available such as the **Forever Flashlight III**, selling for $25.45, and the **Extreme Forever Flashlight**, priced at $39.95. Both of these units feature a single LED, and all you have to do is shake them for 15-30 seconds and they will produce light for up to five minutes. The Extreme version is available in yellow, and includes a ruggedized non-slip grip.



Forever III

Extreme Forever

Forever Flashlights are also available in the Micro Version and these are twice as bright as previous years' models.

These **Micro Forever Flashlights** sell for $21.21 each, and are available in clear, blue, grey, and yellow.

Micro Forever Flashlights

All Forever Flashlights use the Faraday Principle of Electromagnetic Energy to eliminate the need for replacement bulbs and batteries. The Faraday Principle states that if an electric conductor, like copper wire, is moved through a magnetic field, electric current will be generated and flow into the conductor.

By shaking the Forever Flashlights back and forth, for 15-30 seconds, enough electricity is generated to light the LED bulb for up to five minutes of continuous light, or in the case of the Dynamo unit, hand cranking for one minute provide up to 45 minutes of light from its three LEDs.

Forever Flashlights may be ordered directly on line at: www.ForeverFlashlights.com

Excalibur Products
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Boca Raton, FL 33433
Phone 561-883-3774
www.ForeverFlashlights.com

Consultant Guide

Radio Consulting Engineers

Gear Guide: Automation, Digital Audio Studio Control and Interface

Audion Labs

VoxPro® PC Audio Editing Software

www.audionlabs.com • 206-842-5202

VoxPro® PC is simple, fast, PC based, audio editing software optimized to record and edit phone conversations or any audio for quick turn-around to air.

VoxPro PC uses one screen on your PC monitor. You record, name, edit, and play back recordings in one window. All recording titles are listed and sortable alphabetically, by length, or by date created.

Import or export MP2-3, WAV, WMA, AIFF. Multiple files with different formats can be imported or exported at one time. Play back in stereo or mono.

VoxPro PC is networkable over existing station's LAN. Networked workstations can access files from any other workstation allowing air talent to continue recording and editing off the air in other studios.

VoxPro PC runs on Windows 2000 or XP-Pro PCs. An optional control panel or computer keyboard executes VoxPro s easy to learn features.

Broadcast Software Intl. (BSI)

SkimmerPlus and Simian Upgrade

www.bsiusa.com • 888-274-8721

NAB 2005 witnessed the launch of BSI's newest application, SkimmerPlus, and the announced release of the latest upgrade to the flagship digital automation system, Simian.

SkimmerPlus records up to eight stereo channels of high-quality uncompressed and compressed audio simultaneously. A built-in web server allows audio files to be replayed using any web browser.

Simian 1.7 builds on the success of previous versions of the software, including new command macros adding the ability to insert a program log within an existing program log on-the-fly. It's also now easier to deal with 'ball games' with floating ends or 'rain stopped play' with the new GOTO function.

Those using Simian's built-in dynamic HTML generator get a whole host of new functions including the ability to insert any HTML text from Simian itself, and there also are changes to better support XML users.

CircuitWerkes

REX and pREX Relay Multipliers

www.circuitwerkes.com • 352-335-6555

The CircuitWerkes REX & pREX relay multipliers give you the ability to create multiple contact closure outputs from a single closure input.

The REX is a basic relay multiplier with 6 inputs and 24 outputs. The pREX has 12 inputs & 16 outputs and is an incredibly powerful tool for managing and multiplying contact closures.

Each relay can be triggered by any number of inputs that can be combined together using basic logic functions like AND, OR, XOR, NOR, NAND, NXOR, Interlocked, etc. Relay output modes include: Momentary, Latched, Leading or Trailing edge, Pulse stretching up to 4.5 hours, Input debounce, Maximum ontime and more.

pREX programming is done using jumpers or from a PC with a serial port using their free pREX configuration software. Outputs for both REX & pREX appear on 50 pin SCSI (RJ-21) connectors for instant connectivity to standard telco punchblocks.

Broadast Electronics (BE)

AudioVAULT Version 9.0 Automation

www.bdcast.com • 217-224-9600

No radio automation systems has stronger, more bullet proof technology than AudioVAULT. You can configure AudioVAULT for your unique operation now and keep using it as your format or company goals change.

Start with a single affordable AudioVAULT workstation for voice tracking, programming and live assist. Add unlimited storage, RDS text and HD Radio data support, web streaming with automatic program-driven text and graphics, powerful newsroom and wire capture features and integration with satellite services.

With AudioVAULT, you can build to a multi-server, multi-site system that automatically shares data and audio via Internet, or a syndicated program origination service, or any other application you ll ever need: our powerful macro language even lets you invent new features. AudioVAULT's power doesn't get in the way of smooth operation and you never get lost in sub-menus. (Pictured: Voice tracking with automatic backtiming of music intros)

Broadcast Tools

GPI-32 Interface

www.broadcasttools.com • 360-854-9559

The GPI-32 interfaces 32 optically isolated inputs to a users PC's RS-232 or USB port. The serial data conforms to our standard switcher PIP format. The GPI-

32 is equipped with dual plug-in Euroblock connectors and two independent DB-37 connectors that may be interfaced directly to the DB-37 connectors located on the StarGuide II/III relay cards.

Additional features; dual RS-232 connectors, one for daisy-chaining multiple units on the same legacy serial port and a DB-9 to interface to our supplied USB adapter; LED indicators for power and input activity; twin power connectors allowing up to four units to be driven off of one power transformer.

The GPI-32 is supplied with two 3-foot mating DB-37 connecterized cables, serial cable and wall transformer. The GPI-32 is powered by a surge protected internal power supply. The GPI-32 may be mounted on the optional RM-3 mounting shelf.

Conex

CS-25B Sensor

www.conex-electro.com • 360-734-4323

The CS-25B sensor provides a simple, economical method for sensing tones from satellite systems, reel-to-reel tape machines, etc. The CS-25B is based on a modular concept that allows you to build a sensor system that exactly meets your needs. The controls for the modules are adjustable from the front panel.

The modules that are currently available for the CS-25B include: DS-25 dual sensor module (Each half of the module can be tuned to 25 Hz, 35 Hz, 50 Hz or 75 Hz), HPF25 high pass filter that features balanced audio in and out, PS3 power supply that can power a mix of up to 7 other modules, DTA dual tone adaptor (used to detect 25 Hz, 35 Hz and 25/35 Hz)

You can mix a variety of these modules in one package depending on your requirements.

Gear Guide: Automation, Digital Audio Studio Control and Interface

Henry Engineering

Digistor-MP Digital Audio Recorder/Player

www.henryeng.com • 626-355-3656

Henry Engineering's DigiStor-MP is a self-contained digital audio recorder/player that has numerous broadcast applications. DigiStor-MP stores up to 40 minutes of monaural audio with 15 kHz bandwidth and excellent audio quality. Up to 99 "tracks" can be stored for instant random-access playback. DigiStor-MP uses non-volatile dynamic RAM; there are no hard drives or other moving parts.

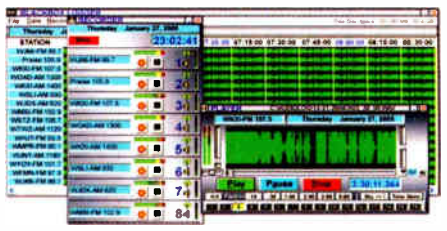
DigiStor-MP is ideal for playing station IDs and jingles, or for inserting local spots and IDs on a translator. The unit can be remotely controlled using GPI (contact closures). The RS-232 interface also allows control via a PC. The unit accepts an analog input and generates MPEG files for storage and playback. Digital files can be downloaded from a PC into DigiStor-MPs memory.

DigiStor-MP provides relay outputs to signal End Of Message (emulates a cart's "secondary tone") plus a second relay for utility use.

Pristine Systems

Blackbox Digital Audio Logger

www.blackboxlogger.com • 800-795-7234



BLACKBOX Digital Audio Logger, Monitor, and Alert System is a comprehensive radio and television audio logging product designed to meet compliance, proof, audit, programming, management, and engineering needs.

Up to 16 stereo (or 32 virtual mono) channels of logging. Choose from a variety of wav audio devices, and AM, FM, TV tuner boards. Most popular audio storage formats are supported.

Advanced tools provide the Program Director or Consultant with everything needed for quick review or detailed analysis of the entire market. Of course, time based and microphone Skimmer modes are included.

A Virtual Radio style player allows switching between multiple stations during playback as though listening to a radio in real-time.

Real-time monitoring of Audio Level and RF Signal Strength (when equipped with ASI Tuner Boards) with an extensive alarm system provides quick alerts to help avoid lost air time.

Prophet Systems (PSI)

Radio Automation Systems

www.prophetsys.com • 877-774-1010

From major market sites to Internet operations, Prophet Systems has created solutions that are powerful and yet user-friendly and affordable enough for any station.

Prophet Systems provides everything from complete digital automation solutions (NexGen Digital and NexGen101) to standalone modules that will work with any radio automation system.

All software packages include a fully-functional 30 day trial program allowing you to try before you buy. Our goal is helping our customers design the best digital solution for their unique needs. With software starting at $495 and non-proprietary hardware and audio cards, now anyone can afford professional radio automation. Operating System Platforms Windows 2000/XP, Windows NT 4.0.

Check out our one stop online shop at Store.prophetsys.com.

Sine Systems

CAS-1 – Air Monitor Control

www.sinesystems.com • 615-228-3500

The Sine Systems CAS-1 is a solution to the signal delay problem caused by digital processing and transmission equipment.

Digital broadcasting devices have a very short inherent delay. When installed in the "air" feed, there is a very short delay between the live audio and the air audio monitor. This delay is particularly noticeable, and most annoying, during live breaks when the air staff hears their own voice delayed in the monitor.

The CAS-1 substitutes a local audio feed (not delayed) in place of the (delayed) air feed to the monitor when the mic is on. An audio correlation circuit compares the two audio signals and switches the monitor to the air feed if the signals are not similar. Additionally, controls for equalization and compression can be used to tweak the monitor audio so that it sounds like the live air feed.

Radio Design Labs (RDL)

RU2-CS1 – Serial Control Interface

www.rdlnet.com • 800-281-2683

Serial control of all RDL modules and other OEM equipment is now available using the new RU2-CS1 Serial Controlled Interface. The RU2-CS1 controls 8 open-collector outputs. It also provides 8 separate 0 to 10 VDC outputs to control external VCAs (typically RDL ST-VCA2s) or other equipment with 0 to 10 VDC control inputs. Eight status inputs are provided for sensing external switch or transistor closures.

The RU2-CS1 connects to a computer through an RS-232 serial link. Commands include individual and global instructions for the inputs and outputs. Ramp rates for VCA control are programmable. The RU2-CS1 commands are simple and logical, providing the programmer with a wide variety of flexibility.

The RU2-CS1 is constructed in a steel chassis with detachable euro block connections on the rear panel. Front panel LEDs show audio outputs, active status inputs, transmit and receive data, errors and power. Rack mounting is possible using two bays in an optional RDL RU-RA3 Rack Adapter.

The RU2-CS1 is a powerful, flexible and economical programming tool for switching, level control and event sensing in computer controlled audio visual automation.

RAM Systems

Virtual Radio – Radio Automation Software

www.ramsyscom.com • 800-779-7575

Virtual Radio, a true 32 bit automation software for Windows™ 98/ME/2000/XP, is user-friendly software for music and commercial scheduling.

It may be used as a stand-alone or multi-station and multi-tasking system for simultaneous access to audio and data files, and features MPEG 1 layer I / II / III audio coding, layer 3 direct recording, and compatibility with every editing software.

It is CD audio direct conversion compatible, has import/export for ".WAV" or "MPEG" files, and may be used with Digigram, Soundblaster or any other compatible audio card.

Virtual Radio offers digital recording with unlimited storage capacity, as live-assist or fully automated broadcast. And thanks to its modular structure, it is possible to introduce this system step-by-step, allowing simple dedicated configurations to be adapted to the most different requirements of any broadcaster.

Service Guide: Radio Equipment Products and Services

Service Guide: Radio Equipment Products and Services

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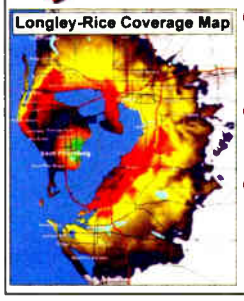

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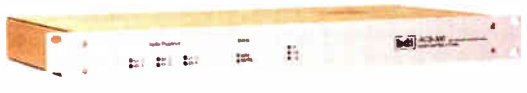
New BDI Audio Controllers

Broadcast Devices, Inc. announces the ACS-300 Six Channel Audio Controller. Two versions of this product will be offered: The ACS-300 will accept up to six balanced audio channels and upon command dim the level of these channels by 10, 20, or 30 dB or mute all channels.



The ACS-300V will incorporate the same features but will also include remote volume control of all channels. Either version is suited for control of monitor audio for 5.1 multi channel audio systems, stereo pairs or individual channels as well. The ACS-300 is a solution for the control of monitor audio for control rooms and studios that are being equipped with 5.1 multi channel audio systems beyond normal stereo.

Broadcast Devices
www.broadcast-devices.com • 914-737-5032

2005 Radio Guide Event Calendar

Email your information to: radio@rconnect.net

Northern New England Broadcasters & SBE-110
June 23 – Manchester, NH – bteffner@wcax.com

Texas Assoc. of Broadcasters (TAB)
Aug 3-5 – Austin, TX – www.tab.org

Nebraska Broadcasters Assoc. & SBE-74
August 10-12 – Lincoln, NE – www.ne-ba.org

SBE Certification Exam
Aug 12-22 – Local Chapters – Jun 10 App Deadline

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

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

SBE Chapter 22
September 28 – Verona, NY – www.www.sbe22.org

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

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

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

Boscon, Boston & SBE 11
Oct 25-26 – Marlborough, MA – www.bos-con.org

Arizona Broadcasters & SBE 9
Mid October – Phoenix, AZ – www.sbe9.org

SBE National and 2nd Annual Engineering Expo
Oct 10-20 – Grapvine, TX – sandytex@swbell.net

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

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

SBE Certification Exam
Nov 11-21 – Local Chapters – Sep 23 App Deadline

TFT Introduces New Analog STL

At the recent exposition of the National Association of Broadcasters in Las Vegas, TFT, Inc. announced its new analog Studio-to-Transmitter Link with true front panel frequency agility.

The new 5200 Series of transmitters and receivers will feature a 10-Watt transmitter and receiver with improved sensitivity. The 944-952 MHz versions will be available in August, 2005; other frequencies from 140 MHz to 1.7 GHz will be available shortly thereafter. A 20-Watt transmitter will also be available for frequencies below 1 GHz that require higher transmitter power.

Both the transmitter and receiver are front panel frequency selectable in 6.25 kHz steps over an entire band segment. No further tuning or optimization is required. Jumpers on the main board select composite or monaural operation for one-time initialization. Operation is completely compatible with existing STL systems.

A front panel LCD on each unit displays operating parameters such as frequency, forward power, reverse power, VCO voltages, and even a bargraph of audio and MUX levels. Accessories for back-up and hot stand-by operation are available.

The receiver has two selectable IF bandwidths and a high/low pre-amp gain selection switch.

Applications include clustered stations with need for a spare STL system that can be rapidly deployed on any frequency and for stations with limited budgets that need only a basic STL package.

The 5290/5291 transmitter and receiver package lists for $4,695.00 for both units.

TFT, headquartered in San Jose, California, has been manufacturing monitoring, STL (both digital and analog), and EAS equipment for the broadcast industry since 1970.

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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.

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