BULK RATE
US POSTAGE
PAID IN
DES PLAINES IL
PERMIT NO 321

Radio World®

Buyers Guide
Test & Monitoring
Equipment
see pages 29-39

PO Box 1214, Falls Church VA 22041 | January 15, 1988 | Volume 12, Number 2

Capitol Still in Production

by Judith Gross

Winchester VA ... Broadcast cartridge production continues at a steady pace at the Capitol Magnetics plant here despite a recent announcement that the company would be shut down.

While parent company Capitol Industries continues to negotiate a deal to sell its cart manufacturing operations, the production of Audiopak carts and the supply to at least major distributors remains uninterrupted for the present.

Industry sources say that the Winchester plant has sufficient finished goods and raw materials—in the way of tape—to keep manufacturing and supplying carts until a deal is consummated.

And while work is expected to trail off in the area of cassette duplication and tape manufacture, there may be enough raw materials available to keep as many as three shifts a day operating, although reports vary as to the number of shifts currently working at the plant.

Capitol Industries announced in December that it would withdraw Capitol Magnetics from the magnetic tape business and close the Winchester plant.

That decision came about after the company apparently sustained losses in its cassette manufacturing business due to overseas competition.

But since mid-December, Capitol has been talking to "at least two" interested parties about buying the cart manufacturing operations.

One of them, Fidelipac, which has been producing broadcast carts and cart tape for many years, confirmed interest in buying the rights and certain manufacturing assets and keeping the Audiopak line in production.

But at press time, the company stressed that it was still too early to predict the outcome of the negotiations.

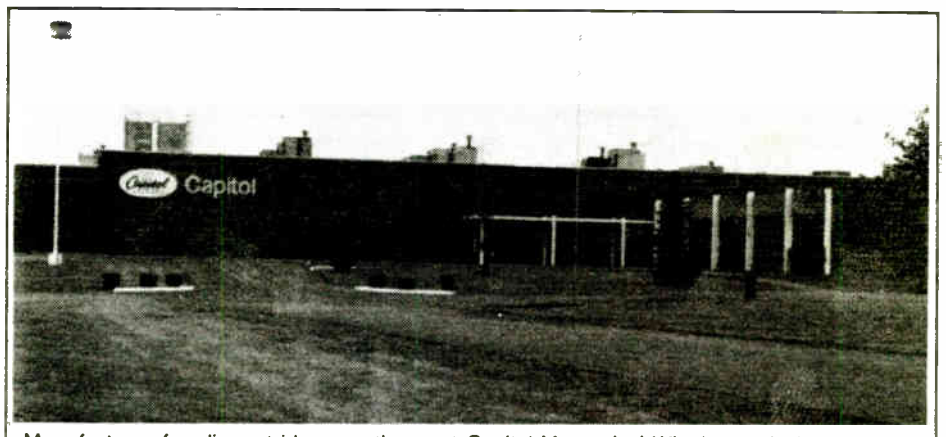
The continued availability of Audiopak carts as the talks continue would help allay stations fears that they may have to find a new cart supplier.

It would also help maintain the value of the cart manufacturing operations as the parent company attempts to negotiate a deal.

Allied Broadcast, a major distributor of Audiopak carts confirms that the company is continuing to supply the carts.

An Allied spokesman said it was "business as usual in accepting and filling orders," both at Allied and at the factory, at least as of the end of December.

Capitol would not confirm reports of the availability of raw materials or the pace of cart production, but sources indicate the manufacture and supply of carts is expected to be maintained until some sort of purchase deal is reached.



Manufacture of audio cartridges continues at Capitol Magnetics' Winchester facility while its parent company negotiates the sale of the cart operations.

IBEW Inks CBS Deal

by Alex Zavistovich

New York NY ... In the recently signed labor contract between CBS and the International Brotherhood of Electrical Workers (IBEW), the guaranteed number of IBEW's members employed at the CBS Radio Network will be reduced by nine people over three years.

Despite the possibility that up to 22 IBEW positions may be at risk by reducing the guaranteed number, a union source seemed unconcerned. Contract terms will prevent layoffs of those employees, he assured.

The radio issue is one of a number of points agreed to by CBS and IBEW in a contract negotiation which began in late August. The union's previous agreement with the network expired on 30 September.

On 20 December IBEW signed a new contract with CBS, after submitting the proposal to its membership for a two-week voting period. The contract was ratified by a vote of 947 to 352, with 1,299 of the union's roughly 1,500 members voting.

The contract includes a 3% ratification bonus for each worker and 3% pay increases over the second and third years of the contract, and gives IBEW the exclusive right to operate equipment for all CBS productions nationally.

Where the contract may affect radio workers is in the agreed-upon reduction of the guaranteed minimum number of IBEW members at the radio network in New York.

Although the guaranteed number of IBEW employees had been 24, that figure will drop to 18, and finally to 15 under the terms of the contract. Currently, CBS radio employs 37 IBEW members.

(continued on page 3)

VOA May Move After Remodeling Studios

by David Hughes

Washington DC ... Despite the ongoing efforts to renovate two dozen studios at its Washington DC headquarters, there is increasing talk that the Voice of America (VOA) may abandon its existing facility and move to a new location in three years, by 1991.

According to VOA sources, there is a desire within the US Information Agency (USIA), which oversees the VOA's operation, to consolidate all of the agency's operations under one roof.

"Yes, there is talk to that effect," said a VOA official who asked not to be identified.

The talk of a move comes just as the VOA is spending $6.6 million to renovate 19 studios at its headquarters. It also comes after a report, contained in a USIA Inspector General's audit made public in 1987, which claimed that the VOA's overall 10-year, $1.3 billion modernization program is characterized by waste and inefficiency.

Insiders indicate that the USIA has been offered other space in downtown Washington by the General Services Administration (GSA) that would be available in 1991.

"By the time we have the (VOA) studio renovation project completed, with all of that investment program, we will have to start all over again," said one VOA official.

Gary Marco, president of the National Federation of Federal Employees local representing VOA technicians, said that it is "not just idle talk to put everyone (the VOA and the USIA) in one building by 1991."

Officially, the VOA will not discuss plans for a move.

For more information about the VOA, contact Beth Knisley at 202-485-6231.

REGULATORY NEWS

FCC May Relax Equipment Policy

by David Hughes

Washington DC ... The FCC has issued a plan to relax authorization procedures for microwave and other transmission equipment used in broadcast.

The proposed rule change, the Commission indicated, would involve placing Part 74 and Part 78 microwave transmitters and all Part 73 transmitting equipment, except Emergency Broadcast Service (EBS) equipment, under the "verification procedure."

According to FCC Engineer George Harenberg, most of this gear is now covered under the "notification procedure."

In addition, the FCC said that it would place transmitters operated in frequency bands below 900 MHz under the "notification procedure," rather than the verification procedure.

The Commission said the plan, if approved, would "reduce the authorization burden" for many categories of equipment, resulting in "faster FCC service."

Authorization procedures

Notification and verification are two of the FCC's five equipment authorization procedures. The other three are type approval, type acceptance and certification.

According to the Commission's verification procedures, the manufacturer, importer or marketer of the equipment must "retain" measurement and other data that proves the equipment complies with FCC rules.

In the notification procedure, the FCC grants an authorizatiion based on the applicants' statement that the equipment has been tested and complies with Commission regulations.

In the certification procedure, as well as with a type acceptance, the FCC reviews the applicants' measurement data and other information about the piece of equipment before an authorization is issued. Type approval involves the Commission performing its own tests on the item before issuing approval.

Harenberg explained that the major difference between notification and verification is that under notification, the applicant submits a form indicating that it has performed tests on the product and that it complies with Commission regulations.

He added that the applicant does not need to notify the FCC in the verification procedure. However, if the Commission gets an interference complaint it will require that the applicant supply the information showing that tests were conducted on the piece of equipment in question.

Relax oversight

In its December proposal, the FCC said that "since the equipment marketed for use in these services has a satisfactory record of compliance with FCC technical standards ... the continued regulatory oversight can be relaxed."

It added that since its 1984 decision relaxing authorization programs, the FCC has not found an increase in noncompliance of broadcast related equipment that was placed under the notification and verification procedures.

Also, the FCC said it wants comments on whether to include FM boosters, a type of translator, along with some TV translators and boosters, under the verification procedure as well. Currently, many are covered under the Commission type acceptance procedures, Harenberg said.

The Commission added that "verification may be appropriate since these devices are produced and operated in limited quantities and are used at fixed locations, making interference sources easier to locate."

In a related issue, the FCC on 17 December rejected a plan that would relax the operational and licensing requirements for remote pickup stations, aural broadcast auxiliary stations, and some TV and cable service relays.

The FCC's existing rules require that mobile and portable broadcast auxiliary stations be licensed for the specific frequencies they intend to use.

The rejected plan would have relaxed the procedures to allow auxiliary stations to operate under a blanket license thereby permitting them to operate on any frequency in the bands allocated for them, the Commission added.

For more information on the authorization procedure proposal, contact George Harenberg at 202-632-7314; comment deadlines in the docket, GEN 87-552, had not been set at press time. For more information on the broadcast auxiliary blanket license proposal, which is contained docket MM 86-405, contact Hank VanDeursen at 202-632-9660.

INDEX

Digital Audio On a Floppy Disk *by Tyree Ford* 13
Building a Team That Works *by John Cummuta* 14
TDR Reveals Problems in Coax *by Tom Vernon* 15
Geometric Proximity Correction *by Tom Osenkowsky* 17
Dealing with Vertical Plane Nulls *by W.C. Alexander* 18
The Adventures of Corky Culver *by Peter Hunn* 21
The Shrinking Compact Disc *by Neil Lewbel* 22
Mute Point: Adapting a Console *by Bill Higgs* 23
20 Years of Technical Innovations for CPB *by Mike Starling* 24
Digital Domain *by Skip Pizzi* 26
Buyers Guide 29

FCC Clips

Richmond & Beethoven

The city of Richmond, VA may lose its only classical-music noncommercial public radio station, due to an action by the FCC which granted a change in the station's assignment license.

On 9 December the Commission upheld the grant of a license assignment for WRFK-FM, Richmond from Union Theological Seminary to Paul T. Lucci and Wayne G. Souza. Lucci and Souza plan to operate the station as a commercial service.

The decision by the FCC to uphold the license assignment came over the protests of a local group, Citizens for Public Radio, Inc., which had petitioned to have WRFK's broadcast channel (293) permanently reserved for noncommercial educational use only.

However, the Commission noted that channels within the reserved noncommercial band are 201 and 220. WRFK-FM, on 106.5 MHz, which does not fall within the reserved channels, was not required to operate as a noncommercial station, the FCC stated.

Although Citizens for Public Radio also requested a review of the Commission's decision, the FCC said the group failed to support the request, which was therefore deemed "procedurally defective."

The Richmond area may still be served by a public radio station, however. At press time, WCVE-TV, a Richmond public television station, was working on establishing its own non-commercial FM radio counterpart.

WCVE VP/Engineering John Prather declined to comment on whether the TV station was close to getting the radio station, saying only that work on the plan was "progressing."

Details of the FCC decision are found in report number MM-286. For additional information, contact the Mass Media Bureau at 202-632-6485. Contact John Prather at 804-320-1301.

Station history cards

The Mass Media Bureau's Station History Cards will be available in microfiche form at the Commission's Public Reference Room on the second floor of 1919 M St NW, Washington DC.

According to a 15 December announcement, the cards were in the process of being copied onto microfiche, and are being transferred to the reference room as they are completed. The cards must be signed out when used and signed in upon return.

At press time, microfiche copies of Educational TV facilities history cards were already available from the reference room, and history cards for the rest of the broadcast service were expected by the end of January.

For additional information, contact the Mass Media Contact Representative at 202-632-7566.

Latest Kahn Filing Dismissed

by Alex Zavistovich

Washington DC ... The FCC has returned, with no action, a letter from Kahn Communications President Leonard Kahn which claimed Motorola was conspiring to keep multisystem AM stereo radios out of the marketplace.

A 3 December letter to the FCC from Kahn requested the Commission "initiate a thorough and detailed study" of Motorola, to determine whether Motorola had illegally "frustrated the growth of AM stereo."

The letter included a Kahn patent dispute with Motorola, and suggested that Motorola "threatened" radio manufacturers to block multisystem AM stereo radios.

Although Kahn's latest volley in the ongoing AM stereo war was meant to uncover a Motorola plot, the FCC, after reading the evidence, has declined to take any action. Motorola issued only a short statement denying the charges.

Letter to Sony

Along with his allegations, Kahn included a letter to Sony from Motorola dated 12 September 1985. The letter informed Sony that Motorola held the patents to independent sideband AM stereo decoders, which Sony was planning to use in multisystem radios.

After telling Sony the AM stereo business unit was "unwilling to license" under those patents, Motorola wrote, "We, therefore, must ask you to cease selling AM stereo radio receivers in the United States that use these patents."

Motorola stressed there was "absolutely no change" in its licensing of the C-QUAM system to Sony.

Kahn, however, took the letter as evidence of a plot by Motorola to keep multisystem radios out of the market. With no multisystem receivers on the market, Kahn's AM stereo system—which has few receivers of its own—could be quickly eclipsed by Motorola's C-QUAM system.

The Commission did not take the same view of the matter as Kahn, however.

On 22 December, the FCC returned Kahn's letter, with a letter of its own. The FCC stated the Kahn charges "do not fall within the purview" of the Commission and were not "essential to resolving the AM stereo issues" before the body.

In addition, the FCC considered it "premature or inappropriate" to refer the matter to another government agency. Kahn had requested the Commission to route the letter to the correct agency if the FCC could not act on the charges.

The Commission's letter acknowledged, however, that Kahn could "feel free to go to the Department of Justice" himself.

Bill Hassinger, deputy chief of the FCC's Mass Media Bureau, said the letter to Sony from Motorola did not seem threatening. He said the letter simply "sounds like Motorola is saying 'we have these patents and you can't use them.' "

Motorola took a somewhat disinterested tone in its corporate response to the Kahn allegations, maintaining "detailed comments are unnecessary."

"Motorola has compassion for those who have lost" in AM stereo, the statement read. The company urged the industry to begin to work for the "common benefit."

In response to Kahn's charges regarding the letter to Sony, Motorola called it a "private matter between companies" which pertained "only to who first developed the methodology to decode independent sideband transmissions."

The allegations made by Kahn regarding Motorola's letter to Sony "pose no threat to C-QUAM broadcasters or manufacturers," Motorola stated.

A source at Motorola maintained the company had "every right" to request that Sony cease certain US receiver sales.

The patents (4,185,171 and 4,184,046) cited in Motorola's letter to Sony were for devices capable of decoding independent sideband (ISB) transmissions. Kahn's system is an ISB system, while C-QUAM is a quadrature design.

The source confirmed that the Motorola AM stereo business unit was unwilling to license to Sony under those patents. "Why would we want to compete with ourselves?" the source maintained.

Patent dispute

In the context of his letter to the FCC, Kahn also disclosed that a reexamination of patent 4,184,046—the same as mentioned in the letter from Motorola to Sony—had been granted Kahn by the US Patent Office.

That same patent—for a Motorola-designed independent sideband AM stereo decoder—had been disputed earlier by Hazeltine (an early player in AM stereo now aligned with Kahn Communications) and was resolved in Motorola's favor.

However, in a statement accompanying the order granting reexamination, Patent Office Examiner Douglas Olms acknowledged "a substantial new question of patentability" raised by Kahn against the Motorola patent.

Olms told **RW** that a "substantial new question of patentability" was required to be shown when granting a reexamination, meaning that new "prior art" introduced is more relevant than anything used in rendering the preceding decision.

In this case, the "prior art" introduced by Kahn were patents which he claimed "anticipated" certain design features in Motorola's patent.

However, Olms stressed he "did not agree" to specific points in Kahn's complaint, only that it was material to the case and therefore grounds for reexamination.

Although in its worst case a reexamination can nullify a patent, Olms pointed out that instead changes are often made to the patent claims, offering only somewhat less protection than the original patent.

In its best case, however, a reexamination procedure can be resolved "in six to nine months, with no substantive change to the claims," said Olms.

For additional information, contact Motorola at 312-397-8000 or Kahn Communications at 516-222-2221. Contact Douglas Olms at 703-557-1143.

IBEW Deal Cuts CBS Jobs

(continued from page 1)

That means up to 22 IBEW members could lose their jobs at the radio network. However, a source in IBEW said the impact of the contract term was actually minimal.

"The only way the number over our guaranteed number can be reduced is by death, voluntary resignation, retirement, or buyout," explained the source. "The company can't just lay them off."

In another change, CBS has done away with the IBEW position in its Washington DC Radio News Service. However, the IBEW source again said the change was unimportant because that employee had already retired on a buyout.

On the whole, the CBS contract with IBEW is similar to the contract between NBC and the National Association of Broadcast Employees and Technicians (NABET). NABET, however, had to mount its longest strike ever against the network to arrive at an agreement.

While the union source acknowledged that the NABET strike may have affected IBEW's negotiations, he speculated that a greater force was "the general atmosphere regarding unions in this country at present."

The source characterized negotiations as tough, adding, "with any tough negotiations, you wind up giving up a little more than you expected going in."

At CBS, spokesperson Alice Henderson said the network was "pleased the contract was ratified. It was a long negotiation, and we are glad that our union people are here with us."

For more information, contact CBS at 212-975-4321. Contact IBEW at 202-833-7000.

What's In A Name? For AM, Plenty

by **Judith Gross**

Falls Church VA ... And now the moment you've all been waiting for ... sort of. Several clever readers have sent in catchy titles for that new, **high-fidelity AM radio** incorporating the NRSC standard and AM stereo that the NRSC is seeking to name.

The idea is to have an easily recognizable trademark that identifies AM with a **quality sound** in the minds of consumers, something that's long overdue.

My personal favorite (and the first one sent in) is **MaxAM**. It has a nice ring to it. A close second is **SuperAM** (faster than a speeding square wave, more powerful than IMD ...).

Also worthy of mention are **AMpro and ProAM**, especially since golfers might indentify with that last one. Then there were the "high" thinkers: **AM Hi-Tech, AM Hi-Band** and **AM Hi-Fi**.

One reader suggested **NRSC-AM**, cautioning that he meant "nursc-am, not nur-scam." And a few really creative suggestions came in the way of **VectrAM, AMplimax** and **AMphasis**.

Mugs are on their way, and I've forwarded these names to the NRSC in time for their meeting at the CES show and hope they can convince receiver manufacturers that there really is a market for better quality AM radios.

Then maybe we can all stop talking about the band in mournful tones and teenagers will find out that AM is more than just a time of day.

But a lot of engineers in the know realize that it's going to take more than just better signals and reception to help AM.

After reading some of Cousin Brucie's comments about the demise of AM (15 December **RW**) many of you wrote and called to comment on **AM's plight**.

Regular **RW** columnist Tom Vernon said it well. "AM improvement has to be sold to broadcasters (and the public) as a package—improved technical quality *and* improved programming. One without the other will be unproductive."

Tom pointed out that smaller markets seem to be taking the creative lead in this, and I agree. When there are fewer dollars at stake in the ratings, stations are more willing to take risks.

He also lamented the end of the last major market AM music holdout when Chicago's **WLS** recently switched to **all talk**. All we can do is hope that the newest crop of broadcasters coming through the ranks will realize AM's potential and reestablish it as the market force it can still become.

☆☆☆

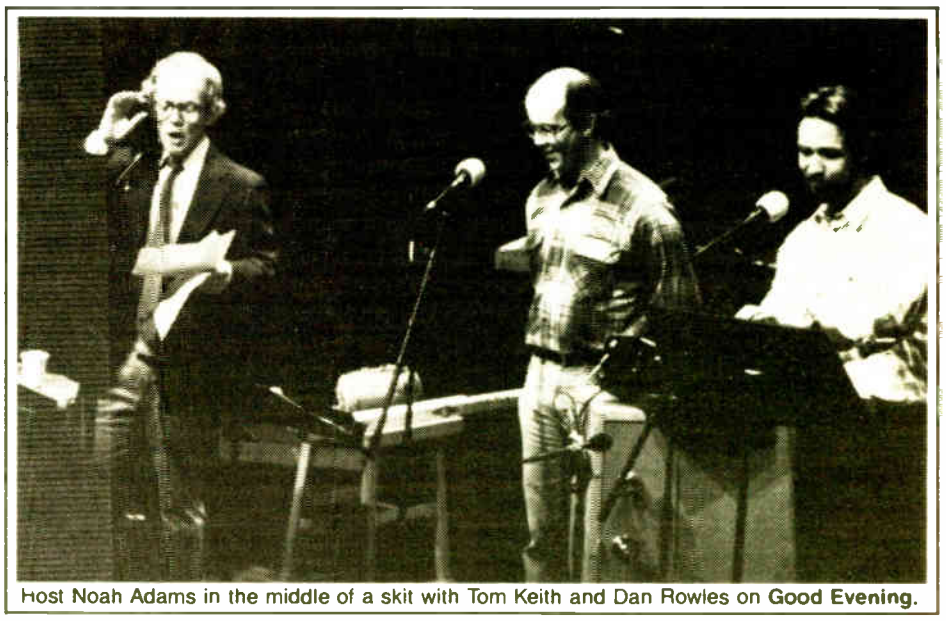
The initial panic on the part of **Audiopak** users on learning that **Capitol Magnetics** was shutting down has now been replaced by relief that parent company Capitol Industries wants to sell off the cart manufacturing part of its business.

Right now carts are still being made until a possible deal goes through. You can still get them from your distributor.

At the **VOA** meanwhile, rumors persist but can't yet be confirmed of the possibility of **cost overruns** on the renovation of the first ten radio studios. Inside word has it that the original specs were too narrow in the descriptions of the work that needed to be done.

Apparently broadcast companies knew this, and adjusted their bids to reflect the actual work it would take, so many came in **higher than the** bid which was finally awarded.

Did contractor Grunley-Walsh know this in bidding on the specs as they were



Host Noah Adams in the middle of a skit with Tom Keith and Dan Rowles on **Good Evening**.

written? Maybe not, since the broadcast field is new to them. But either way it may end up **costing Uncle Sam** more.

Lots of positive comments to date on the job being done by **Rick Dobson** in assigning booth space for **NAB convention exhibits**. Firms requesting space are pleased with his manner and the promptness and courtesy their requests are getting.

Seems Dobson has taken to heart some of the concerns expressed through the exhibitors' advisory committee. This time in Las Vegas, there will be *good* reasons to visit the overflow exhibits at the Hilton Center.

Dobson has also had success weeding out the so-called "ad incentives"—not the real guys who sell promo items, but you know, the gold chains and all that. Now if we could just get a roulette table *on* the exhibit floor ...

Interesting to note that the **NAB** is now looking elsewhere for its lab, the **Broadcast Technology Center**. NAB had wanted space adjacent or at least close to its downtown DC building, but couldn't get it.

Now the association is looking not just in the district but also in nearby Maryland and Virginia. Say, we know of a certain **Loudon county** site not being used for a certain antenna project ...

☆☆☆

Good news for lovers of live radio who have been feeling a little lost since *A Prairie Home Companion* left the airwaves last June. Although the program has been in reruns, somehow it just isn't the same.

Now **American Public Radio** (not to be confused with National Public Radio) has begun *Good Evening*, 90 minutes of live music and fun from the very same locale as PHC—St. Paul MN's **World Theater**.

That's a good choice, since about a year before PHC left the airwaves Minnesota Public Radio spent time and money renovating the theater, including the installation of a new audio booth.

Anyway, the show is hosted by **Noah Adams**, and keeps live radio on the air with down home music and fun each week. Some of the same folks who worked on PHC are with *Good Evening*, which means you can still hear things like those nifty voices from Tom Keith, and other sketches.

And, while we won't be hearing the news from Lake Wobegon, there will be some homey story-telling, and some story-reading by Adams. Sounds like it's worth a listen.

☆☆☆

The plot sickens ... We waited breathlessly to hear about that major "plot" by Motorola to thwart **multisystem radios** alleged by Kahn Communications in its recent filing.

Lo and behold, the "plot" turned out to be nothing more than Motorola deciding not to compete with itself. Even if one of its C-QUAM chips can decode Kahn's ISB stereo system, there's no reason Motorola should allow its use when it is trying (and successfully) to market its own system.

And they don't have to. In this country that's called **"free enterprise"**—remember? If you believe in the marketplace and all that, then you have to agree with that logic. The **FCC apparently did**, when it dismissed this latest Kahn complaint. Sorry, but what's fair is fair.

Heard something interesting? Spill your guts to **Earwaves**. *Write PO Box 1214, Falls Church VA 22041, or call me at 703-998-7600. Best tidbit of the month wins a coveted* **Radio World** *mug.*

OPINION

Readers' Forum

Got something to say about *Radio World*? Any comments on articles? Call us at 800-336-3045 or send a letter to Readers' Forum (*Radio World*, Box 1214, Falls Church VA 22041 or MCI Mailbox #302-7776).

Continued praise for NRSC

Dear **RW**:

If you operate an AM station, you need to cooperate with the NRSC and your fellow broadcasters and upgrade your facility to conform to the NRSC premphasis/deemphasis and 10 kHz band pass filter standard.

Even more importantly, you owe it to yourself and the listeners you serve to make the small investment required that can single-handedly produce the biggest improvement to the AM band in decades.

KYMN recenty installed the modification to our CRL processing unit, and I truly am impressed with the "new sound" of our station.

Having experience in broadcast engineering and programming, I feel qualified to share my view with fellow broadcasters.

The NRSC standard limits audio bandwidth to 10 kHz. It drastically reduces second channel adjacency interference. The preemphasis boost makes our signal "stand-out" on the dial with added brightness even on the poorest AM radio.

The 10 kHz notch filter has cleaned up our C-QUAM Stereo signal to a point where our 20 year old plate modulated Gates transmitter sounds like a new installation.

And though this may be a shocker to some AM operators, your listeners *do* care about audio quality on the AM band, and they'll notice the improvements to your signal clarity, and the station's "tuneability" (due to less occupied bandwidth)

I admit that I had reservations about limiting audio to 10 kHz.

I am still amazed at how well the preemphasis curve compliments the filter circuit, and even on the station monitor the bandwidth-limited audio is clear, crisp, and doesn't sound frequency limited at all!

Receiver manufacturers are in support of the new NRSC standard, and now the AM stereo, and even more importantly the AM quality issue is back in the broadcaster's court.

The NRSC standard is a very small investment that any AM station must make now.

AM is not dead unless we as broadcasters choose to continue ignoring this band that in many areas of the country is vital to communities.

Rich Harris, PD
Stereo KYMN
Northfield, MN

Part-time job

Dear **RW**:

I believe that Jeffrey Baker's article on contract engineering (15 November) is well based and comes at a time when many radio engineers in smaller markets have realized that their salaries are not keeping up with the higher costs of living.

Contract engineering is a good way of supplementing a full time salary.

The declining requirement by small and medium market radio stations to keep an engineer on staff should be an incentive for broadcast engineers to increase their knowledge and ability to perform as much of the technical needs of a radio station.

The one who can perform the majority of these tasks will probably be in most demand for engineering services.

Al Tarasiuk, Project Engineer
Radio Free Europe/
Radio Liberty, Inc.
Washington, DC

Use **Maritime calls**

Dear **RW**:

There has been much ado in recent months concerning call letters, both at the FCC and in the trade press.

The FCC's proposal to rescind their "W east of the Mississippi and K west of the river" policy met with great opposition.

Likewise, the Commission's plan to allow separately-owned facilities to use the same call sign spawned a storm of protest.

For years broadcasters have looked longingly at the hundreds of call signs held by maritime stations.

One recent writer to **RW** made mention of the multitude of good call signs "floating around the Mediterranean."

Why not release all the maritime calls and make them available for radio and TV use? This could be accomplished by simply adding a number to the end of all maritime call letters now in use.

For example, if a maritime call was WBPQ, it would become WBPQ4, etc. A three-letter maritime call would become WBP4.

There should be no confusion with other services, because no other class of station uses this system! Or since the USA is also allocated "N" and "A" prefixes, maritime calls could be modified using these letters.

WBPQ could be changed to NBPQ or ABPQ, or the maritime stations could be given five-letter calls such as NWBPQ or AWBPQ.

The end result would be the availability of hundreds of new call letters for use by broadcast stations.

In addition, the FCC could reinstate three-letter calls for broadcasters, assigning them on a "first request" basis, and perhaps charge a first time fee for the three-letter assignment, thus raising a little revenue to defray the cost of the program!

There are 1,352 three-letter K and W combinations, not to mention the 35,152 four-letter possibilities.

Even if we delete a hundred or so possible obscene or objectionable combinations, such as KRAP and WIMP, the potential would be unlimited for years to come!

Howard McDonald, President and GM
KKMT
Ennis, MT

Minority story off-base

Dear **RW**:

The news item titled "Bill Prohibits Minorities Studies" in the 15 November **Radio World** paints an erroneous and misleading characterization of the FCC's MM-Docket 86-484.

Contrary to the impression given to **Radio World** readers, the FCC has neither embarked upon an "attempt to eliminate minority licensing preferences" nor is there any basis to assume that a final Commission action in this docket "would eliminate preferences."

One only needs to look to the introductory text of MM-Docket 86-484 to ascertain that this inquiry is specifically seeking to "establish (a record) that would *support* the constitutionality of its preference scheme" (emphasis added).

There is absolutely no language in this docket that supports a result-orientated, fait accompli outcome as advanced in the subject news article.

At best, it seems to this reader that **Radio World** may be guilty of accepting at face value the self-serving, perjorative press release from Senator Lautenberg's office as factual.

At worst, the editorial opinions of **Radio World** concerning this legitimate FCC inquiry, however controversial it may be viewed, are being injected into its so-called "hard news" columns.

In any event, I hope you will take positive action to correct this disinformation served upon your readership.

Specifically, the article in question should have reflected that "the FCC may be undermined in its attempt to *reexamine* minority licensing preferences . . . " (not "eliminate") and that the "FCC actions *could* eliminate preferences (not "would").

The semantical difference speaks for itself.

Thank you for your time and attention to this matter.

James U. Steele
New York, NY

Give NRB Industry Support

As religious broadcasters get ready to gather for their annual convention in Washington DC, they are looking back on a year filled with turmoil.

But even if the problems which surfaced received a large share of the media attention, most religious station owners can still feel good about the service they provide for their audiences and be assured of their listeners continued support.

One sign of growth over the past year is the increase in the number of engineering and technical sessions scheduled at this year's NRB show.

This increase encourages greater support from equipment manufacturers in the way of more exhibits on the show floor.

So, along with programming services, the number of equipment booths has continued to grow at the NRB over the past few years. Religious broadcasters offer a particularly good marketing niche for equipment vendors.

Many of them, especially AMers, have taken over stations in need of upgrading, and are spending the dollars necessary to produce an improved technical plant.

Thay are also often among the first to experiment with a new technology. WCFB, a Christian station in Tupelo recently wrote a glowing report of its conversion to the NRSC standard.

And with the new, high-quality contemporary Christian music formats so popular, many stations also see the need for stereo, digital audio systems or FMX.

Because these stations are often supported by a religious institution, and because they enjoy an unusually loyal audience, they do not always fall prey to the volatile finances of the commercial secular radio market.

The evidence of past years shows that those station owners who visit the NRB exhibit floor often come there to buy, with a clear idea of their station's needs and a reasonable budget to fulfill them.

They may be a specialized market, and compared to the total number of broadcasters their ranks may be small. But their continued growth and success proves that their show deserves everyone's support.

—RW

Radio World

Vol 12, No 2 January 15, 1988

Publisher: Stevan B. Dana
Editor: Judith Gross
Buyers Guide: Marlene P. Lane
News Dept.: David Hughes, Mgr.
Alex Zavistovich
Circulation Mgr.: Marion Alsup
Advertising Coord.: Simone Leeser
Production Dept: Jean Barnes, Mgr.
Gina R. Rosario,
Jeanne Pearson/
Graphic Artists

Radio World (ISSN: 0274-8541) is published twice a month by Industrial Marketing Advisory Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phone: 703-998-7600.

Advertising Sales Representatives
East Coast
Ernest Robitel **516-671-2502**
Midwest
Steve Dana **800-336-3045**
West Coast
Patricia B. Macsata **415-786-2198**

Free subscriptions are available to professional broadcasting and audiovisual equipment users. For address changes, send current and new address to RW a month in advance at the above address. Unsolicited manuscripts are welcomed for review; send to the attention of the appropriate editor.

ALLIED

The *FULL SERVICE* Broadcast People

We're very big in TELEPHONE TALK.

We're very small, too.

As easy as pressing a button . . .

Your operators and on-air talent will love the easy operation of Gentner's TELEMIX X system! At the push of a button, TELEMIX X takes one of up to 18 telephone lines and interfaces it to your equipment.

TELEMIX X operates much like a ten-button telephone set. To take a line, your operator pushes the appropriate line button. To place the call on hold, the HOLD button is depressed; to drop the call, the OFF button is pushed. Depression of the CONF button allows multi-line conferencing. The DUMP button provides connection to an external delay system.

Actual Size

The most compact control surface is 5¼" x $5\frac{13}{16}$".

Other sizes and configurations in stock.

ONLY FROM

ALLIED Broadcast Equipment

P.O. BOX 1487 • RICHMOND, IN 47375

Join Our FAX Network • Prompt Response on Your RFQs
FAX 317-962-8961

Log In...Bulletin Board Modem...317-935-0531

ATLANTA, GEORGIA 404-964-1464
LOS ANGELES, CALIFORNIA 818-843-5052
CHICAGO, ILLINOIS 312-470-0303
RICHMOND, INDIANA 317-962-8596
DALLAS, TEXAS 214-423-8667
SEATTLE, WASHINGTON 206-838-2705
RICHMOND HILL, ONTARIO, CANADA 416-731-3697

USED EQUIPMENT DIVISION 317-962-1471
BROADCAST SYSTEMS DIVISION 714-752-6664
SATELLITE EQUIPMENT DIVISION 317-962-8596
NIGHTS/WEEKENDS EMERGENCY 317-962-8961

Boosters May Need RFR Analysis

by Alex Zavistovich

Washington DC ... Because of recently permitted power increases, FM boosters may soon be subject to RF radiation (RFR) analysis, although the FCC had originally excluded that category of equipment from such analysis.

The FCC on 4 December proposed the addition of FM boosters to a list of facilities required to be analyzed for environmental RFR. The stations would be included in a category of transmitters which are analyzed for their potential to overexpose humans to such radiation.

And while the FCC is working to broaden the scope of its RF evaluations, the NAB has petitioned the Commission to have some "multiple use sites" excluded from the process, and to clarify FCC practices regarding RF evaluations.

FM boosters

The FCC explained that inclusion of FM boosters in RF measurements was due to recently adopted higher limits for the boosters' power.

FM booster stations are FM translators which provide service to areas where terrain obstructions might otherwise limit reception. The transmitters operate at the same frequency as their full service station.

According to FCC Physical Scientist Robert Cleveland, boosters were originally categorically excluded from regulation because their power had been limited to 10 W.

However, Cleveland said, a rulemaking adopted 16 July 1987 eased limitations to "20% of the maximum permissible effective radiated power of the primary station."

> *"...higher powers required that the transmitters be analyzed."*

The FCC concluded that the higher powers required that the transmitters be analyzed to assure they meet RF protection standards, he added.

Initial reaction to the FCC change was favorable at the NAB. Deputy General Counsel Barry Umansky said the association "has always supported reasonable federal standards."

"If boosters approach the power of full-service FM stations, we (NAB) would not opppose having them conform to some RF radiation standards," he said. "It would provide additional security for broadcasters."

NAB petition

While the NAB may not oppose RF regulation for FM boosters, it petitioned the FCC to remove some multiple use sites—possibly including antenna farms—from evaluations of compliance with American National Standards Institute (ANSI) RF guidelines.

ANSI guidelines for RF exposure are used by the FCC as a general emissions evaluation standard. The NAB proposed this past fall that the FCC exclude from RF evaluation "facilities which contribute 5% or less of the ANSI limit (50 $\mu W/cm^2$)" at FM frequencies in multiple use sites.

According to Umansky, the sites would include antenna farms.

The NAB's suggestion, Umansky said, came in support of an earlier filing from San Francisco-based engineers Hammett and Edison requesting FCC clarification of the ways in which the standard is employed.

Excluding multiple use facilities from evaluation "would not create a situation where adverse biological effects would be expected to occur," which the NAB attributed to a built-in safety margin in ANSI standards.

The ANSI protection guide requires field emanations be kept at a level "ten times lower than fields assumed to produce any biological effects," the NAB explained.

Hot spots

Another suggestion supported by the NAB was a minimum measurement distance of 20 cm for localized peak readings—"hot spots"—and retaining the time averaged aspect of the ANSI standard as a hot-spot exposure criterion.

The ANSI standard suggests a time-averaged level for whole-body exposure, based on a sliding scale with a six-minute upper end—the shorter the duration of exposure, the higher the permissible exposure level.

The scale "accommodates most situations" of hot spot occurrence, the NAB held, adding that hot spots are "not normally in areas of expected continuous human exposure."

The FCC's Cleveland declined to comment on the NAB's request for rulemaking, although he noted that other commenters have supported the proposal.

At press time, Cleveland predicted that the filing would not see action "until the new year" because it is preceded by "several things of higher priority."

For additional information, contact Robert Cleveland at 202-653-8169. Contact Barry Umansky at 202-429-5456.

FCC Warns of Tower Hazard Crackdown

by David Hughes

Washington DC ... The FCC is warning radio stations that it has mounted a campaign against towers that do not comply with the Commission's painting and lighting requirements.

Branding such towers "potential hazards to air navigation," the FCC in a 27 November announcement indicated that 13% of the 289 towers it recently sampled have "problems with the required lighting."

It added that fewer than half of the stations comprising the 13% with tower problems had notified the Federal Aviation Administration (FAA) as required by FCC regulations.

"These notifications," the Commission said, "are essential to the issuance of alerts to pilots."

Faded, peeling

The FCC inspections, which were conducted by the Field Operations Bureau, also uncovered the fact that 27% of the towers had paint that was "faded, peeled, or deteriorated so badly that the visibility of the tower was severely diminished."

According to George Dillon, an electronics engineer with the FCC's Inspection and Investigations Branch, the tests were conducted during a three month period in mid-1987.

Commission rules indicate that radio towers greater than 200' in height or near airports are required to comply with a series of marking and lighting regulations.

The station licensee is required to make daily observations of tower lights and report outages to the nearest FAA Flight Service Station within 30 minutes.

The FCC stressed that it intends to continue its "close scrutiny of radio towers and to take appropriate action"—including fines—against violators.

Dillon said that the FCC plans to continue its survey of towers in 1988 to determine if the problem of towers not meeting its criteria continues.

"In addition, we will resume our surveying of towers in the near future to see whether these problems have abated," the Commission added in its notice.

Complaints received

Dillon indicated that the FCC responds to tower complaints from pilots, the FAA, and the public in order to enforce its regulations. However, he indicated that there has been no reported recent increase in such complaints.

"With 78,000 antenna towers that are required to be lighted and painted, we do not have the manpower to do regular inspections," Dillon said. "That is more than could be handled by a fulltime staff."

But Dillon stressed that when the Commission receives a complaint, it gives it high priority. "We respond promptly to complaints. They indicate a safety hazard," he added.

The FCC responds to tower rule infringements in several ways, depending on the situation, Dillon indicated. The actions range from a warning letter, up to a $2,000 fine, and even the filing of criminal charges if a problem goes uncorrected.

The FCC contacts are James Voigt, 202-632-7521, and George Dillon, 202-632-6345.

Move To Stem Filing "Abuses"

by Alex Zavistovich

Washington DC ... Petitions to deny and requests for frequency allocations filed with the FCC are sometimes used to "extract some financial consideration from an applicant," rather than to raise questions about an applicant's fitness to be a licensee, according to a Commission Notice of Proposed Rulemaking.

To stem such abuses, the FCC has suggested modifications to its petitioning practices. Comments from broadcasters generally applaud the changes, which include limiting the amount of cash a party filing a petition to deny could expect.

However, at least one group is opposed to the Commission's proposal. The National Black Media Coalition (NBMC), a minority-oriented public interest group, maintains there has been no abuse, and has requested specific examples from the FCC of alleged misuse of the procedures.

Concerned about extortions

In August, the Commission said it was concerned about parties who may be using petitions to deny licenses of applicants or allocation counterproposals to extort cash from those applicants.

A petition to deny license renewal can cost a licensee most or all of its investment in building and operating a broadcast facility, and even a brief delay can be expensive, the Commission explained.

To avoid such expense, it's possible an applicant might pay the filing party to withdraw its petition to deny, not necessarily outright, but as a fee for consulting services.

The FCC therefore proposed prohibiting an applicant from paying more money to a petitioner than was spent in preparing and prosecuting the petition to deny.

In the case of frequency allocations, the Commission tentatively suggested that parties filing counterproposals without the intention of seeking a license could be subject to a fine or forfeiture.

By some accounts, filings with the FCC have resulted in cash settlements. Washington DC-based communications attorney Robert DePont commented that in some instances interest groups have cited deficiencies in a licensee's minority hiring practices in petitions to deny.

Often, the parties enter a settlement whereby the petitioner provides consultancy services to the licensees, DePont explained.

However, according to NBMC Chairman Pluria Marshall, "from a public interest group perspective, there is no abuse" in such practices.

The Commission proposal, Marshall said, has come at the request of "self-serving lawyers" and "a few red-neck broadcasters who don't want anyone interfering with their renewals."

Petitions to deny

Marshall admitted that the NBMC has filed a number of petitions to deny against licensees "for equal employment opportunity reasons." He said that often the NBMC acts as a consultant to the licensee "to help them get their act together" after the filing.

The NBMC receives consultancy fees for their service to the licensees, Marshall said. However, he noted "there is nothing wrong" with the practice, adding that legal fees are routinely charged on a consulting basis.

"There are 15 to 20 different consulting areas in broadcasting," Marshall said. "Why should legal fees be the only legitimate ones?"

In September, the NBMC filed a request with the FCC under the Freedom of Information Act, challenging the Commission to provide specific examples of abuse of the procedures. At press time, the Commission had not responded.

> *"The Commission proposal ... has come at the request of 'self-serving lawyers' ..."*

Marshall added that the NBMC has also petitioned the FCC for an extension of the comment deadline on the proposal until after the coalition has reviewed the FCC's evidence.

Limit on cash

Despite the NBMC's protests, comments filed with the FCC generally supported more stringent methods of curbing abuses of petitions to deny and allocation counterproposals.

In particular, the NAB agreed with the Commission's suggestion of a limit on the amount of money or other considerations parties can demand for withdrawal of their filings.

Under current Commission practices, the NAB wrote, "a petitioner has very little to lose in filing a petition to deny a broadcast application, whereas an applicant ... is subject to substantial delays" by such a filing.

To "assure responsible public participation," the NAB recommended "a petitioner be limited in the amount he could receive to withdraw a petition to deny."

The association agreed with the FCC that a "petitioner should only be able to recoup the legitimate and prudent expenses incurred in preparing and prosecuting the petition."

Reasonable and prudent expenses

KLOK-AM, San Jose, CA, also agreed the FCC "should adopt its new proposed rules limiting settlements to reasonable and prudent expenses."

The station, in its comments, pointed out that the "Commission and its rules and processes exist to protect a limited public resource and to enhance the relationship between the broadcaster and the community served."

Abuse of FCC process, such as the petition to deny, "jeopardizes the legitimate transfer of broadcast properties and undermines the Commission's policies," KLOK held.

Manipulations and "coercive pressures" stemming from abuses of FCC policies "serve no public interest and should not be tolerated," according to KLOK.

The proposed Commission rules, KLOK wrote, "should effectively restrain groups or individuals from using the petition to deny process solely as a means of extracting payments in exchange for the petitioner's withdrawal."

Scrutinize settlement agreements

Media Access Project (MAP), a nonprofit public interest law firm, generally supported the notion that settlement agreements "be fully disclosed to the Commission," and that reimbursements "be scrutinized to insure against abuse."

However, the group cautioned against drawing distinctions "between settlements reached before and after the filing of petitions to deny," which MAP said "would undermine the Commission's objectives."

The "best way to avoid the kind of harm which the Commission believes has occurred" in petition abuses is "to require that every single aspect of any agreement is fully disclosed," MAP held.

Licensees should be required to implement such disclosure practices, MAP said, and failure to inform the FCC of any aspect of the agreement "should be treated as a misrepresentation to the Commission."

"As long as a licensee can represent that an improper agreement will have to be disclosed to the Commission, there will be no improper agreements," MAP explained.

The group stressed that the FCC should "avoid a blanket ban" on settlement provisions in which money is paid to third parties. "Payment for legitimate services actually rendered should not be precluded," the firm stressed.

The law firm also noted that it "almost invariably counsels against filing petitions to deny in the current environment." In most cases, MAP wrote, the process "merely wastes limited resources."

FCC docket number is MM 87-265. For additional information, contact Mark Solberg at the FCC: 202-632-7792. Contact the NBMC at 202-387-8155.

Buyout Won't Change Copycode

by Alex Zavistovich

New York NY ... CBS Records has not changed its opinion regarding copycode chips for Digital Audio Tape (DAT) recorders, despite announcements that the company will be purchased by Sony Corporation, which is developing the DAT technology.

On 19 November Sony announced it had entered into a letter of agreement to purchase CBS Records for $2 billion. At press time, CBS Records spokesperson Robert Altshuler said the transaction was "expected to be consummated by early January."

The expected purchase has led to some industry speculation about the future of the CBS Copycode chip. Both companies, however, maintain CBS Records will have the last word on whether to pursue the chip technology.

The copycode chip is designed to read a "notch" inserted into recorded digital material, which would prevent recording and, its inventors say, would discourage digital-to-digital tape piracy, mostly of CDs to R-DAT.

The copycode has come up against stiff opposition from interest groups such as the Home Recording Rights Coalition and equipment manufacturers, including Sony. Encoded source material, the groups have said, is flawed with audible distortion at certain frequencies.

With the impending purchase of CBS Records by Sony, which intends to market R-DAT technology to consumers, the fate of this concept seems uncertain. However, Altshuler maintained that Sony will not influence the development of the copycode.

In announcing the purchase agreement, Altshuler said, Sony officials maintained they were "sensitive" to the recording industry's concerns about DAT. The company reportedly said it would allow CBS Records to make its own decision regarding the copycode.

Acccording to Altshuler, Sony assured it would not attempt to impose its own opinions regarding the copycode on CBS Records, nor would it try to "adapt, modify, or change" the record company's opinion.

Sony spokesperson Jason Farrell echoed Altshuler, maintaining that Sony had "no plans regarding the chip."

"We (Sony) expect CBS Records to maintain a high degree of independence in its management, and we would not pressure a change in its stand on the chip," said Farrell.

CBS Records' opinion, Altshuler said, is that the copycode issue is not a technical issue, but one of protection from copyright violation.

"The recording industry has been looking for a way to protect song copyrights," Altshuler said. "(The copycode) is it."

At press time, CBS Records was awaiting the results of subjective copycode listening tests from the National Bureau of Standards (NBS) in Gaithersburg, MD.

NBS is investigating allegations of audibility of the copycode for the US Senate and House of Representatives, which has been considering a bill to include the copycode in all DAT machines.

However, both the Congress and CBS Records may have to wait longer than they had expected for the NBS test results. Some time in early December, NBS was robbed of approximately $8000 worth of equipment, including CD players and receivers.

NBS Project Manager Dan Flynn said the theft has caused a delay in the testing timetable.

The negotiated deal by Sony is not the first time the equipment manufacturer expressed interest in purchasing CBS Records. In November 1986 the executive board of CBS, Inc. rejected an offer of $1¼ billion from Sony.

By some industry reports, Sony's new offer includes $50 million earmarked to assure that senior level management at the company remains in place. Although Alshuler would not confirm the reports, he commented that CBS Records management would indeed remain in place.

For additional information, contact Robert Altshuler at 212-975-5047 or Jason Farrell at 201-930-6432.

Listening Tests Being Developed

by **Alex Zavistovich**

Washington DC ... Subjective listening tests being created in a NAB-sponsored study responding to the FCC's pending review of AM technical standards were at press time still under development.

The listening tests are being researched jointly by the NAB's Marketing and Policy Research department and Bronwyn Jones, formerly of the CBS Technology Center (which closed in 1986). Late in 1987 the NAB allocated $60,000 for the study.

The NAB plans to use the test results in its comments on an FCC-initiated proceeding to evaluate FCC AM technical criteria. In December the Commission granted an extension of the comment deadline on the matter to 17 June, in response to a request filed by the NAB for more time to conduct the tests.

Still in the works

Jones, who has taken an office at NAB headquarters in Washington, said in mid-December that test designs were still in the works and the actual tests had not begun.

"Development of a psychoacoustic test design is a substantial effort," said Jones.

A similar opinion was held by Richard Ducey, director of the NAB's Marketing and Policy Research Department. However, he noted the test should provide "a limited set of questions which would be a measurement of human auditory perceptions of interference."

The results, he said, should be presented in a way which would be useful in making judgements regarding allocations policy and AM improvement.

While acknowledging that she and her colleagues had not defined specifically what the tests would measure, Jones speculated they would be based at least in part on listeners' expectations of fidelity and performance.

Audience expectations may have changed since the 1940's when the FCC last held psychoacoustic tests, said Jones. "They probably have changed," said Jones, "but we don't know; that has never been tested."

Ducey added that the FCC's existing psycho-acoustic data is probably "no longer valid" in terms of today's technology.

"At minimum," he said, "the information must be updated, and it may have to be expanded to take into consideration improvements in technology."

At press time, although she cautioned that no tests had been developed, Jones said a possible test might involve a listener in at least two separate listening situations.

In the first case, the listener would hear some desired signal. Later, the listener would hear the same signal, with an added undesirable signal—such as co-channel or other types of interference.

> *"Audience expectations may have changed since the 1940s."*

Listener grade

The various situations would be ranked by the listeners on an as-yet-undetermined scale, Jones said.

On 16 December, the project team met with an NAB advisory committee, in which Ducey said the researchers were informed of various industry concerns related to the project. Ducey added "at least one more meeting" would be held with the committee before the end of the year.

Barring any problems, Jones expects to develop a final proposal for the tests by the end of January, with formal testing to be started in February.

A possible obstacle which may need to be overcome is a suitable facility. Jones commented the tests would require a "good listening room," and extensive supporting hardware and software.

One option for a test facility, Jones acknowledged, might be the NAB Broadcast Technology Center, a research center approved by the association this past fall. If the lab is available in time to conduct the study within the FCC's deadline for comments, Jones said it would be a "logical choice."

For more information, contact Richard Ducey at 202-429-5382. Contact Bronwyn Jones at 202-429-5346.

Exhibitors Visit Las Vegas Site

by **David Hughes**

Las Vegas NV ... According to both the NAB and exhibitors, the process of organizing the equipment exhibit floor at the NAB's spring show appears to be flowing without a hitch.

"It's going extremely smoothly," said NAB Exhibits Director Rick Dobson.

He hosted a 14 December walk-through to show 160 representatives of the exhibiting firms the layout of the Las Vegas Convention Center. The show will be held there in mid-April.

"While there were some specific logistical questions about individual firms' booth space, the walk-through was uneventful," he said.

Changes made

The NAB has planned changes since 1985, when the spring show was last held in Las Vegas.

Like three years ago, the NAB plans to use the Hilton Center, located next to the Las Vegas Convention Center, for exhibit overflow.

But this year the NAB also plans to use incentives to attract exhibitors and convention-goers to the overflow space. In 1985, Hilton Center exhibitors complained of poor traffic.

To encourage exhibitors to locate in the Hilton Center, the NAB plans to hold guest registration operations there. The extra hall, which features about 12% of the total convention exhibit, will open

> *"... the Hilton Center has been 'received very, very well' by the exhibitors."*

a half hour before the main floor each day of the show. The hall will also be the first stop for shuttle buses.

Also, in a change from 1985, the outdoor exhibits will be wedged between the Hilton Center and the convention center.

Dobson said that the Hilton Center has been "received very, very well" by the exhibitors.

Union concerns

Dobson maintained that there was only one "slightly hot" issue raised during the December walk-through—possible disputes with electrical unions. Three years ago, exhibitors complained about difficulties with the unions.

While the NAB will do what it can, "Basicially, things have not changed regarding the electrical unions," he said.

Dobson also reported that, as of mid-December, the floor space at the show is sold out. As some exhibitors which have already been assigned booth space make reductions, the remaining space will be made available to those on various waiting lists, he added.

NAB Exhibitors Advisory Committee Chairman Irwin Ungerleider said that no significant problems—"nothing of any consequence"—surfaced in the committee's meeting, held in conjunction with the NAB walk-through.

"We feel that the (1988 show) plans are worthwhile. Many of the fires have been put out," he added.

The next meeting of the NAB Exhibitors Advisory Committee was scheduled during the April show; a meeting planned for February has been cancelled.

For more information on the 1988 NAB Convention, contact Rick Dobson at the NAB, 202-429-5335. The exhibitors group contact is Irwin Ungerleider at Sony, 201-833-5200.

Religious Broadcasters To Meet

by David Hughes

Washington DC ... A wide range of sessions, including some focusing on engineering, and a number of equipment booths will be on tap at the National Religious Broadcasters (NRB) 45th Annual Convention and Exhibition.

The show is scheduled to be held 30 January to 3 February in Washington DC.

More than 4,000 people are expected to attend the event, which will take place in its usual venue at the Sheraton Washington and Omni Shoreham hotels.

Three-hundred exhibitors will show their wares—everything from the latest technical gear to religious programming—in 100,000 square feet of space contained in three halls.

Technical workshops

Several radio engineering workshops are planned during the show. The workshops will take place at various times from Monday to Wednesday.

Two workshops are entitled "Engineering and Technical Workshops." One of these features a satellite technology update at 11 AM on 1 February.

The second workshop, slated for 9:30 AM on 2 February, will cover AM-FM allocations, translators and "satellators," along with the "care and feeding of computers." The moderators will be Carl Smith of WCRF, Cleveland, and Richard Dean of WFMZ, Allentown, PA.

"Areas of Legal Concerns" features four workshops dealing with regulatory issues. A question-and-answer session with FCC attorneys will take place at 11 AM on 1 February. Former FCC Chairman Richard Wiley will moderate. Topics will include deregulation and license renewal.

Four workshops are planned under the overall title of "Improving the On Air Sound." Topics will focus on production issues.

Many other workshops are planned, covering black and hispanic broadcasters needs, research and audience building, TV, programming, financing and religious issues.

Exhibits, other events

Upwards of 300 exhibitors will show their wares in the three-hall exhibit showcase.

While many of the exhibitors are not equipment related, several are, including Continental Electronics, Fidelipac, BTS Group, Audio-Technica, Bogner Broadcast Equipment, Shively Labs and QEI Corp.

NRB

The majority of the firms, however, are not equipment manufacturers. Many religious programming organizations will exhibit including the CBN Radio Network, The Inspirational Network, LeSea Broadcasting, the Moody Broadcasting Network and God's News Behind The News.

In addition to the exhibit floor and sessions, many other events have been scheduled.

Both President Ronald Reagan and Vice-President George Bush have been invited to speak at a "Presidential Plenary" session on 1 February. An "FCC Luncheon" has been scheduled at 12:30 PM on 2 February, with TV preacher D. James Kennedy slated to be the speaker.

Presidential candidate Pat Robertson will also address the delegates.

For more information, contact the NRB at CN 1926, Morristown NJ 07960, or call 201-428-5400.

New McMartin Buys Assets of Former Co.

by Alex Zavistovich

Gunnison CO ... McMartin Industries of Council Bluffs, Iowa has purchased by auction the assets of Gunnison, Colorado-based McMartin International, in what may be the final chapter in the latter company's demise.

An auction of the assets of McMartin International was held on 16 November in Gunnison.

The auction was conducted to recoup some of the money loaned to McMartin International President Ray McMartin by a consortium of banks—the First National Bank of Gunnison, Gunnison Bank and Trust, and the Crested Butte State Bank.

Together the banks had loaned approximately $250,000 for the establishment of McMartin International in Gunnison.

The company was to have been Ray McMartin's successor to McMartin Industries—an Omaha-based broadcast equipment manufacturer which filed for bankruptcy in 1985, but has since been revived under new owners.

After McMartin International began operations, the original McMartin Industries was purchased by a California company, which retained the company name and began new operations in Council Bluffs, Iowa on 15 September.

McMartin International's assets were seized by the state of Colorado for failure by Ray McMartin to pay $5100 in state withholding taxes.

Only fraction raised

The consortium of banks which had underwritten McMartin's Gunnison venture had hoped that proceeds from the November auction of the company's assets might regain some of its nearly quarter-million dollar loan. However, the auction was able to raise only a fraction of that sum.

McMartin Industries VP/Finance John Miller said his company purchased work in progress, finished goods, patterns, drawings and inventory at prices "considerably below cost."

Although Miller would not disclose the auction price, Bob German, of Broadcast Technology of Colorado, estimated that the banks got between $16,000 and $18,000 from the bidding.

German, formerly director of engineering for McMartin International speculated that such a small return has harmed the financial status of the banks.

'They (the banks) have to be hurting," German said after the auction. Spokespersons from the financial institutions declined to comment.

Customers' interest

The purchase of McMartin International's assets by the Iowa-based McMartin Industries was seen by Miller as an act in the interest of McMartin's customers.

"We had to take care of the customers, to get their equipment out of there," Miller commented.

He added, however, that the company was unable to purchase all of the service work outstanding at McMartin International.

At last report, Ray McMartin had moved on from TTC, where he worked as a consultant during the Colorado Springs company's divestiture of the Ampro-Scully line. Rumors at press time were that McMartin was planning to purchase an "SCA franchise" in Colorado Springs, although the nature of the franchise was undetermined.

McMartin could not be reached for comment.

For additional information. contact John Miller at 712-366-1300. Contact Bob German at 303-641-5503.

Digital Audio on a Floppy Disk

by Tyree Ford

Baltimore MD ... This month's edition of the *Producer's File* is about a device that has been hanging on the leading edge of audio technology for at least two years. Is it digital? Yes! Does it record and play back? Yes!

What's the bandwidth? 15 kHz ... certainly wide enough for FM. The recording time? Just over seven minutes in stereo, twice that in mono. Can you edit on it? Sort of.

It doesn't currently have the RAM (Random Access Memory) to allow full-scale cut and paste yet, but you can trim and loop with a "dumb terminal" or personal computer. Any guesses? If you guessed the CompuSonics DSP 1500 you're right!

It was sometime in the middle of last summer when David Schwartz was able to ship me "a recently updated" version of the DSP 1500. He had just moved the firm from Colorado to Palo Alto, CA.

Amid cries of "Snake Oil!" and "Heresy!", CompuSonics dared to believe that broadcasting's trusty friend the cart machine was becoming obsolete.

David and I had many conversations in which the conservative nature of broadcast engineers was discussed.

They would not likely put their buns on the line for some "new fangled" idea that would become just a flash in the pan. Especially on something as foreign sounding as "a Bernoulli Box." (If it had been a "Marconi Box" they might have seen it differently.)

Digital debate

These conservative attitudes were being stoked by the cart machine manufacturers who were tightening their analog specs and at the same time secretly working on ways to digitize their existing tape paths.

Having recently lost market shares to broadcast CDs, they were not about to give in to the concept of digital audio on floppy disc.

My talks with electronics manufacturers outside the broadcast industry concerning radio production resulted in answers including phrases like "just around the corner," or "at the next convention."

Calls to PPG, Lexicon and Akai resulted in pleasant but disinterested responses concerning the radio production market. The real dollars are in video post-production audio sweetening.

As amazed as I had been by the SoundDroid, its mass production was never realized. "Too expensive and too radical for radio station production" were nails in its coffin.

Try telling any chief engineer you know that New England Digital's keyboard-operated Synclavier was the answer, and most of them would look at you like you were nuts.

Right or wrong, if they couldn't figure out how it worked, you certainly couldn't expect some lightweight DJ to do anything but break it.

Rugged, foolproof and reliable were the words these people wanted to hear. Nothing less would do. It is toward these goals that CompuSonics has been trudging with the DSP 1500.

The concept is simple: digital audio on floppy disk. Actually the disk is inside a hard plastic enclosure called a Bernoulli Box. It's like a 5¼" version of the 3" diskettes used with an Apple computer.

Similar to cart deck

The DSP 1500 functions the same way a cart machine does, with a few differences. Each time you use a new disk, the machine must first initialize or format the disk. This takes about 15 minutes per disk. For convenience, CompuSonics sends the disks already formatted.

The disks are not cheap, but CompuSonics offers them at a substantial reduction relative to the manufacturer's regular list price.

A 25 disk carton from CompuSonics is a little over $600. That includes 12 disks at 20 Megabytes, 9 disks at 14 Megabytes, and 4 disks at 7 Megabytes.

Producer's File

CompuSonics' John Stautner also mentioned that the boxes were to be found at your local Radio Shack.

A call to mine revealed that they didn't have any at the store, but had them pool stocked two days away by express mail. Each 20 Mb disk bought this way costs $99!

Recording time

Because of the way the DSP 1500 encodes the audio, total recording time varies. Factors like complexity and loudness use up disk space faster.

In addition, there are three disk speeds. The slow speed, with a 4 kHz bandwidth yields about 18 minutes in stereo. The fast speed provides 4:40 in stereo on a 20 Mb disk.

While CompuSonics claims that a 20 Mb disk will hold just over seven minutes of 15 kHz bandwidth stereo, I was able to get over eight minutes of synthesizer before running out of space. Double these times for mono use.

Right now, Iomega of Roy, UT is the only company making Bernoulli Boxes, although according to David Schwartz a Japanese firm has just been licensed to produce them.

With IBM, Hewlett Packard and Apple making drives for the box, the increased demand should provide a volume of sales that will result in lower prices. Remember, I did say we were on the cutting edge here.

Set-up steps

When I received my first DSP 1500 earlier this summer, I quickly read the 50 page manual before firing the unit up. The manual is well laid out and does a good job of explaining installation and operation procedures. Circuit board layouts and schematics are available upon request.

The front panel is very simple; a power switch; start, stop and cue buttons; three multi-function buttons; two rotary pots for setting record levels and two VU meters.

In addition, there is a back-lit LCD panel which titles the multi-function buttons, shows record time during recording, the time remaining during playback and the cut number currently cued or playing. It also asks twice if you really want to erase the disc.

According to the manual, up to 12 secondary and tertiary cue tones may be entered in each audio cut during record or playback. They may also be deleted during playback.

That's about as far as you can go without help from a video display terminal or a computer. An additional set of commands is available by entering the PC Interface Mode.

Computer control

The DSP 1500 comes with a RS-232 serial port, a CMOS remote port and a parallel port, all mounted on the back.

The terminal or computer you use should have its serial port set for 9600 baud, 8 data bits, 2 stop bits, no parity and x-on/x-off (handshaking) enabled.

The first advantage of computer interface is the ability to delete the last cut on the disk.

Say you were assembling audio bits for morning show drop-ins and you screwed up a mix move while recording your last bit. If you had used a standard tape cart you would've had to start all over again with a blank cart.

When controlled by a computer, the DSP 1500 lets you erase the last cut and start all over again. In fact you can keep erasing one by one all the way back to the first cut!

You can also delete a cut without erasing it. The cut will still be on the disk, but won't show on the screen until you reclaim it. This could be a handy feature for anyone with lots of bits who wants to streamline the screen display during show prep.

Each cut is identified by number, name, your comments, speed, stereo/mono, length and whether it is deleted or looped.

Looping audio cannot be accomplished without a terminal. With it you can trim unwanted audio from the front or back of your recorded sample to improve its continuity.

Work on new software is now in progress to allow cut and paste editing. The company hopes to show this updated feature at the spring NAB show.

David noted that all existing DSP 1500's could be inexpensively updated with the enhanced editing capabilities. He felt $50 or less should cover the update costs.

Test drive

My first practical use of the DSP 1500 came when I needed to record a series of in-store announcements. A simple job really. Read 20 or so scripts over an instrumental jingle bed.

(continued on page 22)

Building a Team That Works

by John M. Cummuta

Downers Grove, IL ... Whether talking sports or business, we hear a lot about "teamwork," and "team-spirit" these days; but what exactly is teamwork?

In fact, it might be more beneficial to begin with the question, "What is a team?" And why should I want to build one? What will it do for me?

First of all, a team can simply be defined as two or more people moving along a path of interaction toward a common goal.

There are several key terms in that definition, without which we won't have a team, or any of the good things that can come from assembling one.

For example, if we don't have two or more people it would be hard to describe ourselves as a team. That's self-evident. But how about the expression "interaction?"

Without effective communications going on among the two or more people, presumably working toward a common goal, there will be no teamwork or any of the other potential benefits of team activity.

It should also go without saying that if the group doesn't have a common goal or vision to work towards, they're just an assembly of acquaintances—not a team.

Why build a team?

A team can accomplish more than any of the individuals can by themselves; and when properly managed, can outperform the collective productivity of the individuals added together.

The old adage that the whole is greater than the sum of the parts is an accurate description of a successful team effort.

That amazing productivity multiplication happens because each team member is usually allowed to concentrate in an area in which they're strong. They can center their performance on their own gifts.

Most times when a person is acting individually, he or she is saddled with both strengths and weaknesses. An example is a tax consultant who is fabulous at the intricacies of tax laws, but is very uncomfortable dealing with strangers.

Engineering—Manager—

This weakness dramatically interferes with his or her ability to develop customers and become successful.

However, if the consultant teams up with an outgoing and friendly receptionist/secretary, the resulting business will probably outstrip the economic potential of either person individually.

The receptionist's strengths compensate for the consultant's weaknesses and vice versa. The resulting team output is greater than the sum of the parts.

Grand-slam team

A good example of this principle is the power-hitter on a baseball team's lineup. That's usually the person with the most strikeouts as well as the most homeruns. Team management knows that hitting for a high average is usually not a power-hitter's strength, so they usually put high-percentage batters up before him, so when he clears the fences with a blast, several runs cross the plate.

The less-powerful, more-consistent hitters have strengths that compensate for the power-hitter's weaknesses. That's a team.

Another crucial benefit of having people concentrating on their strengths is that they are usually much happier working that way.

Individual needs

While each team member brings his or her strengths to the group, each also brings certain needs that the effective manager must understand and meet—as much as possible.

Each member needs to use individual skills and gifts to assist the team's efforts. A certain amount of individual identity is established in the perceived value of that contribution and those skills.

A common error committed by many inexperienced managers is simply stuffing people into the tasks that "need to be done," rather than seeking to use each employee in such a way as to benefit the productivity of the department or business, while simultaneously letting the person contribute via his or her unique gifts.

Anything else is just trying the age-old losing game of pushing a square peg into a round hole.

Each team member needs to be accepted by the other members. Not only as a person, but also as a contributor of valid ideas.

Personal and team goals

This sense of belonging is critical, and cliques or other relationship isolation problems can destroy productivity. They frequently cost managers some of their best potential employees.

Each member needs to pursue team goals, compatible with personal goals. This is considered by many experts to be the most important need a team member brings to the group.

A manager is challenged to try to task his team members, indeed to choose his team members in the first place based on their personal compatibility to the team's goals.

The engineering manager should keep this in mind in cases such as when considering a very state-of-the-art oriented technician, while your station's equipment is "old faithful."

Technicians on the cutting edge would probably not be happy maintaining equipment, when their personal goals lie more along the road towards the horizons of technology.

Building a team

Having a clearly defined team goal or mission is the most critical element in successful team building.

As the Bible says, "Without a vision the people perish." There can be no focused effort without a clear purpose and goal.

The members of the team need to "own" the goals. The way to accomplish that is to have them participate in the development of those goals.

This helps in two ways: your goals will be stronger from everyone's input, and the individuals will work harder for their accomplishment.

The most subtle, yet possibly most important element of team building is the identification and influencing of the roles team members play.

Good and bad roles

A list of these roles will give you a good idea how they impact team dynamics.

The positive roles you'll see team members assume are: organizer, initiator, data collector and facilitator.

These are all roles that contribute to team effort.

Dominator, blocker, attention seeker and avoider are the negative roles team members can assume that destroy team effectiveness.

The bottom line is that from the sands of Iwo Jima to the board rooms of old Wall Street, effective team-work is what shapes the world. It's what generates success. It can work for you if you know how it works.

John Cummuta is president of Marketline, a broadcast management and marketing consulting firm. and a regular **RW** *columnist. He can be reached at 312-960-5999.*

TDR Reveals Problems in Coax

by Tom Vernon

Harrisburg PA ... Most technical problems that crop up in the average station can be handled with conventional test equipment, DVM's, signal generators and oscilloscopes.

But there are some types of problems that can only be handled with specialized gear. Locating problems in transmission systems is one such area.

When problems with coax develop, the Time Domain Reflectometer, or TDR is probably your best ally.

The TDR relies on transmission line theory for its operation. Lines terminated in their characteristic impedance will have no reflections.

Lines not properly terminated, or having other problems that would disrupt impedance, will have reflections.

These other problems include cable abrasions, changes in the characteristic of the dielectric, bad connectors, antenna problems or water getting into the transmission line.

Detecting problems

A block diagram of a TDR is shown in Figure 1. A step generator is connected to the line being tested via a diplexer.

Station Sketches

At the same time that a pulse is sent down the line, a sawtooth waveform is applied to the horizontal channel of the oscilloscope. The signal returning from the line is coupled to the vertical channel.

The horizontal channel is calibrated in feet, or meters. The vertical channel is calibrated in p units, which we'll discuss later.

Any kind of anomaly that is present in the line will cause reflections, with different problems causing varying displays or signatures on the screen. The distance to the anomaly is indicated on the horizontal scale.

If this process sounds a lot like radar, it is. TDR is also known as "wire radar" in some circles, because the operating principles are quite similar.

Figure 2A illustrates the pulsed output of the TDR while Figures 2B and 2C show different types of reflected signals. Usually the reflected signal is superimposed on the incident signal.

Type of fault

The type of deformation of the reflected signal is related to the characteristic impedance of the line, as well as the type of fault.

A rising waveform occurs when an inductive fault exists (open circuit) because the incident and reflected signals are in phase and add together, as illustrated in Figure 2B.

A falling waveform indicates a capacitive fault (short circuit) where the incident and reflected waves are out of phase and cancel out. This condition is illustrated in Figure 2C.

Other less dramatic problems may also be observed. A step in the trace usually indicates that a cable with a different impedance has been spliced into the line.

A series or shunt loss reveals itself as a rising or falling trace. Splices, connectors or cable abrasions show up as small bumps on the trace.

With practice, an operator can become skilled at interpreting the bumps, sags and steps into real world cable faults.

The p scale on the vertical axis mentioned earlier is really the reflection coefficient, determined by the formula: p=Er÷Ei, where Ei is the incident pulse and Er is the reflected pulse.

Typically the vertical scale is calibrated in milli-p per division, for 50 ohm cable, with limits of −1 to +1 p. The −1 p corresponds to a short circuit, and +1 p to an open circuit.

In practice

Practical operation of the TDR is a bit more involved than the theory, and there are some limitations to what this device can do.

Usually a TDR cannot withstand any voltage on the line being tested. Cables must be disconnected, and the ends shorted to discharge any static built up on the line.

Cables must be securely attached to the TDR. This usually means having a good collection of RF adapters on hand.

The use of jumper cables or clip leads in this instance will disturb system impedance and render all measurements invalid.

The impedance of the TDR must be matched to the cable under test. Most TDRs are set up with a 50 ohm standard, and impedance adapters for 75, 93 and 125 ohms are available.

It's difficult to get a good trace from a noisy cable and several types of isolation networks are available as accessory items.

VSWR calculations

It's possible to calculate worst case VSWR with the TDR by using the formula:

$$VSWR=(1+|p|)\div(1-|p|)$$

Operating VSWR is a bit more complex, since reflected waves in a system combine in a complex manner, and this cannot be determined with the TDR.

Other testing limitations stem from the fact that the TDR is a narrow band device.

To analyze bandwidth characteristics of a transmission system, frequency domain techniques are often employed. This is easily accomplished with a network analyzer.

Some types of cable faults, such as insulation breakdown, don't show up with a TDR, but can be detected with a bridge type transmission test set.

New installations

While the TDR is often used to troubleshoot high frequency transmission systems, it's not a bad idea to document these installations when they're new. In this way, a known good signature is available as a reference if trouble develops later.

To this end, some TDRs have a strip chart recorder in place of a CRT. Others have special output connections for an external strip chart recorder. Barring this, a scope camera can be used to record images off the screen.

Another advantage of the chart recorder is improved horizontal resolution. While the display is necessarily compressed horizontally to fit the CRT, it can be expanded on the chart recorder.

The TDR is a valuable tool in the evaluation of transmission lines and antenna systems. While their cost makes ownership expensive, many test equipment rental organizations have TDRs available for reasonable weekly and monthly rates.

Tom Vernon, a regular **RW** *columnist, divides his time among broadcast consulting, computers and instructional technology. He can be reached at 717-249-1230.*

Figure 1. The Time Domain Reflectometer sends a pulse into the transmission line, and displays the reflected image on a CRT or strip chart recorder.

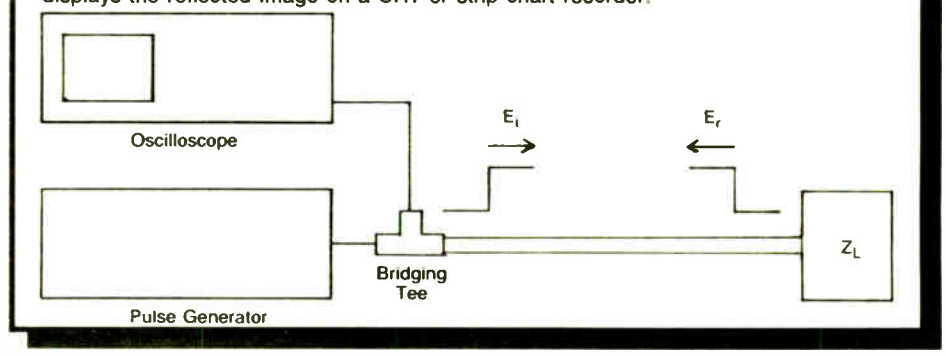


Figure 2. A, B, C. TDR Waveforms. A. "Ideal" cable terminated in characteristic impedance. B. Display of open circuit. C. Display of short circuit.

Indecency Policy Still Not Clear

by Alex Zavistovich

Washington DC ... Preliminary reactions from some broadcasters suggest the FCC's most recent decision on the airing of indecent programming is vague.

In response to the decision, the NAB is pondering possible legal action, and some broadcasters are banding together to inform the public about the problems of censorship.

On 24 November, the FCC affirmed its findings of an April 1987 indecency decision against three stations. In doing so, the Commission determined that midnight to 6 AM comprised a period during which children would either not be in the audience or could otherwise be monitored by parents.

Broadcasters who intend to air "blue" material may do so between midnight and 6 AM, providing the programming carries appropriate warnings, the FCC said.

Beyond the seven words

The Commission also broadened its concept of indecent material from the George Carlin list of "seven dirty words" to the generic definition of broadcast indencency approved by the Supreme Court in 1978.

The Commission upheld its finding of indecency against three broadcast stations—KPFK-FM, Los Angeles; WYSP-FM, Philadelphia; and KCSB-FM, Santa Barbara.

These stations, the FCC held, did broadcast indecent material, although the broadcasts did not necessarily use the seven dirty words which had previously been used by the FCC as an informal indecency standard.

The FCC noted in the decision that it applied the generic definition of indecency as approved by the Supreme Court in its landmark ruling involving Pacifica-owned WBAI-FM, New York.

By that definition, indecency is "material that depicts or describes, in terms patently offensive as measured by contemporary community standards for the broadcast medium, sexual or excretory activities or organs."

Such material may not be broadcast especially at times of day when there might be a reasonable risk of children in the audience, the FCC noted.

As for determining the period when there would not be a risk of children in the audience, FCC General Counsel Diane Killory said the Commission would "rely on parents to supervise any children remaining in the audience" after midnight.

The cut-off point for the period is 6 AM, which Killory said was based on the Howard Stern case—the New York DJ's show runs from 6 AM to 10 AM.

"If a program is adult—not obscene—programming and appropriate warnings are put on with the program, it can be aired after midnight," Killory said, stressing that obscene material "cannot be aired at any time."

Killory commented that the decision "differs from earlier rulings in which the burden could have been placed on the broadcaster to show there was not a reasonable risk of children in the audience."

Questioned as to what broadcasters can use in their determinations of indecency, Killory acknowledged, "all (they) have to go on is the specific cases the Commission decided."

The Commission had "never tried to give you a blueprint for anything that might ever come within the parameters of indecency," Killory maintained. She noted that "(broadcasters) can't make a judgment based on an abstract."

Vague decision

For broadcasters concerned about how to decide whether programming is indecent, the Commission's pronouncement did not seem to make things any easier.

The NAB and Pacifica are remaining noncommittal about their reaction to the decision, although both groups expressed concern about the vagueness of the decision.

In a statement issued 24 November, NAB Senior VP and General Counsel Jeff Baumann said the association had "grave concerns as to whether or not the FCC's indecency policy is too vague." He said the NAB will "have to examine the document very closely to determine whether legal action is in order."

"At least the FCC saw fit to establish a safe harbor of midnight," Baumann said.

No further comments were available from the NAB, pending the release of the full text of the decision from the FCC.

Pacifica Broadcasting's attorney in Washington DC, William Byrnes, also noted that the decision was "vague." He maintained it seemed to imply that the "Commission could consider anything" in its indecency rulings.

However, like the NAB, Byrnes chose not to comment specifically on any aspect of the FCC's statement until after the release of the full text.

The FCC's statement on indecency has also reinforced the position of organizers of Open Ears/Open Minds, a grass-roots broadcasters campaign. The campaign, at press time slated for 1-7 January, will devote a week of programming to the examination of censorship in the US.

According to event spokesperson Melanie Collins, Open Ears/Open Minds responds to the FCC's 16 April ruling on indecency and "takes on even more significance in light of the FCC's 24 November 'clarification.' "

Among the special programs expected to be broadcast during Open Ears/Open Minds is *Hear No Evil*, produced by KPFA-FM, Berkeley, CA. The Pacifica-owned station's program will focus on the "devastating effects" of censorship on cultural and political ideas, Collins said.

For more information, contact Renee Licht at 202-632-6460. Contact Melanie Collins at 404-523-3471.

Geometric Proximity Correction

by Tom Osenkowsky

Brookfield CT ... In last month's installment I discussed specific application of talkdown error vectors to geometric proximity correction.

Let's examine a four tower in-line array I designed having tight nulls which are representative of nighttime operation and highlight the worst case for theoretical proximity correction.

Figure 1 shows the design parameters and field calculations using FCC formulae and methods.

RF Reader

For the purpose of illustration, we will examine the null and major lobe only. Since this is a symmetrical array, the complimentary nulls are not shown.

Adjustments

When we set up our array, we may adjust our inverse fields to fall between the theoretical and standard (or modified standard) pattern limits.

Assuming a 15% "comfort zone," if we adjust our minima and null fields to .85*Estd, we can no longer expect our array to be adjusted to the theoretical specifications.

This is to say nothing of ground conductivity, FIM calibration and orientation, terrain roughness, etc. All of these factors affect our determination of the actual radial IDF.

It should now be obvious that application of theoretical parameters to proximity correction formulae may not be very accurate.

As a bit of review, let us consider that the standard pattern equation, as shown in Figure 2, is a quadratic expression. This means that the amount of increase above theoretical is greater for the minima than for the lobes.

Bear in mind that parameter manipulations have a far greater effect on the minima than they do on the major lobe(s) as well.

Therefore, depending on the input parameters to the proximity formulae, widely varying results are possible.

Inaccurate factors

The most inaccurate correction factors are centered around those parameters whose real and/or imaginary components have a zero or near-zero value.

The ERROR program which appeared in last month's column can determine the vector sum components for your particular array.

With the realization in mind that the theoretical parameters may not be the optimum choice for use in conjunction with proximity correction, we need to establish a method for determining what parameters to use.

We must determine what the complex value of radiated field is for each element in the array. This may be accomplished by using the actual antenna monitor readings with an associated set of error vectors for each azimuth requiring proximity correction.

By utilizing the previously described talkdown procedure, we may determine the error vector value for each minima radial.

(continued on page 18)

Figure 1.

TWR	Spacing	Phase	F Ratio	Orient
1	0	0	1.000	0
2	90	135.1	2.039	313
3	180	-90.7	1.766	313
4	270	37.3	.62	313

Azimuth	Eth	Estd
4.0T	19.9	27.58
44.0T	11.7	21.8
133.0T	990.4	1040.1

Figure 2.

$$E\ std = 1.05 * Sqr(Eth^2 + Q^2)$$

Figure 3.

TWR	Spacing	Phase	F Ratio	Orient
1	0	0	1.000	0
2	90	137.1	2.079	313
3	180	-90.7	1.746	313
4	270	37.3	.62	313

Azimuth	E
4.0T	26.7
44.0T	21.4
133.0T	999.63

Tabulation of Proximity Correction Factors

Azimuth	Original Array Distance (mi)	Factor
4.0T	.1	.102
	.2	.388
	.5	1.209
	1.0	1.174
	5.0	1.033
44.0T	.1	.042
	.2	.082
	.5	.246
	1.0	.601
	5.0	1.305
133.0T	.1	1.387
	.2	1.207
	.5	1.086
	1.0	1.044
	5.0	1.008

Azimuth	Actual Array Distance	Factor
4.0T	.1	.139
	.2	.860
	.5	1.552
	1.0	1.168
	5.0	1.025
44.0T	.1	.074
	.2	.135
	.5	.334
	1.0	.578
	5.0	.938
133.0T	.1	1.389
	.2	1.207
	.5	1.087
	1.0	1.044
	5.0	1.008

Dealing With Vertical Plane Nulls

by W.C. Alexander

Part II of III

Dallas TX ... In the last installment, we discussed in detail the causes of obstruction-induced multipath and some of the techniques that can be used to combat it.

In this part, we will take a look at vertical-plane nulls, where they occur, what can be expected as a result and how to eliminate the problem.

All FM antennas exhibit some directivity in the vertical plane. The majority of the radiation in a non-beam-tilted antenna will be centered on the horizon, or at an elevation angle of 90°.

The amount of directivity in this plane is dependent on the number of sections or bays the antenna has and, conversely, the gain of the antenna.

It is good that antennas are directive in this plane, for if FM antennas were truly omnidirectional in both the horizontal and vertical planes, a tremendous amount of power would be wasted as radiation straight up, straight down, and in every elevation in between.

The vertical plane directivity is how the antenna achieves its gain. Lower gain antennas are not very directive in the vertical plane.

As was mentioned in Part I, two-bay antennas, such as are often used by Class A stations, have an extremely broad main lobe in the vertical plane.

As the number of sections is increased, so is the directivity in the vertical plane (not to be confused with vertical polarization).

The main lobe, which is normally centered on the horizon, becomes sharper and sharper as the number of antenna sections is increased.

The result is a higher gain antenna.

The side effects are that the power being radiated from the antenna is concentrated in a relatively narrow band of elevations, thus nulls (where the relative field drops to zero), become present at specific elevation angles.

Antenna manufacturers will provide their customers with vertical plane radiation patterns, such as is shown in Figure 1. The main lobe is clearly centered on the horizon, and as the elevation angle decreases, so does the relative field, until the first null is reached.

Beyond the first null, as the elevation angle continues to decrease, another lobe is present. Below this minor lobe is the second null.

While these nulls usually occur in an area close to the antenna site, antennas with more bays and those mounted on tall towers create bands at fixed distances around the antenna site where the direct-path field strength is zero.

These bands directly correspond to the first and second nulls, and their position is easily calculated using simple trigonometry.

For example, the distance to the null area from the base of a tower with a ten-bay, non-beam-tilted antenna (which has the first null at −6°) with the center of radiation at 1000′ AGL, can be calculated.

First subtract 6 from 90° to get the depression angle (84° in this case), then

(continued on next page)

Error Vectors and Proximity Correction

(continued from page 17)

Although one may elect to use algebraic correction to the antenna monitor, I prefer to use complex error vector averaging which is readily performed by computer.

The latter is more accurate especially in light of the fact that asymmetry may indeed exist on symmetrical arrays, etc.

The most accurate results are obtained when using the complex-averaged antenna monitor readings with associated error vector components for each radial azimuth.

For the sake of clarity, I am going to represent the array shown in Figure 3 in its usual form.

These parameters would normally be represented as the cume difference between the theoretical parameters and those shown which represent how the array is actually adjusted.

Note that our pattern values approach but do not exceed the standard values.

The error vectors that normally would be (inverted and) added to the antenna monitor readings would be the result of actual adjustment plus reradiator influence, sample element location, sample line length and so on.

Note the differences in the amount of correction for each distance on each radial. Certainly the analysis of a proof-of-performance would yield different values of inverse field for each case.

However, by using the original theoretical parameters, our analysis would be confined to the results obtained by that usage as opposed to the more realistic case.

Note that the K factor of 233.04 was used to determine the fields in Figure 3.

It is hoped that a more accurate solution to the geometric proximity problem has been demonstrated. I will endeavour to include a real world working example of this method when the need for proximity arises.

Tom Osenkowsky is a radio engineering consultant and president of MASTER Software, and a regular **RW** *columnist. He can be reached at 203-775-3060.*

Practical Solutions To FM Antenna Nulls

(continued from previous page)
find the tangent of that angle (9.51), and multiply by the height of the center of radiation (1000'). In this case, the result is 9514', or 1.8 statute miles.

A 1500' tower with the same antenna would have the first null on the ground at 2.7 statute miles from the base of the tower.

A band located at a radius of 1.8 statute miles from the base of the tower will be receiving a direct-path field strength of zero from the station.

> *First null-fill is easily accomplished in the construction of the antenna.*

Inside this band, reception will vary, but moderate to severe multipath can be expected in most cases on either side and, if the site is part of a large antenna farm with numerous other FM and TV antennas, front-end overload and mixes in the receiver will make satisfactory reception impossible.

In many cases, the area within a few miles of the antenna site will be of no concern. These are often rural areas with small populations.

In some cases, major arteries traverse the area, or bedroom-community suburbs lie inside the null area, making elimination of signal problems in the null necessary.

First null-fill is easily accomplished in the construction of the antenna. Values from one to ten percent are common.

In an antenna utilizing ten percent first null-fill, the null is, very simply, filled with a ten percent relative field.

Instead of dropping to zero in the null, the field drops to ten percent of the maximum. This is normally more than enough to solve any reception difficulties caused by the null.

Null-fill has another added advantage. By filling the null, the main lobe in the vertical plane is broadened considerably.

This does lower the gain of the antenna somewhat, but it results in more radiation on the ground in the coverage area (often called the "umbrella").

Second nulls occur at a much lower elevation angle than the first, and are usually so close in to the antenna base as to present no problem

If it is an area of concern, a small amount of second null-fill, usually in the order of one or two percent, can be used, again at the expense of lowered antenna gain.

As a rule, the broader the main lobe in the vertical plane, the better the penetration that will be achieved in the coverage area.

The visible light comparison would be

(continued on page 25)

Figure 1.

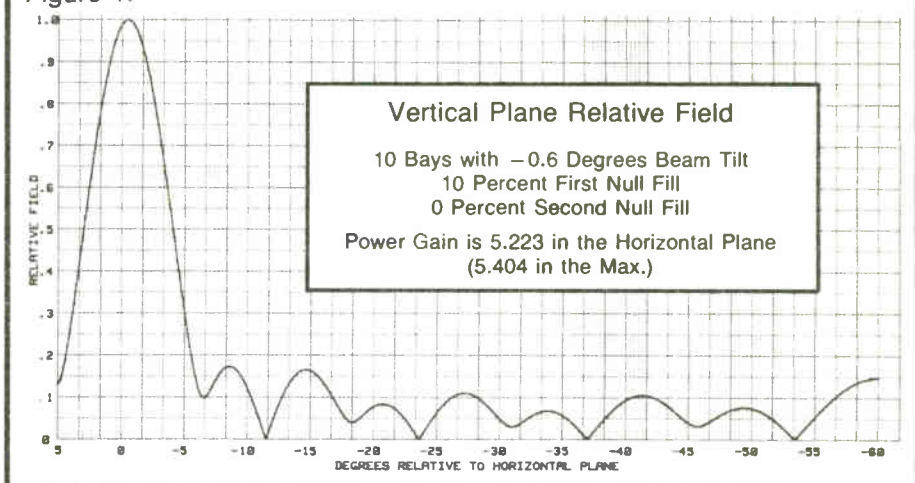
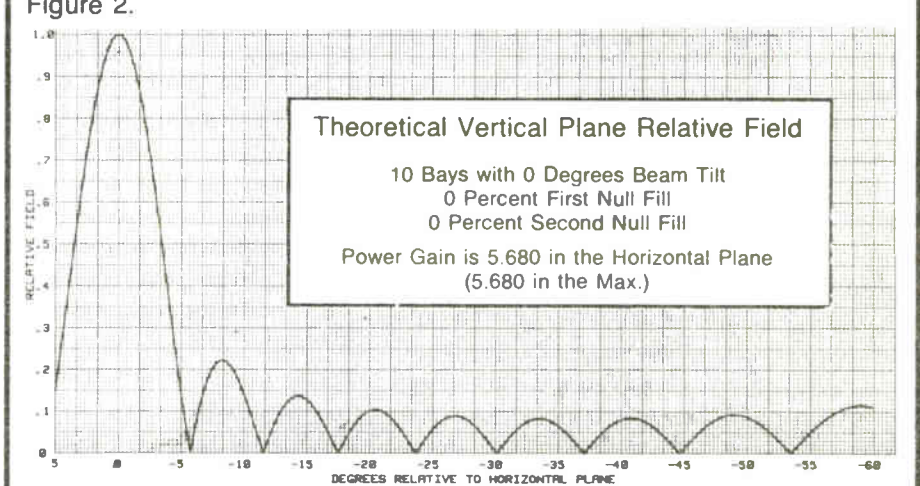


Figure 2.



An important letter to the industry:

HARRIS

ALLIED Broadcast Equipment

Today's broadcast environment is more competitive than ever. To keep pace, your station needs to rely on the strongest team possible, in every area.

When it comes to radio broadcast equipment, now there is one strong team you can always count on: The Harris and Allied team. The combined forces and resources of Allied and Harris together form the strongest team in the industry. And it's easy to put our team to work for you.

Whenever you call Allied -- the leading full service broadcast distributor, or Harris -- the largest full service radio transmitter manufacturer, you tap into the total resources of both of our companies. Because every Harris radio field representative and every Allied office in the U.S. now represents our entire combined product lines, through our separate sales organizations.

No other source can give you the total product selection, one-call convenience, depth of inventory, and field support service of the Harris and Allied team. All at unbeatable prices. It's a total service and value commitment only Allied and Harris can deliver.

So the next time a Harris or Allied Representative calls on you, or when you call Allied or Harris, expect a greater level of convenience and service than you've ever experienced before.

From the studio mike to the transmitter, and everything in between, the Harris and Allied team can do it all for you. Just give Allied or Harris a call and let us show you.

Ronald C. Frillman
Manager Domestic Radio Sales
Harris Broadcast Division
(217) 222-8200

Tom Harle
Sales Manager
Allied Broadcast Equipment
(312) 470-0303

The Adventures of Corky Culver

by Peter Hunn

Westport NY ... Nestled in the rolling hills of one of our country's finest states sat radio's most efficient station.

This particular pint-sized broadcast facility faithfully sent 250 W worth of its "sumthin'-for-everyone" format into a sturdy 150' tower.

The three-roomed station, staffed by as many people, was owned by a Mr. Myers—a gentleman with two, distinct characteristics.

(1) He was an extremely knowledgeable radio engineer, and (2) he had a patient, forgiving personality topped off with an easy-going voice that closely resembled that of Bing Crosby.

Although he enjoyed children, Mr. Myers had never had any kids of his own.

So it was only natural that the kindly station owner would take a liking to Corky Culver—a shy high school student who showed up at the broadcast facility looking for an after school job.

Corky gets his first break

"Uh ... um ... sir, I guess I'm pretty good with electronic gadgets ... and ... um ... I'd like to apply for the position of part time technical helper."

> *That was a week that the little station will never forget.*

"Well now son," Mr. Myers smiled, "looks like this is your lucky day. You see, the Missus was just saying how nice it would be if I could find a bright young fellow to hire as the assistant engineer."

"How's about starting this very afternoon? Yes, it will work out fine, because once you learn the ropes, I'll be able to take a few days off. Won't that be dandy?"

"Oh boy! Swell!" Corky Culver cheered.

The truth was that Mr. Myers could have taken a few days off prior to Corky's arrival.

In fact, he could have taken leave to ride an 18" bicycle backwards to New Zealand, and the station's simple equipment chain would have easily survived his absence.

In such a tiny facility, known for its conscientious DJs, there was only so much for a technician to do. In any event, Mr. Myers broke Corky in, and, in time, left on a seven day vacation.

That was a week that the little station will never forget.

Remote—by mistake

It wasn't long before Corky Culver, assistant-part time engineer, felt comfortable in his new post.

And, with Mr. Myers gone, Corky's once reticent nature gave way to an overzealous determination, one bent on inventing dozens of revolutionary devices that would improve the broadcast industry.

"This new five tube, superhetrodyne unit that you see resting on the back of the water closet," he instructed the afternoon DJ, "serves both as an auxilliary amplifier and timed, spring-locked door control."

"It is especially designed so that when an announcer is, shall we say, indisposed, he can hear the broadcast program on this overhead speaker."

"Also, when the rest room light is switched on, the door closes and will lock for 2.5 minutes (the average length of a popular record)."

"Theoretically, the door lock should release just in time to remind the DJ to return to the studio before his song runs out."

"So, remember," assistant engineer Culver warned, "the door will stay locked for 2.5 minutes exactly!"

Well, as it turned out, it wasn't precisely two and a half minutes ... it was more like 25 minutes before the invention's sticky relays finally let go of the door-lock device.

Unfortunately, at the time of the malfunction, the afternoon drive DJ was utilizing the locked room for its most popular purpose.

"Let me out!" the announcer yelled. "I'm stuck in the bathroom, and I can hear my record running down!"

"OK, don't panic," the morning DJ/GM directed from the hallway. "Just keep calm, and look down at the bottom of the door."

Even though Corky's emergency slide rule calculations indicated that, until the auto-lock cooperated, nothing could be done, a poorly-fitted rest room door allowed the manager to slide a lavalier mic to his trapped co-worker.

"What in the world can I say in here?" the embarrassed on-air man asked.

"Just tell as much of the truth as possible without resorting to words like potty. And, talk softly so we won't get

(continued on page 25)

The Shrinking Compact Disc

by Neil Lewbel

Stratford CT ... Recently a few companies have introduced compact disks in a new 3" format.

These small diameter CDs, which are compatible with existing CD players, have the same relationship to standard 5" CDs that a 45 has to an LP album. The currently available small CDs offer up to 20 minutes of playing time on one disc.

The new 3" CDs can be played directly on portable and spindle type CD players. Drawer type and cartridge unit players require a special adaptor.

The adaptor is basically a plastic ring, with a 5" outside diameter. The 3" CD fits into the center of this ring.

Two companies which have introduced 3" CDs are Rykodisc USA and Delos International, Inc.

Adapter included

The first such CD from Rykodisc is "Peaches En Regalia" by Frank Zappa, with three selections.

Rykodisc has planned a promotional campaign for this CD starting with a radio push aimed at AOR and Classic Rock formats.

According to Marketing Manager John Hammond, the promotional service will include the adaptor, which will enable stations to play the 3" CD on their existing equipment.

The adapter was developed by Shape Optimedia. Rykodisc, which calls the new format a "subcompact" disc, is planning to release several other 3" CDs in 1988.

These CDs will be sold with a suggested list price of $4.98 in the stores, compared to $11.99 for the 5" CDs (on sale).

Not for rock only

Delos International has introduced a series of 3" compact discs called Pocket Classics, which are targeted at first time classical record buyers.

Twenty discs in this series are planned for delivery in the last part of 1987.

The initial release in this series, entitled "D/PC 2001: A Sonic Odyssey" will include a plastic adaptor, designed by Shape, Inc., that properly positions the disc in players with a sliding drawer loading mechanism.

Each disc in this series is said to give a portrait of a particular composer, era or instrumental style.

Classical stations might be interested to learn that other releases in this series include selections by Handel, Vivaldi, Debussy, Prokofiev, Haydn and Rachmaninoff.

According to Amelia Haygood, Delos President, reduced manufacturing costs would allow a $3.99 suggested list price per disc, compared with full size CDs that sell between $12 and $15.

For additional information contact John Hammond of Rykodisc U.S.A. at 617-744-7678 and Amelia Haygood of Delos International at 213-459-4597.

Neil Lewbel has written many articles on radio and communications. His background includes broadcast engineering, technical support for a vendor of computers for broadcasters, and marketing of data communications equipment. He can be reached at 203-377-8517.

A Look at the CompuSonics DSP 1500

(continued from page 13)

I dubbed the jingle master to the DSP 1500. Although you can't do an A/B comparison of input to output audio, I did compare the DSP 1500 playback to the master tape. There was no discernible difference.

Because each script was a little different, I had to play with pacing to hit the right places in the music. This required several takes to get things right.

Had a cart machine been used I would've had to wait for it to recue. Since the jingle was one of four cuts on the disk, tapping the cue button four times before the end of an aborted play cycle, or three times after its end recued the jingle. Total recue time was maybe two seconds!

A few days later while mixing a jingle demo from four-track to two-track I thought of a great part, but had no tracks to lay it down. The mix required some moves so I couldn't play the part on the fly while going to master tape.

Instead I mixed to the DSP 1500. It was then easy to concentrate on playing the extra part along with the DSP 1500 playback to my analog mastering machine—with no analog generation loss.

Drawbacks

As good as it is, there are a few things which may bother you about the DSP 1500.

Due to the enclosed disk drive and cooling fan, the unit makes more noise than a standard cart machine. If you're using a terminal to operate it, simply install the unit off-axis from your mics.

I've heard air conditioners in air studios make more noise than this and not be objectionable, but you know what your tolerance for noise is.

Another possible liability is operator abuse. Unlike your trusty cart machine which can have its heads knocked out of alignment by forceful cart insertion, the greater fear for the DSP 1500 is the jamming of the disk drive.

Gorillas and type A humans should not be allowed to operate in the vicinity of the DSP 1500.

Morning show producers and PDs will appreciate this piece a lot. Cataloging sound effects and bits is easy.

Dubbing jingle and donut masters to disk so you can safely keep the masters provides a special peace of mind. The cut and paste editing PROMs due in early '88 will make the machine even more useful.

At present CompuSonics knows of only three bugs, or irregularities in the system.

During recording, use of the "pause" button may cause a drop-out if the unit is paused for more than 10 seconds while the orange disk drive data lamp is lit.

To avoid the problem, keep recording pauses under 10 seconds, or press "Pause" when the orange lamp is not lit.

While setting overlapping cue tones during record or playback, a cue tone may be set, but not saved. To insure that overlapping secondary and tertiary tones are recorded properly, tones must be set sequentially.

When editing a stereo slow speed recording, the user may hear silence during a trial edit playback. This problem is eliminated by using double key presses on all trimming commands.

These problems are expected to be eliminated by April '88.

Cost

The list price for the DSP 1500 is $6000. The playback only DSP 1200 lists for only $5,000.

Also consider the DADD 1510 (Digital Audio Disk Dubber) at $4000 list. It allows you to format or dub complete disks in less than real time. These dubs occur via SCSI port, with the audio remaining in the digital domain.

Leading edge technology always comes with a high price tag and a certain amount of risk. The DSP 1500 is not for everybody. At present less than a dozen stations have them. If you'd like more information give me a call, or call David Schwartz or John Stautner at CompuSonics (415) 494-1184.

Ty Ford, a radio audio production consultant, helps stations optimize their use of production and airstaff skills. He can be reached at 301-889-6201.

Mute Point: Adapting a Console

by Bill Higgs

Louisville KY ... Silence is golden! These words could have easily been spoken by an aggravated production director whose console lacks muting capability.

You know the scenario: the mix is ready, the sound effects are ready, the background is ready, tapes roll, the mic key is pressed, then—SCREECH! Feedback. Frustrated talent. The spot is ruined and must be redone.

There was a time not so long ago when the production room contained a console similar or identical to that in the on-air studio.

Most had full muting capabilities, with enough flexibility to handle two or three studios and their monitoring requirements.

For production work, however, these ubiquitous devices had their shortcomings. One was usually limited to mixing no more than two channels into no more than two channels.

Cost-cutting approach

Modern production requirements have led many stations to purchase sound reinforcement or recording type multitrack consoles for production.

As these units are often produced in larger quantities than consoles designed for broadcast use, they represent a very cost-effective approach to production needs.

Unfortunately, sound reinforcement or recording consoles rarely have any provision for muting of monitor speakers.

BottomLine—Broadcaster—

But muting circuitry can be added relatively easily to most consoles which lack this feature.

As a bonus, the addition of muting circuitry also will allow the control of an "on-air" or "recording" warning light and mute the telephone bell.

Total cost less small power supply? Usually under $15.

Basics of muting

The basic idea of muting is to have the microphone "on" button close a relay which either disconnects the speakers from the power amplifier, or opens/shorts its input.

Opening the speaker lines is the easiest and quietest approach. Be sure though that the relay contacts will handle the current and the amplifier itself will be happy without a load (many early solid-state units aren't).

If you switch the input to the amplifier, use one of the circuits shown in Figure 1.

Do not merely open the input to the amplifier, since open high-impedance inputs tend to lead to noise and hum. If RFI is a problem at your location, the amplifier input should be bypassed with 0.001 μF disks.

There appear to be two different schemes for turning on the channel in these boards. The first type switches the audio on directly.

Best case

If you are lucky, you might find an extra pair of switch contacts on the "channel on" button.

Some manufacturers use the largest stock switch engineered for the largest configuration and mixing scheme, and simply leave the extra sections unconnected.

This unplanned benefit is most commonly found in consoles which actually switch the audio with the pushbutton.

Even if the switch has no unused contacts, it may still be possible to change the switch to a larger model with an extra pole.

This is not always feasible if the switch is PC board mounted. Switches made by ITT/Shadow and others can often be ordered in multiple lengths.

Find an empty spot on the back panel, drill and mount an insulated ¼" phone jack. If an insulated jack is not used, it is possible to set up a nasty ground loop inadvertantly.

Grab some handy audio cable (the current will be low), and run a pair from the contacts to the jack. Shielding the pair is probably a good idea also. Refer to Figure 2.

Channel on

The second type of console uses the "channel on" button to switch a DC voltage to either a relay or FET switch closer to the innards.

Check the schematic or use a high-impedance multimeter to find out whether the voltage goes low to high or high to low for "on."

Add a transistor and resistor as shown in Figure 3 and bring the circuit to the rear panel jack as described above.

If more than one channel is to be muted, add a diode for each channel as shown. Perf board works great for this.

For miniature relays a 2N2222 (NPN) or 2N3906 (PNP) is adequate, but for larger relays consider a TIP-31 or TIP-32.

Watch the polarity—a transistor is a one-way device! Note here that the power supply has to float; again, ground loops can be a sneaky problem.

Inaccessible switch

If your day is really going badly, you may find yourself with the third type of console. This type, like the first, switches audio directly, but through a sealed or otherwise impossible-to-get-to switch.

I found this situation on a console at WXLN, and was forced to use a little magic.

Epoxy cement should have become a long-standing friend by now. With a little ingenuity, you should be able to cement a leaf-type microswitch to the circuit board or chassis in such a way that it is actuated by the plunger or plastic button.

Find out which contacts are closed when the button is pushed, and route the wires to the back panel as in Figure 2.

You may be tempted to "borrow" power from the board's internal power supply to operate the relay; after all, a matchbox-sized relay draws very little current.

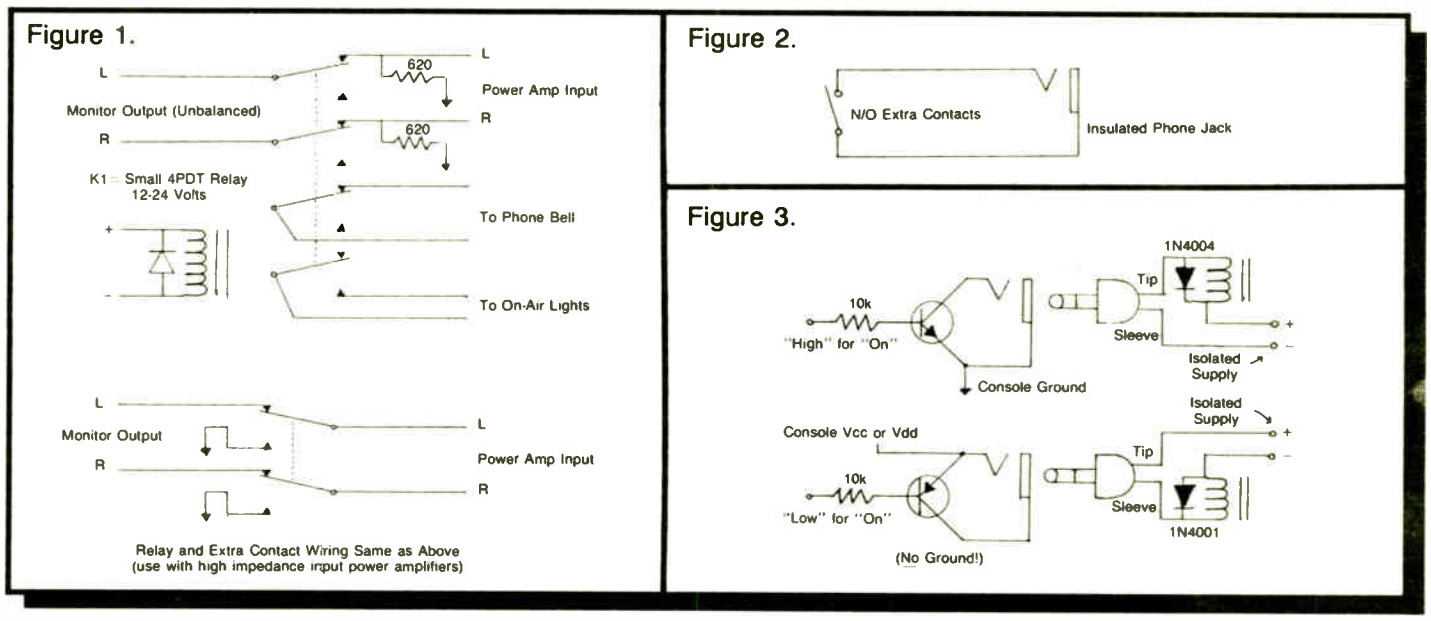
Don't! The relay represents an inductive load, and even with a shunt diode can cause spiking on the power supply rail.

At the very least, pops and other unwelcome noise can get on the output when the mic is turned on. It is better to use a separate power supply and avoid the grief.

This circuit has been in use at WXLN for the last two years with no problems. The power for the relays (24 VDC in our case) comes from a central power supply.

However, the relay current requirements are usually small enough that a small "wall-mount" power supply is sufficient. Most parts are available at Radio Shack or by mail at several distributors.

Next time we'll look at the advantages of a central DC power supply, and how to do it inexpensively. In the meantime, use your imagination!



Bill Higgs has been CE for WXLN/WFIA Louisville for six years and has also done station consulting work. He holds a PhD in Theology, which helps explain his patience in coping with small market radio. He can be reached at 502-583-4811.

20 Years of Technical Innovations for CPB

by Mike Starling

San Diego CA ... Public radio had its beginnings at 9XM (later WHA) in 1917 at the University of Wisconsin under an experimental license, preceding the regular broadcast schedule of commercial KDKA by several years.

In the ensuing fifty years the small numbers of noncommercial stations struggled to find a formula for funding its alternative mission of providing needed programming which might not survive in the ratings oriented commercial system.

The nation received an early holiday present on November 7, 1967 as President Lyndon Johnson signed into law the Public Broadcasting Act of 1967.

The Public Broadcasting Act was passed as an amendment to the Communications Act of 1934 in Section 390.

In a flurry of last minute lobbying radio was included in the act and changed the name away from the title of the "Public Television Act".

In the two decades since the Act created the Corporation for Public Broadcasting public radio has increased its numbers from 72 "CPB-qualified" outlets to just over 300.

CPB's qualification standards include minimum levels of power, staffing, hours of broadcasting and adequacy of local production facilities.

The funding distributed by CPB under the Public Broadcasting Act has enabled a number of impressive technical innovations spearheaded by public radio.

On June 20, 1980 National Public Radio became the first all-satellite interconnected radio network.

By pioneering the development of 3:1 dbx-type companding, NPR turned the basic 34 dB SNR single channel satellite carriers into full 15 kHz, 70 dB SNR channels.

This technology coupled with careful carrier assignments to prevent intermodulation gave new meaning to the term "multicasting" by creating 12 full fidelity channels and some 15 narrowband (5 kHz quality) channels on Westar I, Transponder 2d.

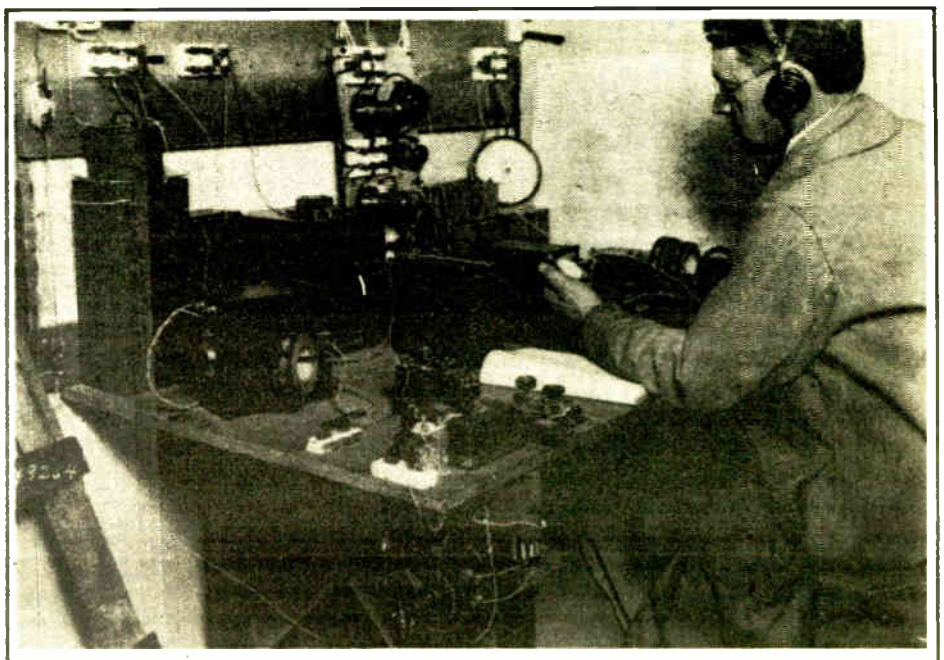
Public Radio switched to Westar I's replacement, Westar IV in 1984. To date no radio network approaches the channel capacity of the public radio satellite system.

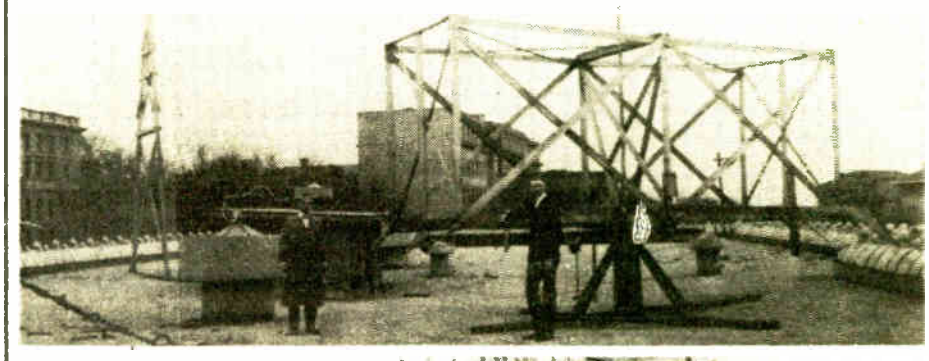
Not only was the quality of the NPR system unsurpassed but the development of automated coordination techniques were unprecedented as well.

The NPR Satellite Operating Support System (SOSS) automated downlink equipment by reassigning receivers between stereo or monaural configurations, changing channels, and starting and stopping tape recorders.

Additionally the Uplink Remote Control system automated the network origination, almost eliminating network created double-illuminations by controlling the activities of 17 regionally placed uplinks.

(continued on page 27)



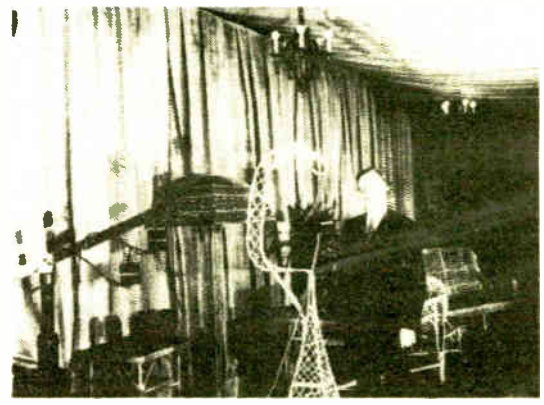


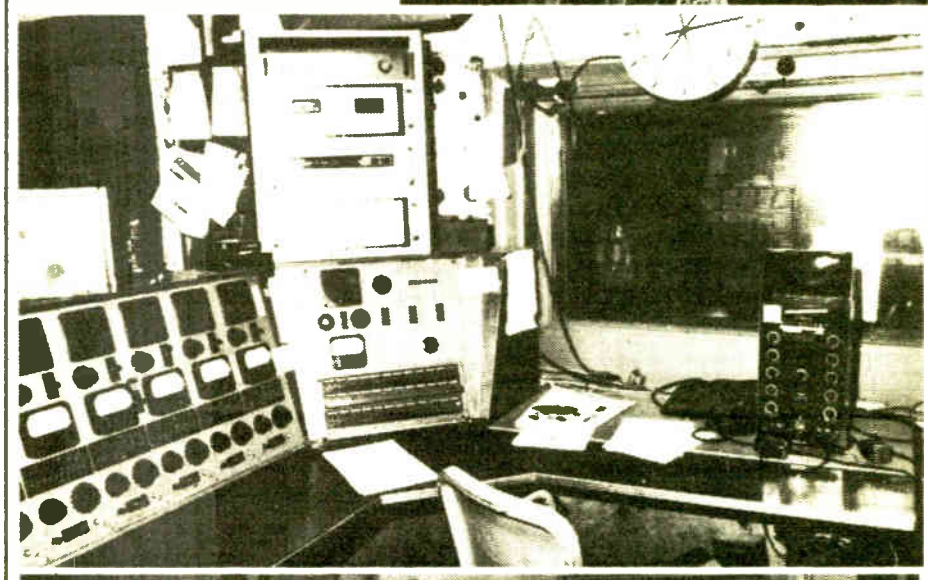
Then and Now

Above: Professor Earle Terry at work on Wisconsin's WHA in the early 1920's. Later Terry and Burton Miller inspect WHA's directional antenna on the roof of Sterling Hall in 1922.

Right: New York's WNYC had that old draped ornate look back in the old days.

Below: WNYC's old studio gave way to refurbishing by Pacific Recorders & Engineering in 1985.





Minimizing Problems With Nulls

(continued from page 19)
the effect of a floodlight as opposed to a spotlight. The floodlight will provide light to a much broader area than will the spotlight, albeit at a lower intensity at a given location.

Most of the time, when an antenna is ordered specifying beam-tilt, null-fill is also specified. The result is the very best antenna for a given application.

The amounts of beam-tilt and null-fill are best determined by a qualified consulting engineer who is thoroughly familiar with the antenna location, desired areas to provide coverage and terrain/obstructions that are present.

When beam-tilt and null-fill are employed, the overall gain of the antenna will be considerably lower than the gain of a non-beam-tilted/null-filled antenna.

If you are considering adding beam-tilt or null-fill to an existing antenna, be sure that you have enough reserve transmitter power output to make up for the gain loss and maintain the proper ERP.

The FCC does not require a construction permit for the modification of an antenna to include beam-tilt/null-fill, provided that the height of the center of radiation above average terrain remains unchanged from the licensed value, and that the maximum ERP does not change.

Obviously, the ERP on the horizon will be somewhat lower with a beam-tilted antenna. The maximum ERP will occur at the beam-tilt elevation angle, and this value must be the same as the presently licensed ERP value for the station.

If any of these parameters are varied, a construction permit must be obtained before the modifications take place, and this can be a lengthy process, often more than one year from filing to grant. It is wise to always check with your consulting engineer before proceeding with such things.

Most production antennas in use today can be modified in the field to include beam-tilt and null-fill.

The modifications entail replacement of the center feed (power divider) section with a new one specially constructed to advance the power and phase to the upper antenna bays, creating the beam-tilt and null-fill.

If your antenna is already center-fed with an equal number of bays on either side of the power divider, this will probably be the extent of the modifications.

If your antenna is end-fed, other modifications will be necessary to replace the interbay feedline with one that accommodates a center-feed.

Retuning of the antenna after the modifications are complete is always a good idea, and if the modifications are extensive, it can be absolutely necessary. Check with the manufacturer of your particular antenna for details.

In the final part of this series, source-induced multipath will be discussed, as will some common fallacies concerning FM antennas.

W.C. Alexander is Director of Engineering for Crawford Broadcasting Company, and a horror fiction novelist. He can be reached at 214-445-1713.

Corky Culver, Part-Time Assistant CE

(continued from page 21)
a terrible echo."

A half hour later, the incident was over. Except for the subsequent phone call from an elderly listener.

"Our whole family enjoyed it," the octogenerian stated. "It was so nice to hear your recent, live broadcast special about Carlsbad Caverns!"

Creativity unleashed

With the back half of the building now off limits, Corky Culver concentrated on gizmo-izing the front lobby.

The day after he rigged up a spare, 3½" monitor speaker behind the official station picture of President Eisenhower, a visiting official from the local Republican Women's Club fainted.

"It was simply ghastly," she told the emergency squad people who'd revived her. "I must have had one of my spells. I could have sworn that I distinctly heard Ike sing a three-part, soprano harmony version of *Mr. Sandman*!"

Even the grandmotherly station receptionist lost her temper, after one of Corky's innovations—the self pouring, sonic sensor coffee pot—made a regrettable mess of her shoes.

"Please," she begged the manager, "you must tell that young man to stop inventing, or I'll be forced to charge the station for some rubberized footwear."

"Well, hopefully Mr. Myers will be back on Monday," the GM reasoned. "I'm sure that when he finds out about all of this, plus the orthopedic headphones, he'll decide to straighten things out."

And, sure enough, at approximately 2:45 on Monday afternoon, the friendly station owner returned from his trip.

The GM, who had been eating his lunch under a nearby shade tree on station property heard a commotion, and immediately rushed back to the building.

He couldn't believe what he saw.

The receptionist was on top of her desk, screaming, as whole record albums were seen rolling, willy-nilly, out through the open, station door.

And, the afternoon DJ was busy describing the disaster over the air.

"What in blazes is going on here?" Mr. Myers asked the GM.

"Sir, I'll bet it's that Corky Culver trying out another one of his dangerous broadcast inventions again!"

"Easy now. Calm down son," the congenial licensee advised, in his most Bing-like tones. "Let's go easy on the lad. After all, we can't expect instant efficiency from radio's first rack-mounted transcription turntable."

Peter Hunn, who swears he bears no resemblance to his protege Corky (or to Mr. Myers), is a former FM station owner/operator and has authored a commercial FM station handbook slated for publication soon. He will be sharing more Corky Culver adventures with **RW** *readers periodically, and can be reached at RD#1 Box 1067, Westport NY 12993.*

DIGITAL DOMAIN

by Skip Pizzi

Digital Systems Ready Now . . .

Washington DC ... Let's look at some of the digital audio recording formats and systems available to broadcasters today.

This is an area of great complexity and non-uniformity of hardware. Table I gives an overview of the formats available in the past or present for such applications.

Pseudo-video systems

The so-called "pseudo-video" formats allow existing video recorders or channels to be used for storage or transmission of stereo digital audio signals.

These systems utilize a black-box processor that converts analog stereo audio to a digital bit stream with appropriately robust error correction algorithms included, and then feeds this data into a buffer which outputs it in the form of video frames according to NTSC (or PAL) format.

The video signal that comes out of the processor can now be sent to the video input of a VCR (1/2" formats work fine, using premium tape at medium or high speeds) or sent through a video link.

Playback off the VCR, or reception at the termination point of the video link is accomplished in a complementary fashion.

The video signal is applied to the video input of the same type of black box processor (there are several incompatible formats—see Table I), which converts it back to an analog stereo audio output, theoretically with minimal audio degradation.

By the way, the audio tracks of the VCR are not used by this system, and are thus available for other applications.

Dropouts

As with any digital audio system, dropouts are about the only thing that can create havoc.

A sufficiently effective error correction and concealment system has been devised for each format, and it is these that really make the systems work, compensating for what is expected to be any typical dropout in the medium.

In the case of large-scale, catastrophic dropouts caused by some physical damage or defect in the tape, for example, the system mutes until good data and synchronization has been restored.

The pseudo-video system came about due to the need for a wide bandwidth when recording or transmitting digital audio.

The popular 16-bit pulse-code modulation (PCM) requires about a 2.5 MHz bandwidth, and there were plenty of video recorders (even domestic ones) easily capable of recording this. Make the data look like video, and you're all set.

You may have noticed, by the way, that the need for sync and the wide bandwidths required make all formats of digital recording behave a lot more like video than old analog audio. Welcome to the world of spinning heads.

Of course, PCM is not the only scheme which can be used for digital audio recording, pseudo-video or otherwise.

A number of variations on the Delta Modulation (DM) technique have also been implemented, such as Adaptive Delta Modulation (ADM) and Companded Predictive Delta Modulation (CPDM).

Each system has its pros and cons. R-DAT and most of the high-priced systems do use PCM, though, usually in a 16-bit format.

For a complete treatment of each of these techniques, a recommended source book is Ken Pohlmann's *Principles of Digital Audio* from Howard W. Sams & Co.

Applications

Unfortunately, all the reasonably priced (under $5000) pseudo-video processors are being or have been discontinued, primarily in anticipation of R-DAT's introduction.

However, one application of these pseudo-video processors that no other current system can duplicate is their use on either end of a video circuit for STL or RPU systems.

A few processors will still be available for a short time (Sony PCM-601ES, around $1500) but supply is sketchy. Some more will inevitably appear on the used market, where a few have already turned up, as R-DAT becomes reality.

Of course a more expensive version (Sony PCM-1630—the CD mastering format) is still available, but it's out of the question for most broadcasters due to its $20,000 pricetag. And remember, for an STL or RPU you would need two (one at each end).

With this one major exception, however, the R-DAT and pseudo-video systems are similar in application around the station.

Recording, but not editing

Think of using them for recordings where audio fidelity needs are high, and where heavy finessing needs in post-production are low.

Neither are easily editable without transfer to another format, and mixing to and from them is cumbersome.

R-DAT will be slightly better than pseudo-video in the latter respect (i.e.—punch-in/out, access time and accuracy, and start-up time are all improved). Later generations of R-DAT may be even more flexible in this regard.

But for now, both of these formats are most useful for remote music recording, time-shifting of satellite feeds, high quality ENG and perhaps studio mastering, where pick-up edits are not required.

For more complex production, the higher priced systems shown in Table I are required.

This is probably not the time for the braodcaster to get into these, but as prices drop on RAM systems, they will become quite cost effective, especially for short-form production (spots, etc.) since one of these boxes could replace an entire multitrack production studio and then some.

Whither the cart?

Meanwhile, R-DAT may also be useful for some of the less demanding roles now served by the cart machine, although I wouldn't start tossing the old Spotmasters out just yet.

As a recent RW guest editorial pointed out, cart machine manufacturers are not rolling over and playing dead. There's a good bit about the latest generation of cart machines to make them attractive to the broadcaster.

Other issues to consider here are control room/rack space, ambient noise output (for combo operation), heat load and reliability when the air conditioning goes down.

Again, it's an individual decision; start from the end and work back, asking yourself a few basic questions.

- What do I need to do with this equipment?
- What proven technology does it best right now?
- What gives me the most bang for the buck?
- What should I keep my eye on for the near future in this regard?

Eventually, say two years down the road, R-DAT or some RAM/recordable disc system may have all the features of today's top cartridge machines and more, for the same price or less, and with equal or greater reliability.

But for right now we are still in the twilight zone of digital audio transition. Those who have to buy or budget today for the studio of tomorrow are in a tough spot. This is our current "digital dilemma."

Waiting posture

This has started to show up in the buying habits of the broadcaster. Many seem to have taken the wait-and-see approach, while a few others I've spoken to recently are planning to hybridize—

(continued on next page)

Circle Reader Service 42 on Page 28

DIGITAL DOMAIN

At a Price and With Limitations

(continued from previous page)
keeping mid-fi cart machines for news, and going to R-DAT for spots.

And there are the several entrants in the product line aimed specifically at replacing the cart machine ("Other" in Table I).

Although there's room in the industry for more than one format here, none seems to have gained a foothold, and most of us still regard these with a fair amount of healthy skepticism as yet.

Of course, this transition is an even more ominous prospect for the station whose entire format is largely cart-based.

Typically, these stations have a big investment in top-end cart machines, so they will be among the last to convert.

First they would possibly go to a 15 ips, noise-reduction and sum/diff. matrix format, and perhaps make use of Dolby SR, and implement all the automatable functions, to stretch the utility of the hardware to its fullest.

Smart move in their case, but not necessarily a path for others to start down now.

Decisions, decisions ...

Along the same lines, what about the station that wants to improve its STL, and looks at 18 or 23 GHz hardware?

Using a standard video modulator and demodulator, a pseudo-video digital system can be set up to provide excellent specs for a very reasonable cost, if the link isn't more than five to seven miles or so, and line-of-sight can be easily had.

But pity the poor CE who has to gamble this whole system on the uncertain availability of the two little black boxes (PCM processors, making up far less than 10% of the systems cost, usually), most of them built to domestic specs to boot.

Hopefully, this insanity won't last too much longer, and an appropriate, affordable and truly professional product will be unveiled and properly marketed for this application.

Meanwhile, consider putting analog noise reduction on your old STL: Dolby, Telcom C4 and dbx Type II are the most appropriate choices.

By the same reasoning, a station with an already significant investment in pseudo-video digital gear might be wise to continue incremental expansion in this same format, using either new or used processors, with new VCR's.

Due to the VCR's popularity in the pro market (unintended by the manufacturer), informal user groups have formed, cottage industry peripherals to the system abound, and manufacturer support/service should continue at some level for a while.

The vagaries of the 1/2" VCR—and the processor manufacturers' frequent disavowal of any knowledge of the product—are the system's weakest links, but most users are willing to put up with these for the price.

Stock available

Both Beta and VHS tape stock and hardware will continue to be available for the foreseeable future, although Beta will end up as more of a pro (video) than a consumer format soon.

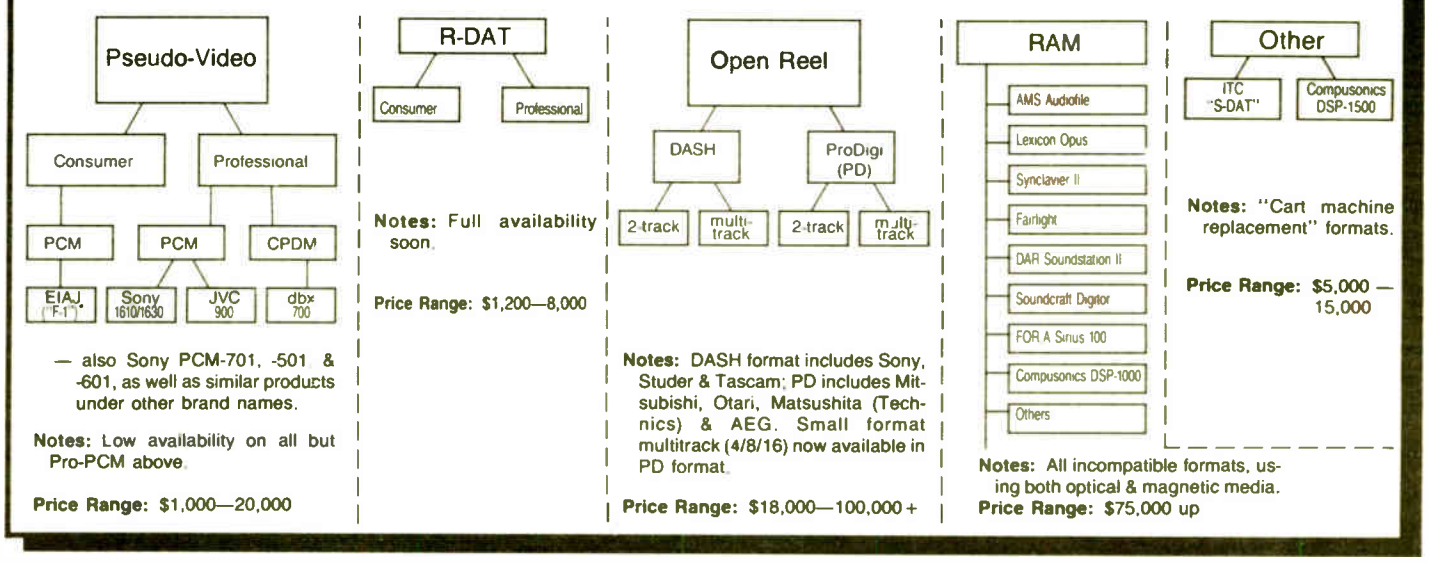
The pseudo-video digital audio processor may end up as the Ampex 350 of the digital age.

On the other hand, stations without an existing pseudo-video commitment should look to pro R-DAT instead (or possibly even some consumer models) for a low-cost digital audio recording system.

Next time we'll look at the current state of digital in automation systems, switchers, telephone interfaces and more on the continuing saga of R-DAT.

Skip Pizzi is the training coordinator for National Public Radio's Program Engineering Department. He can be reached at 202-822-2483.

Table 1. Digital Recording Formats in Current Use



CPB's Technical Advances

(continued from page 24)
This still represents the most decentralized satellite origination system in the nation.

NPR's then senior engineer John Kean (now with Moffet, Larson & Johnson, Inc.) developed and lobbied for the adoption of the second SCA (at 92 kHz).

In 1985 Kean demonstrated to the Commission's satisfaction that a new carrier at 92 kHz created no objectionable interference and could provide new sources of station revenue as manufactuers adapted the new technology to disseminate paging, electronic billboards, or specialized audience programming.

Today a number of regional and nationwide services are developing this new delivery system as more FM stations implement additional SCAs.

Key to the success of the plan was convincing the Commission that total baseband modulation should be increased out to 110% for stations running a total of 20% non-pilot subcarrier injection.

But Public radio's technical contributions haven't been limited to RF improvements.

NPR spearheaded the use of "tapesyncs" whereby each end of a phone interview is studio recorded and the tapes and ambient noise conditions are subsequently mated resulting in the impression of an in-person interview.

Public radio has also been perhaps the widest developer of digital music recording techniques for location and postproduction.

Some of NPR's specific innovations include establishing coincident microphone recording techniques as a standard in recording for stereo broadcasting and becoming the first network to use T1 (video-bandwidth channels) technology in interconnecting its New York and Washington studios.

Additonally, NPR has played a leadership role in establishing standardized processing and interfacing techniques for telephone recordings.

Currently the biggest technical issue facing public radio centers on the possiblity of adding digital transmission modes to the satellite replacement project scheduled for 1992.

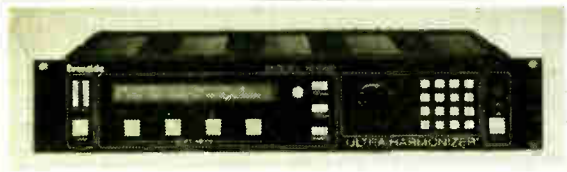
The project could cost anywhere from $25 million to $100 million dollars. Such projects highlight ongoing funding uncertainties.

Yet without the Public Broadcasting Act of 1967 public radio would be closer to it's original 9XM experimental status than its modern prominence as a major player in the American radio landscape.

Mike Starling is CE of KPBS-FM, San Diego, and a frequent contributor to **RW**. *He can be reached at 619-265-5025.*

Radio World Marketplace

If your company has a new product you wish us to consider in *Radio World Marketplace*, please send a press release and black and white photograph to Radio World Marketplace, P.O. Box 1214, Falls Church, VA 22041



Effects processor

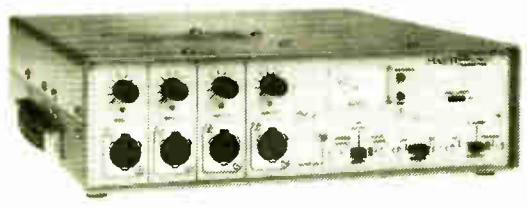
Eventide's new H3000 Ultra-Harmonizer Pitch Change and Effects Processor features stereo pitch change, diatonic pitch change, full high-end signal processor capabilities and complete MIDI implementation.

The diatonic pitch change allows users to create accurate harmony lines. The H3000 analyzes the note being played and generates musically correct harmony in real time.

The processor includes reverb and effects programs such as Warm Hall, Bright Room, several gated and multitap programs, and new programs such as Death Flange and Reverb Factory.

The H3000 is totally MIDI programmable.

For more information contact **Gil Griffith at 201-641-1200**, or circle **Reader Service 73.**



RPU transmitter

Marti Electronics' new remote pickup transmitter, the Model RPT-30 offers four balanced mixing microphone inputs with high level option, built-in compressor/limiter, subaudible encoder and illuminated VU meter.

Compared to its Marti predecessor, it boasts a 20% increase in 450 MHz power output with a 40% weight and 52% size reduction, according to the company.

Antenna VSWR and cooling systems are continuously monitored, with out-of-tolerance warning displayed by flashing LEDs.

The RPT-30 delivers 45 W VHF and 30 W UHF.

For more information, contact **M.E. McClanahan at 817-645-9163**, or circle **Reader Service 78.**

Console

Harrison Systems' new Air-790 on-air broadcast production console is based on its Air/Pro 7 Series.

Along with Penny & Giles 3000 series 104mm linear faders and CMOS switching for assignment busses, standard features include two main stereo outputs, two separately derived main mono outputs, an auxiliary send with level trim and clean-feed bus.

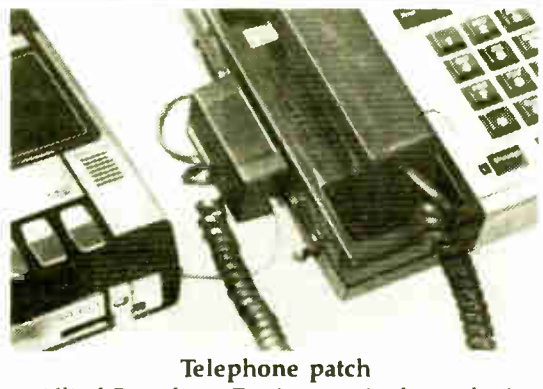
For more information, contact **Martin Burns at 615-834-1184**, or circle **Reader Service 75.**

Oscilloscope

Leader Instruments' 60 MHz Readout Oscilloscope, Model LBO-2060 allows the user to observe waveforms, setting conditions and measured values on a single display.

The LBO-2060 reduces set up time by displaying the setting conditions such as CH-1 and CH-2 sensitivity, main and delayed sweep time and triggering controls. The on-screen cursors provide the user direct reading of measured values.

For more information, call **Marc Reiner at 516-231-6900**, or circle **Reader Service 71.**



Telephone patch

Allied Broadcast Equipment is the exclusive distributor for the Teletap™ Model TRP-100 Telephone Recorder Patch. It adapts a tape recorder to either single or multiple line telephones for recording of telephone reports, and offers plug-in installation and clear recording of both sides of a conversation.

The TRP-100 works with Merlin and other digital systems as well as most older analog systems.

For information contact **your regional Allied representative**, or circle **Reader Service 77.**

Tape recorder

Otari's new MX-55 is a new series of compact ¼" tape recorders, and includes full track, two-track NAB or DIN stereo and a two-track with center-track time code. The transport features a DC quartz PLL capstan motor with user-selectable speed pairs of 15/7.5 ips or 7.5/3.75 ips.

For more information, contact **John Carey at 415-592-8311**, or circle **Reader Service 72.**

Subscription/Reader Service Forms

Radio World®

January 15, 1988 Issue Use until April 15, 1988

FREE Subscription/Renewal Form

I would like to receive or continue receiving **Radio World** FREE each month. ☐ YES ☐ NO

Signature _____ Date _____

Please print and include all information:

Name _____ Title _____

Company/Station _____

Address _____

City _____ State _____ ZIP _____

Business Telephone ( ) _____

Please circle only one entry for each category:

I. Type of Firm

A. Commercial AM station
B. Commercial FM station
C. Educational FM station
D. Combination AM/FM station
E. Network/group owner
F. Recording studio
G. TV station/teleprod facility
H. Consultant/ind engineer
I. Mfg, distributor or dealer
J. Other _____

II. Job Function

A. Ownership
B. General management
C. Engineering
D. Programming/production
E. News operations
F. Other (specify) _____

III. Purchasing Authority

1. Recommend 2. Specify 3. Approve

Reader Service

Please first fill out contact information at left. Then check each advertisement for corresponding number and circle below. NOTE: Circle no more than 10 numbers, otherwise card will not be processed.

001	021	041	061	081
002	022	042	062	082
003	023	043	063	083
004	024	044	064	084
005	025	045	065	085
006	026	046	066	086
007	027	047	067	087
008	028	048	068	088
009	029	049	069	089
010	030	050	070	090
011	031	051	071	091
012	032	052	072	092
013	033	053	073	093
014	034	054	074	094
015	035	055	075	095
016	036	056	076	096
017	037	057	077	097
018	038	058	078	098
019	039	059	079	099
020	040	060	080	100

Sales Call Service

Please have a salesperson contact me about these items (list numbers):

_____ _____ _____ _____

Clip & Mail to: Radio World, PO Box 1214, Falls Church VA 22041

Circle Reader Service 8 on Page 28

BUYERS GUIDE

Test & Monitoring Equipment

KOLA Tests Out Sound Tech

by Dennis J. Martin, CE
KOLA/KMET Radio

Los Angeles CA ... The Sound Technology Model 3000 is a programmable audio test system that is ideally suited for the broadcast environment. Packaged in a single case, or in two to allow split operation of the generator from the analyzer, the Model 3000 is highly portable.

User Report

Since each unit relies on its own internal microprocessor, there's no need to also transport a personal computer (and monitor) to make the system operate.

Internal memories store data for a period of seven to 10 years. In addition, great care in design and construction renders it insensitive to even strong RF fields.

The self-sufficient, modular concept of the Model 3000 is based on suggestions made by the European Broadcasting Union (EBU).

Automated or manual

The Model 3000 can be operated in a manual mode for troubleshooting, or fully automated without an external computer. If a user desires to save test results to a diskette, the Model 3000 offers RS-232 and IEEE-488 (GPIB) ports.

Both the generator and the analyzer are controlled by momentary push-button switches. LEDs tell the operator at a glance which test parameters are in use.

Perhaps most impressive, though, is the ability of the generator to control the analyzer even when separated by an STL. To avoid the cost and complexity of two modems and a phone line for test equipment communication, the generator sends commands over the audio channel being tested.

At the beginning and end of each test, the generator emits an FSK signal in the 1 to 2 kHz spectrum that configures the analyzer precisely as desired.

This results in error-free, repeatable tests that can be conducted by a single person, over a single line.

System generator

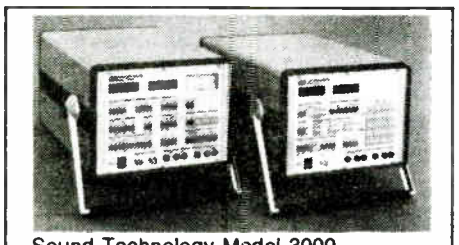
The generator is a digitally-controlled analog oscillator that uses internal crystals to ensure frequency accuracy to 0.03%. It provides two isolated outputs that are electronically balanced and floating with selectable source resistances of 50, 150 and 600 ohms.

Whether operated balanced or unbalanced, the generator produces output levels from −90 to +30 dBm, adjustable in 0.05 dB increments.

Since more than 100 dB of attenuation is available after the output amplifier, it's possible to connect the generator directly to an amplifier's microphone input—no pad is necessary.

Extremely low-distortion sine waves (less than 0.0008% in the audio band) can be selected over the range of 1 Hz to greater than 100 kHz.

Square waves from 1 Hz to 50 kHz, in addition, are generated with less than 1 μs rise time. And to simplify tests of pre-



Sound Technology Model 3000

emphasized equipment, selectable de-emphasis curves of 10, 25, 50 and 75 μs are available.

Two LED displays provide a continuous readout of level and frequency; in the program mode, these displays show automated test programming instructions. A single 20-button keypad is used to enter level, frequency and program commands.

Automated tests

The generator is capable of performing a number of fully-automated tests such as frequency response and distortion versus frequency or level.

Frequency sweeps can be made with 4 to 255 points per decade resolution—frequencies are calculated to maintain linear increments on a log scale.

Sweep speed is set by specifying a number from 1 (fastest) to 999 (slowest); "1" corresponds to a duration of 30 ms/frequency.

To investigate distortion versus level, the generator will automatically sweep up—or down—in level while the analyzer tracks and stores the results.

Up to 80 different front-panel setups can be stored in the generator's program memory and used in any of 16 "proof" tests. Since the memory allows tests to be "chained," an entire set can be repeated at the push of a button.

Options for the generator include SMPTE IM distortion (60 Hz and 7 kHz, 4:1), tone burst and sine/step.

The analyzer part of the Sound Tech-

(continued on page 38)

Automating Testing

by Marlene Petska Lane

Falls Church VA ... If the CE wish lists I've collected over the past year are any indication, by far the most wanted piece of equipment is a "modern" test set.

Ironically, however, test gear seldom makes an appearance in the lists of items stations are intent on buying in the near future.

Industry Roundup

With the recent consumer-driven emphasis on sound quality and the proliferation of digital equipment at stations, this may—and must—change if stations want to maintain high quality audio and remain competitive.

CEs are finding that their vintage '70s manual test sets are simply not adequate for the kind and amount of testing they must do these days.

"There are more channels in consoles and more channels in tape recorders, which means there is a greater requirement to make more—and more detailed—measurements," says Wayne Jones, president of Amber Electro Design. "Using old manual equipment just won't cut it."

Amber recently introduced a software package called AudioCheck that will run on any IBM XT/AT compatible system to control its automated equipment. It can program complete sequences of tests including sweeps and testing against limits.

Fast results

Jones says an engineer can work the system and produce results within a few hours after it is installed.

As most CEs can attest, using manual equipment means spending a couple of long nights at the station, going through inch-thick procedure manuals and jotting down test results on paper.

"While you can test with manual equipment, it's tiring and laborious," says Robert Metzler, president of Audio Precision, which manufactures the System One automated system. "You spend a lot of time with graph paper and a French curve."

In addition, current manual equipment is unable to satisfactorily test digital equipment. (Not even all automated equipment can cope with 16-bit audio.)

(continued on page 35)

BUYERS GUIDE INDEX

User Reports:

Sound Technology Series 3000
by Dennis Martin, KOLA-FM .. 29
Audio Control Industrial SA-3050
by Doug Fearn, WKSZ-FM 30
Harris AM-90 Modulation Monitor
by Mike Elliott, Warner Grp 31
Audio Precision System One
by Lloyd Berg, WDAE/WUSA ... 32
TFT 844 Modulation Monitor
by Fred Krock, KQED-FM 33
Amber 5500 Series Auto Test Set
by Rob Meuser, IBSS 36
Potomac Instruments FIM-41
by Leroy Granlund 37
I.F.R. 1200-S Comm/Spectrum Analyzer
by Lloyd Berg, WDAE/WUSA ... 39

Also an article from Gentner on the Silence Sensor and an article on Delta Electronics' PRH-1 High Power Pulse Reflectometer jointly prepared by Delta's John Bissett and WCPT/WCXR CE John Diamantis.

BUYERS GUIDE

ACI Analyzer Practical, Powerful

by **Douglas W. Fearn, CE**
WKSZ-FM

Media PA ... There was a time not too long ago when a third octave audio spectrum analyzer was so expensive that most radio stations could not justify buying one.

But the Audio Control Industrial SA-3050 real time one-third octave spectrum analyzer is truly professional *and* relatively inexpensive—$800 or so, depending on options.

An audio spectrum analyzer is a measuring instrument that displays the instantaneous frequency content of an audio signal. A series of vertical columns of light-emitting diodes display the spectrum much like a graph of frequency response.

The source could be program material, fixed frequency tones or pink noise. Pink noise is a mathematically defined combination of all frequencies, and sounds very much like the noise in between occupied FM or TV channels.

It's like having an infinite number of audio oscillators all set to different frequencies, all running at once. Instead of measuring one frequency at a time, you can measure them all simultaneously.

The input to the spectrum analyzer can be taken directly from a piece of equipment. For making measurements on loudspeakers, a calibrated microphone with known flat response is used.

In addition, the absolute loudness—the sound pressure level (SPL)—can be measured.

The SA-3050 covers the range from 25 Hz to 20 kHz. It has both microphone and line level inputs.

The sensitivity is set with two controls, a six position switch calibrated in dBm (or SPL with the supplied microphone) and a ±10 dB vernier control with a center detented calibrated position.

The number of dB each light represents is selected with a four-position switch giving 4, 3, 2 or 1 dB per step. This results in a measurement range of from ±4 dB to ±16 dB.

The SA-3050 contains its own pink noise generator with a TRS jack output and level control. This output is capable of driving a 4 ohm speaker directly with 150 mW.

User Report

There are three display speeds provided. The fast speed is good for monitoring program material, especially for catching transients. The medium speed displays an average response on program material. The slow speed is the best for use with pink noise.

The unit also has six memories where displays can be saved. An internal battery holds the memory data after the power is turned off.

One of the most useful options available on the SA-3050 is the printer output. With it, you can print any display on an Epson compatible printer (Figure 1).

The classic application for an RTA is loudspeaker equalization. In fact, there is almost no other way to measure speaker frequency response in a listening room.

A monitor system is more than just speakers and amplifiers—the room also has a major effect on the frequency response. Standing waves make it impossible to accurately measure response with steady tones. Hence the value of the spectrum analyzer/pink noise generator.

In our control rooms, speaker crossover adjustment has been hit-or-miss. I set up the SA-3050 with the microphone located at the monitoring position. I fed pink noise to one speaker at a time. The crossovers on the speakers were adjusted while the RTA display was observed.

Pink noise is, by its nature, random. At any given instant, there may be no energy in a particular one-third octave band or there may be a sudden peak many dB above normal. But over time the level averages out over the entire audio band.

This is why the slow response time setting is necessary. Even so the display does not stand still. By hitting the "Freeze" button repeatedly a variety of results could be assumed. A certain amount of interpretation is necessary.

We expect extremely flat frequency response from most equipment and it may come as a shock to see how "un-flat" a typical monitor system is. It is not unusual to see peaks and dips of 15 dB or more in a poor room. Even the best rooms and speakers are seldom better than ±4 dB.

After adjustment, I felt that the monitors sounded significantly better/"smoother" and less tiring to listen to.

There was a complaint that our live announcers did not have the "punch" of many voices on carted agency commercials. I suspected that the agency tapes were made with a considerable amount of equalization on the voices.

I hooked the SA-3050 to an air monitor feed and watched it display a few live and recorded voices. It was quickly evident that the agency spots had significantly more presence equalization (3 to 10 kHz) than our air mic.

I "captured" a few examples in the SA-3050 memories. Then I readjusted our mic EQ to resemble the curve apparently used on the outside spots and sure enough, our announcers sounded much more like the commercials.

Of course, someone with experience and a good ear could have done the same thing without test equipment, but it was rewarding to be able to quantify what was heard and "prove" the results.

I wondered about the effect of long cables on microphone frequency response. I used the SA-3050 to observe the response through different lengths of cable.

My conclusion? With the microphone, cable and mixer tested, no significant effect on frequency response could be measured with up to 320' of cable.

In another experiment I measured the effect of grill cloths on loudspeaker frequency response. I found that on my speakers no significant change resulted from the installation of the grills, neither on axis nor 45° off axis.

What about using an RTA and pink noise for routine tape recorder equalization adjustments? If you have a machine with odd frequency response, an RTA can help you obtain the best possible response.

But with good machines, the standard steady tone method provides better accuracy and more meaningful documentation.

The pink noise source does not have to come from the SA-3050; I also tried using a pink noise band on a compact disc. Results were similar although the high end rolled off somewhat due to the sharp filters in the CD player.

The SA-3050 comes with a calibrated microphone. Other accessories include a rack mount adapter, battery pack, carrying case and printer output. The instruction manual is brief but reasonably complete and clear.

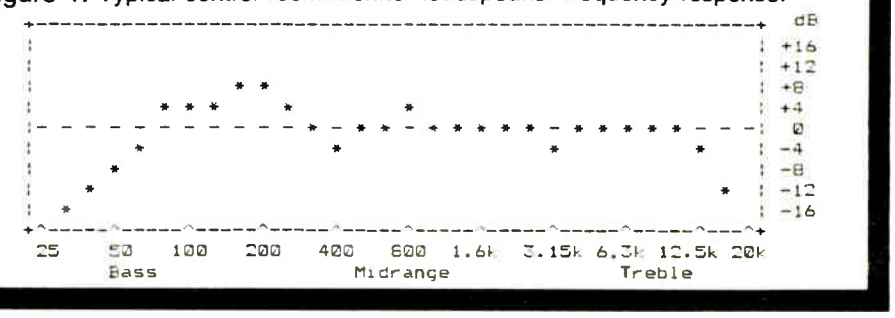
The current model of the SA-3050 has several new features: a peak hold function; digital readout of the SPL; and an averaging function which allows you to observe an average of several displays.

A real time one-third octave spectrum analyzer like the Audio Control Industrial SA-3050 can be a useful and powerful tool, but practice is required to interpret the results. The SA-3050 is priced in a range that makes it practical for broadcast use.

Doug Fearn is a frequent contributor to **RW**.

For more information contact Mark Hess at Audio Control Industrial: 206-775-8461. The author may be reached at 215-565-8400.

Figure 1. Typical control room monitor loudspeaker frequency response.



Circle Reader Service 30 on Page 28

BUYERS GUIDE

DE Sold on Harris Mod Monitor

by Mike Elliott, DE
The Warner Group

Lincoln NE ... A modulation monitor may no longer be required equipment by the FCC, but it is invaluable in both following the FCC's regulations and maintaining a quality transmission signal.

As DE for the Warner Group, I am responsible for engineering at eight radio stations and have a good deal of experience using several brands of modulation monitors.

Recently we needed to purchase a new modulation monitor for our flagship station, KLIN in Lincoln. I selected the Harris AM-90.

The all solid state AM-90 is designed for continuous monitoring of the amplitude modulation envelope in the 450 kHz to 30 MHz frequency range. What sold us on the Harris equipment was the number of advanced features the monitor offered and the quality of the product.

Unique features

I particularly like the AM-90's neon bar display for indicating carrier and modulation levels. The flat panel meter (DMB) displays two separate bar graphs, each containing 201 elements for 0.5% resolution.

This is the only modulation monitor that I know of on the market with an electronic digital display. It is a distinct advantage over electromechanical meters with moving parts.

User Report

Another advantage is the AM-90's ability to cross either peak to monitor RMS modulation for accurate loudness measurement. A rotary meter amplifier switch provides up to 50 dB of gain to the bar graph display.

This switch enables the operator to measure low amplitude modulation or transmitter SNR using a built-in audio filter.

While there are other techniques for checking the amplitude modulation of the carrier signal (e.g. using an oscilloscope) the mod monitor best enables us to track the overall transmission picture and maintain a quality signal. It requires no special skill or interpretation of information.

Monitor alarms

The unit has two fixed flashers adjusted to positive 125% and negative 100% for constant monitoring of modulation levels. These indicators are triggered whenever the monitored RF signal modulation exceeds the preset values.

It also offers a separate digitally programmable flasher so we can adjust the monitor alarms to meet our particular needs. Flasher accuracy is precise within 1% positive or negative.

It will hold a warning signal long enough so we don't miss the overmodulation alarms.

Beyond its obvious modulation monitoring capabilities, there are other benefits to the AM-90. At Warner we are experimenting with different signal processors. The Harris unit enables us to make a good quantitative analysis of each processor.

It is also easy to connect test equipment to the monitor. On the AM-90 all controls are front-panel mounted. Three separate high fidelity audio outputs and the high RF input impedance of the monitor facilitates connection of other instruments to the same RF source.

The AM-90 has an automatic gain control so it remains accurate at varying transmitter power levels. Because of its wide frequency input range with no tuning required, it can be used for domestic and international shortwave stations as well.

The monitor's self-calibration circuit is quite accurate so constant adjustment is unnecessary.

I recommend the Harris AM-90 monitor to other station engineers. It is a quality product that is competitively priced. As we need to replace the monitors at the Warner Group's other stations, we will replace them with Harris' monitors.

Editor's note: Mike Elliott has worked at the Warner Group for 14 years and served as DE for the last eight. He is SBE-certified and is chairman of the SBE Midlands Chapter.

For more information contact Martha Rapp at Harris: 217-222-8200. The author may be reached at 402-475-4567.

Circle Reader Service 34 on Page 28

BUYERS GUIDE

System One Speeds Test Time

by Lloyd Berg, CE
WDAE/WUSA

Tampa FL ... In an effort to get more work done in the same length week, WUSA purchased Audio Precision's System One automated audio test set a year ago.

Once we became accustomed to entering commands into a computer and letting it do the testing for us, we found that we could save tremendous engineering time and energy while obtaining substantially improved accuracy.

The System One is a high quality and very agile audio oscillator and analyzer under computer control. The box itself has only audio output and input connectors, a computer intercable and an AC power cord.

There are *no* controls of any sort on the box itself—no pots or switches to go bad.

Outstanding technical specifications allow it to critically evaluate even the best of our analog and digital equipment.

However, the system's ability to automate the redundant audio testing procedures that otherwise consume so much precious engineering time is its biggest selling point for us.

Setup requirements

To operate the System One, you will need a computer with at least 512K of memory, a disk drive, DOS 2.0 or higher, graphics and a graphics-capable printer such as an Epson.

We added a hard drive to allow lengthy procedures to be written, run and stored, a math co-processor for greater speed and a mouse to aid in set-up speed.

The only modification to your PC is inserting an interface card into a vacant slot on the mother board.

You will need to find a home for the combination. It could live on your test bench, but I recommend that a roll-around cart be purchased so that you can easily move it around to all of your studios and transmitter.

In operation you turn everything on and load the software into the computer in the usual manner. Once you are booted up, use the menu to set parameters, call up pre-recorded test routines or design new test runs.

User Report

To the newcomer, the users' manual is somewhat difficult to follow since you are probably used to operating your test gear manually. It will require some study and trial-and-error work before you become proficient.

Once you are up and rolling, you'll want to start accumulating on floppy or hard disk all of the necessary routines to fully test and evaluate each type of equipment and each system in your station.

You will learn how to document and store your test results either in memory or on paper. It is often valuable to superimpose previous test results of the same equipment to know if things have changed.

It does take some work at first!

Short testing time

By contrast (as we all know) in the old, traditional audio test routines, you had to spend long hours of your maintenance time dialing in frequencies and setting range and attenuator switches over and over again.

Just think about how much more you get done if you could just push a button and your entire FM proof would be done in 3 minutes.

How about if you stayed home asleep and the all-night jock or operator pushed the button and you read the results in the morning when you came into work?

You might even want to schedule something this easy and fast once a week as part of an ongoing quality control program.

Imagine being able to run a previously selected response and distortion step-sweep at 15 frequencies and at four different modulation levels in less than a minute.

Think what a big difference this would make when attempting to optimize your AM transmitter tuning, bias, duty cycle, etc.

You can use a similar routine to align multiband audio processors, optimize bias in tape machines, troubleshoot equalized preamps, etc.

Varied applications

Is your SCA cross-talking into your stereophonic subcarrier region? Is there 44.1 kHz garbage from your CD players getting through your super clean audio chain? Are your control room microphones picking up 15 kHz hash from video screens? It will take you a few seconds to find them.

You should also make up programs to

(continued on page 34)

Silence Sensor Audits Audio

by David Pedersen, Sales Eng
Gentner Electronics Corp

Salt Lake City UT ... With the use of automation increasing and in-house engineering becoming rare, radio stations are finding an increased need for accurate monitoring of audio signals. We believe Gentner Electronics' Silence Sensor provides this capability.

Taking action

The Silence Sensor can be used in any application where action needs to be taken if audio is lost. It can activate lights or alarms, or start backup equipment if necessary.

The Silence Sensor is especially useful for monitoring satellite or network feeds or keeping track of the on-air signal.

When "silence" is detected by the unit, an open collector brought out of the rear panel is activated, and the front panel "Silence" LED lights.

Technology Update

In addition, a time-out counter is started. The open-collector can be used for any desired action such as turning on a light.

Time-out is programmable from 1 to 99 seconds, or 1 to 99 minutes. If audio has not returned when the programmed time limit is reached, a second open-collector on the rear panel is closed.

Additionally, an SPDT relay output is activated and the "Time Out" LED on the front panel is lit. These outputs can be used for sounding alarms, activating tape machines, etc. When audio returns, the Silence Sensor returns to its standby state.

All interfacing to the unit is made via the rear panel barrier strip.

Two audio inputs, labelled Right and Left, are provided for monitoring stereo signals; mono audio can be applied to either input.

The "S" and "TO" terminals are the open-collector closures for "Silence" and "Time-Out" and are rated to sink 250 mA at a maximum of 48 VDC. The LED common terminal provides positive voltages for LED indicators connected to the "S" and "TO" terminals.

The necessary voltage dropping resistor is provided.

Power provided

If the "S" and "TO" terminals will be used to close relays, the "+5V" terminal will provide the needed power for the relays.

An SPDT relay is already provided in the Silence Sensor; connections to equipment are made via the "NO," "NC" and "C" terminals. The "NC" position is selected on time-out.

The Silence Sensor observes audio on both a narrow and wideband basis. This allows the unit to ignore hum and other extraneous signals.

The unit's programmable time-out capability and multiple outputs give you the flexibility needed in monitoring audio anywhere in the station.

With Gentner's Silence Sensor, missing important feeds or having dead air can become a thing of the past.

Editor's note: For more information contact Elaine Jones at Gentner: 801-268-1117.

Circle Reader Service 5 on Page 28

BUYERS GUIDE

TFT Gives Peak Performance

by Fred Krock, Eng Spvsr
KQED-FM

San Francisco CA ... A modulation monitor is not an exciting device. It sits in the rack and as long as it doesn't tell embarrassing things about your signal, people tend to ignore it. Announcers definitely ignore it.

User Report

However, two things combined to encourage us to replace our old modulation monitor. We replaced Ma Bell with a new TFT 8300 series STL and we had our Harris transmitter MS-15 exciters converted to MX-15s.

Suddenly our signal was so much better that we couldn't measure it with our old monitor. The limiting factor in measurements was noise and distortion in the old mod monitor.

We had to use a consumer FM tuner for meaningful noise and distortion measurements.

We looked at several different makes of modulation monitors. We decided on the TFT model 844 for several reasons.

Our old TFT monitor had given very reliable service over the years, and the company had given us fabulous factory support for a few teething pains with our new STL system. Also, the factory is located nearby; emergency parts and service are only an hour's drive away.

So far, we have not regretted the decision.

In with the new

Delivery took about six weeks. A crystal is ground to order, and the entire monitor goes through a one week high temperature burn- in before calibration.

Installation was simple—out with the old and in with the new. This was followed by an equipment shuffle in the rack because the new monitor takes less rack space than the old.

We ordered the monitor without the optional modulation and carrier failure alarm. But after the monitor was installed, a format change made the alarm desirable.

The alarm option comes on a separate circuit board which plugs into one of the main boards. No soldering or other modifications are required.

KQED-FM is a National Public Radio affiliate with emphasis on news and information programming. A limited amount of classical music also is broadcast.

Fortunately we are not an active combatant in the modulation wars. If your station is, and if you don't want to win a Purple Heart, the TFT 844 tells you exactly what your modulation peaks are doing.

Personally, I wish the Commission would have had enough guts to say that 100% is an absolute limit. Exceed that and die. Instead we have to deal with frequently recurring peaks, whatever that may be.

Peak flashers

The TFT 844 has a counter which tells how many times per minute your peak flashers light. The monitor has separate flashers for positive and negative peaks.

A thumbwheel adjusts the minimum length peak required to light the flasher between 0 and 9 ms. You can set the peak flasher to ignore very short overshoot peaks which probably won't show on a spectrum analyzer anyway.

The monitor has two tunable input frequencies. You can dial up the competition on the other input and switch instantaneously between your station and the competition. (You can show the program director how much they are violating the law.)

Our transmitter is located at a multiple station site. We do not have an emergency generator. We keep another station without a generator at the same site dialed up in position 2.

If our transmitter goes off the air, we check to see if the other station also is off to confirm power failure as the cause.

The TFT 844 will not measure carrier frequency. If you have had problems in the past with off-frequency operation, you will have to maintain your old frequency monitor.

But in this day of zero coefficient crystals, off-frequency operation is extremely rare.

Do I have any criticisms of the TFT 844? I do. The technical manual is not complete.

New manual

All the schematics and parts lists are there and typical voltage readings are shown on the schematics. However no block diagrams, theory of operation or circuit board location diagrams are included.

The manual does not mention the flasher duration control, and it also neglects to tell you that the phase cal adjustment can be made only when there is no modulation.

Perhaps I was spoiled by the old Ampex audio recorder manuals which told the function of every component down to the least significant resistor.

TFT is not alone in technical manual shortcomings—some of the biggest names in the industry are equally guilty.

TFT has promised to have a new manual available within the next three months.

One thing I would like to see included in modulation monitors is a gain control in the balanced audio output circuit.

The TFT 844 audio output level is 0 dBm (into 600 ohms) when program material modulation is 100%. Most consoles are nominal +4 dBm devices.

When the console monitor is switched between the console and air, the air volume usually is lower if the TFT 844 is connected directly to the console.

Of course, audio levels rarely match because of audio processing between the console and transmitter. However, if the air levels are lower consistently, the announcers think something is wrong with the transmitter.

An external amplifier wired between the modulation monitor audio output and the console air input solves this problem. However, a better solution would be more gain with a level control in the modulation monitor.

Repeat customer

The TFT 844 FM modulation monitor does exactly what it claims to do. To the extent I was able to measure its performance, published specifications are conservative. I would buy it again with no hesitation.

In the final test, audio coming from the TFT 844 sounds good. I use critical listening as a final test of any audio equipment since I'm not convinced that every measurement of audio quality has been discovered yet.

With a good STL and a low distortion exciter in the transmitter, audio from the TFT monitor is very similar to audio processor output.

If you want an FM modulation monitor to tell you how your equipment is performing in the age of compact discs and digital tapes, the TFT 844 is worth a long, hard look.

Editor's note: The irascible Mr. Krock got into broadcasting at a very early age and says he has never had sense enough to get out. After spending 26 years, the last 16 as CE with another station, he moved to KQED-FM.

For more information contact Jesse Maxenchs at TFT: 408-727- 7272. The author may be reached at 415-553-2129.

BUYERS GUIDE

Delta PRH-1 Finds Cable Faults

by John P. Bisset, Delta Electronics
and John Diamantis, CE, WCPT/WCXR

Alexandria VA ... Most broadcast engineers are familiar with the test instrumentation provided by Delta Electronics, Inc.

But few may realize that the company offers several products manufactured for HF communications that can be adapted to commercial broadcast applications.

One such instrument is the model PRH-1 High Power Pulse Reflectometer. Designed to provide an oscilloscope picture of a station's transmission line system, the PRH-1 can be used to document buried transmission lines as well as determine the location of cable faults.

Figure 1.
Expanded View - Coaxial Transfer Switch

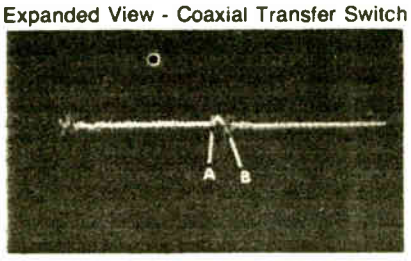


Figure 2.
Auxiliary FM System
Main FM System

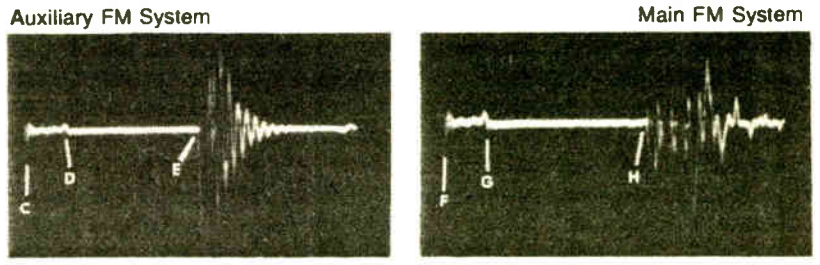
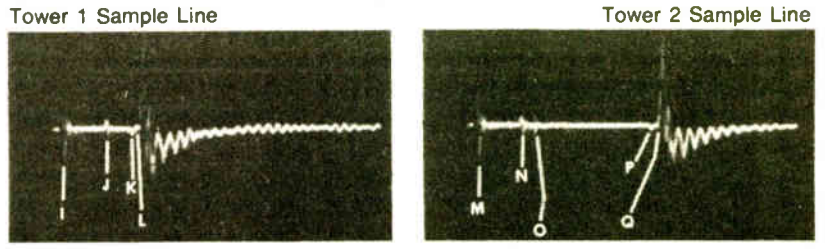


Figure 3.

Shunt Capacitance
(Such as a dent in outer conductor)

Figure 4.
Tower 1 Sample Line
Tower 2 Sample Line



Operates in high RF

The primary advantage the PRH-1 has over other "time domain pulse reflectometers" is its ability to operate in high RF fields.

With the typical reflectometer, caution must be exercised to prevent high voltages from nearby radiating elements from entering and destroying the instrument's front end.

This drawback can wreak havoc when the line to be examined exists amidst other operating broadcast antennas or arrays.

Measurements conducted at Washington DC's WCPT/WCXR were made with a full power 5 kW AM transmitter and 13 kW TPO FM operating. No degradation of the display or damage to the PRH-1 was noted.

Operation of the PRH-1 is straightforward. A high voltage (5 kV) short duration pulse is applied to the transmission line. A time versus amplitude display of the echoes is then viewed on an oscilloscope.

Faults or discontinuities in the line, as well as the terminating load or antenna cause these echoes.

Reference tool

Although most engineers are introduced to a Pulse Reflectometer after damage to a transmission line has already occurred, the PRH-1 can provide a useful reference which can be consulted should future line damage occur.

The ability to convert these oscilloscope pulse distances allow accurate location of faults or line discontinuities in the field.

Technology Update

Figure 1 illustrates this fact. The photograph displays an expanded scale illustrating a coaxial transfer switch. A is the input of the switch, B is the output.

Figure 2 displays the input to two FM transmitter lines. C is the main reference pulse; D shows the input to the coaxial transfer switch; E is the input to a four-bay Jampro FM antenna.

The distance between C & D is a 100' test cable which connects the PRH-1 to the coaxial transfer switch. The distance between D and E is the 400' run of heliax to the antenna.

Dents to the outer jacket of the coax would appear along this line as a small downward pip followed by a flattened upward pulse (see Figure 3).

The second photo in Figure 2 displays the main FM antenna. F illustrates the start pulse. G is the input to the coaxial transfer switch, followed by 500' of rigid line. H is the input to a four-bay ERI FM antenna.

The PRH-1 performs equally well in AM applications. Figure 4 demonstrates the station's two sampling lines. Measurements were taken while the AM operated under full power.

Use for AM

As you can see from the traces, there is no visual disturbance due to the 5 kW RF. I is the input reference pulse; J is the input to the sample line. Remember that the distance from I to J is the 100' reference cable which connects the PRH-1 to the sample line input.

K is the cable termination and L is the input to the sample loop. Since this is a folded unipole tower, the sample loop is mounted parallel to the skirt feed line. That explains the short distance between J and K.

M shows the reference pulse feeding the sample line for a tower; N is the input to the sample system for this tower. O is a splice in the sample line. P shows the cable termination and Q is the input to the sample loop.

Through measurement of a station's transmission lines, using the PRH-1, reference data can be gathered that is invaluable should a fault occur.

Editor's note: John Bisset spent seven years at WCPT/WXCR as CE before joining Delta. John Diamantis is now the station's CE.

For more information contact John Bisset at Delta: 703-354-3350. John Diamantis may be reached at 703-683-3000.

System One Saves Time

(continued from page 32)

track your favorite test tapes, records, CDs and network test tone runs. This is the only type of tests (designed to be tracked manually) that really takes any time at all.

Work reduction

I really don't know why someone didn't come up with automatic testing eguipment years ago. It is completely logical to delegate redundant and repetitive electronic tasks to a computer.

For the first time in years something has come along that will reduce rather than increase the engineer's work load.

The Audio Precision System One will allow you to work more civilized hours, speed your shop testing time and documentation, and maybe even allow you to spend a few more hours with family or friends.

If you don't have computer assisted testing, you are wasting valuable amounts of your time, energy and productivity.

Editor's note: Lloyd Berg has spent half of his 34 years in broadcast, starting at Channel 3 TV in Madison and culminating at his current position with Gannett.

For more information contact Bob Metzler at Audio Precision: 503-627-0832. The author may be reached at 813-876-0455.

BUYERS GUIDE

Automated Testing On the Rise

(continued from page 29)

The manufacturers' answer to the station's dilemma of getting and maintaining both high quality audio and an alert engineer is to buy an automated test set.

"What automation allows you to do is quickly establish a baseline so you can zero right in on the station's problems," says Kent McGuire, director of marketing for Sound Technology.

> *"The biggest benefit to the station is that the CE can spend more time . . . doing routine, preventive maintenance."*

'And a CE can check the audio more often because automation reduces testing time from two nights to maybe 15 minutes," he adds.

Sound Technology's 3000 Series Programmable Audio Test System is one such time-saving device. It does not use a PC for operation but relies on an internal microprocessor. Test results may be saved via RS-232 or IEEE-488 ports.

Manufacturers stressed that automated test equipment by no means changes the requirement that stations have good engineering expertise on staff.

"It just frees people up from the drudgery of doing a lot of seemingly meaningless knob-twiddling in order to get part of a result," says Jones.

The biggest benefit to the station is that the CE can spend more time analyzing test results and doing routine, preventive maintenance.

The stations and CE can gain even more "quality time" by having the system manned by less skilled personnel, or in the case of some systems, by no personnel at all.

Manufacturers say they strive to make their automated equipment very easy to operate.

"I could have my mom run our automated equipment," says McGuire. "I could never get my mom to run our manual stuff," he adds.

Even analyzing test results is easier with the graphics capabilities of automated systems. CEs can store in memory completed proofs and test results, and pull them up later for comparison with new data.

"You get a very thorough, very concise output that raises no questions as to how good or bad you sound—management will get undisputed results," says Jones.

Of course, automation may not be suitable for every station. And manufacturers are quick to admit that manual equipment does have its place in broadcast and will survive for some time.

"I don't see a day when manual equipment will be gone," says Metzler, although he adds that he believes the manual market will diminish and that nearly all audio test equipment companies now offer automated systems.

"Engineers may still want something portable that they can lug around and strap to the back of a motorcycle and carry out to the transmitter," says Jones. "That's where manual may still be used."

But for a station that needs a rigorous, ongoing analysis of its sound quality, an automated system has become the clear choice.

❑ Industry Tidbits ❑

New Directions . . . A new **Audio Products Division** has been formed by **Gentner Electronics Corporation** to serve broadcast, teleproduction/post-production, sound contracting and professional sound markets.

New products from that division include the **Silence Sensor** which monitors the presence or lack of audio and the **Studio Timer** which measures elapsed time in hours, minutes and seconds. The company also recently formed a new **Teleconferencing Division** and acquired Advanced Design Technology (ADT).

❑❑❑

New Locations . . . West coast stations and facilities will be happy to learn that **Harrison Systems** has opened a full-service office in **North Hollywood**. The address is 4721 Laurel Canyon Blvd., Suite 209, North Hollywood CA (818-763-2349). **Jerry Smith** will direct operations.

Meanwhile, **HM Electronics** has moved to a **new facility** at 6675 Mesa Ridge Road, San Diego CA 92121 (619-535-6060).

Amber Electro Design reports it has moved its operation to a **new facility** "three times larger" than the present one **because of increased demand** for automated equipment. The new address is: 3391 Griffith Street, St. Laurent, Quebec H4T1W5. Same phone number.

❑❑❑

People . . . **Harris Corporation's** board of directors named **John Harley**, the company's current president and CEO, to the additional post of chairman of the board . . . **W. Peter Carney** has been appointed **VP-corporate relations** . . .

Also: **Omega International** has promoted **Kinsley Jones** to **VP, marketing and sales** . . . **Bradley Broadcast's Neil Glassman** is now the company's **national sales manager** . . . and **BSW's Irv Law** assumed the duties of **chairman of the board and CEO** while **Bernice McCullough** has taken the position of **president** and chief operating officer.

❑❑❑

Finances . . . For the first fiscal quarter, which ended 2 October, **Harris Corp.** reports a **23% increase in net income** on an 8% increase in sales. Company president Hartley called the earnings "in line with expectations."

If you have industry/equipment news to report, send it to **Radio World Buyers Guide**, *5827 Columbia Pike Ste 310, Falls Church VA 22041.*

BUYERS GUIDE

Amber 5500 Earns High Marks

by Rob Meuser
Int'l Bdcst Support Services

Hamilton Ontario ... Test equipment today is becoming a sophisticated field unto its own. Happily it is one area where the products are becoming genuinely more sophisticated and useful.

Often the quality of connection between the test equipment and the test device is the limiting factor of measurement, when the legendary straight wire is anything but.

User Report

Players in this class of high-tech test equipment are few. Of all the available technology, in my opinion none are able to better the quality and power of the Amber 5500.

I first saw the 5500 last year at NAB and left the show modestly impressed.

One high profile purveyor of this class equipment left me with the comment that, "It is one thing to build in a GPIB interface, and quite another to get it to really work."

I left with the mistaken impression that Amber and some other companies might have a lot more work to do.

GPIB interface

For those who are not familiar with GPIB, otherwise known as the IEEE 488 bus or sometimes the HPIB, let me offer a brief explanation.

The GPIB, unlike the various serial interfaces, is a high speed parallel interface bus especially designed for controlling test and measuring equipment.

Each device is given its own special address, and is commanded to either transmit or receive data by the central controller. While the mechanics of the bus are somewhat complex, and timing is important, using the bus is no more trouble than any other standard computer interface.

Looking at the Amber unit and its use of the GPIB certainly reflects the quantum leap computer technology has taken since the heyday of the old Pet computer.

The Amber 5500 is not only a high-tech, high quality piece of stand-alone test equipment, it is also a complete measurement system.

The hardware itself consists of a signal generator, distortion analyzer, sweep system, waveform generator and stereo switching system.

It is capable of audio spectrum analyses, noise generation, controlling an external audio source and much more. IMD measurements according to either SMPTE or CCIF are possible, all automatically.

With the exception of the spectral analysis and high speed sweeping abilities, all the features mentioned are roughly similar to most other equipment in this class. What sets the 5500 apart is the extensively developed software that works with the GPIB interface.

Amber supplies the most complete documentation I have ever seen with any type of software. Each file is listed and explained, and set-up is clear and concise. The documentation avoids the use of "computerese."

When the Amber 5500 is harnessed to any PC/AT compatible computer, what was just minutes before a piece of test equipment is now a development system.

The Amber software not only interfaces the equipment, it also provides a very high-powered analysis system.

> *What sets the 5500 apart is the extensively developed software that works with the GPIB interface.*

The Amber/PC combination offers the user a complete menu driven development system to specify exactly the measurements desired: every possible parameter can be controlled.

It is no problem, for example, to generate either a preemphasis or inverse preemphasis curve merely by editing a chart of frequencies versus output levels established by the system editor.

The exact frequency in a step can be altered with many pieces of test equipment if you specify a logarithmic frequency step from 20 Hz to 20 kHz. The number of measurement points you choose determines the exact frequency. Most times, these perfect logarithmic steps turn out to be oddball values.

While the Amber system will calculate the same oddball frequency as any other piece of gear, its software allows you to edit those values to ones that fit your whim.

After these values are established, you may then make your tests, and then later analyze the results with different scaling. Since all the files are ASCII files of letters and numbers you can also transport them to other systems like Lotus 1-2-3.

Open to possibility

You can even construct word processor macros that insert file table data into pre-formatted test reports. The software supplied by Amber is so flexible and simple to use you can do almost anything your imagination inspires you to do.

The software has its own simple to use control language, including some basic math functions. You can pre-program a sequence of events (measurements or tests) and name them as a file.

You can also control equipment not made by Amber as a part of your procedures. For example, you can program an RS-232 port to control a tape machine and at the same time control the Amber to test it, producing an entire automated set up system.

You can hook another manufacturer's RF spectrum analyzer to the GPIB and program it along with the Amber to do a complete AM mono or stereo transmitter analysis.

Since much broadcast measurement is done in the wee hours of the morning, the power of such a system is truly useful.

Money saver

In major markets equipment like the Amber 5500 properly programmed could save money by vastly reducing off air time for proofs and greatly increasing data quality. Private consultants can benefit in the same manner. As we all know, one night of work kills two days.

There is so much more that the software can do it is worth several articles itself. Weighting, averaging, settling algorithms, compensation for various mediums (delay from record to play on tape machines), the ability to automatically read test tapes in a single-ended manner and much more are available.

Even the hardware alone has vast capabilities. Distortion and noise can be automatically measured through various weighting filters.

Distortion generally uses either a third or fifth harmonic low pass filter and a high pass filter, after 400 Hz, all automatically swept with frequency. There are sixteen weighting filters available including all noise weighting and telecommunications standard filters.

Performance

Like most equipment in this class, it has substantial weight (45 lbs). As mentioned earlier, equipment like this generally has specs that greatly exceed the performance of most equipment as well as that of older test equipment.

In the case of one equipment test, I had another well-known digital, computer-controllable piece of test gear available.

I took the oscillator output of the Amber 5500 and fed it directly into the Brand X machine. Distortion was slightly over 0.001% distortion (−96 dB); the noise floor was more than 10 dB below this. I then fed the Amber into itself and got 10 dB less distortion in the worst case measurement.

In the early stages of this test, erratic results were noted due to the quality of the interconnection (that wire wasn't as straight as we always thought!).

Such results are typical of what you find down near −100 dBm, proving that we can't enter the world of 96 dB dynamic range CDs and other digital audio sources with poor wiring.

The power of this equipment is so extensive that you should really learn more about it on your own. It is truly a strong player in today's world of wide range audio.

Editor's note: Rob Meuser specializes in all manner of broadcast systems and associated equipment. He is a frequent contributor to **RW**.

For more information contact Wayne Jones at Amber: 514-735-4105 in Canada. The author may be reached via MCI Mail #325-3672, or by calling 416-526-8200.

BUYERS GUIDE

Potomac FIM Used for PSA/PSSA

by Leroy C. Granlund, Bdcst Conslt

Sunnyvale CA ... Pre-sunrise and Post-sunset Authorizations have been a "mixed blessing" for AM stations previously licensed for daytime only. One of the most common technical problems created by the new rules is the need for an accurate method of maintaining operating power at a level far below that utilized during daytime hours.

RF ammeters installed for daytime use are often useless for the lower PSA or PSSA power levels, and in many cases a dual-scale meter or even two separate meters will not solve the problem.

Power levels authorized for PSA and PSSA use are usually a fraction of normal daytime power and may be as low as 1 or 2 W. (For example, one station in the northeast is licensed for 50 kW daytime, but only 1.5 W pre-sunrise!)

Unsatisfactory methods

The method of power reduction is left up to the individual station, and many stations choose to simply switch in an attenuator between the transmitter and the antenna matching (or phasing) equipment.

In addition to the obvious waste of electric power and tube life posed by this method, it may result in illegal operation. Unwanted stray radiation from the transmitter and attenuator can actually exceed the authorized PSA or PSSA power.

User Report

It is usually better to modify the transmitter to accomplish the power reduction or to provide a separate low-power transmitter.

Measurement of operating power of a few watts (or less) by the normally accepted method of measuring antenna base current will often produce inaccurate and misleading results, because RF current induced in the tower by other broadcast stations may approach or exceed that produced by the PSA or PSSA transmitter.

Some stations have solved this problem by constructing a "dummy load" having the same resistance and reactance as the antenna, and measuring current into the dummy load.

After the transmitter is adjusted to produce the authorized power input to the dummy load, transmitter output is re-connected to the antenna system.

This method may not be accurate for stations using an RF attenuator because it does not show power radiated from the transmitter or attenuator.

Using a field intensity meter

I have developed a simple method for measuring PSA or PSSA power which is extremely accurate and effective for almost any station, regardless of power levels authorized. It makes use of the Potomac Instruments Model FIM-41 Field Intensity Meter, which is available to most broadcast stations.

For best results, a mounting tripod or ladder (preferably made of wood) and a radio or telephone communications system should be available during the test procedure.

No special skill or training is required, other than a knowledge of the normal operation of the FIM-41, and of the transmitter and power reduction system. It is an ideal method where several different power steps are authorized.

The success and accuracy obtained in these measurements depends upon several factors. The station must have accurate knowledge of daytime operating power, preferably based on an accurate antenna current meter and a recent antenna impedance measurement.

Also, daytime and PSA or PSSA operation must use the same site and antenna configuration, or a special test plan must be used.

Finally, the FIM-41 Field Intensity Meter used must be in good condition and must be accurately calibrated. It must *not* be moved during the test procedure.

The procedure

Before beginning, inspect the FIM-41 Field Intensity Meter for satisfactory mechanical condition, and check for normal operation and battery condition. If possible, check it against another field intensity meter in order to verify calibration.

Provide a tripod or other mount for the FIM-41. A wooden ladder or chair is quite satisfactory. In case of high winds, use rope or tape to secure the instrument to the mount.

Then adjust the transmitter to exact licensed daytime power. Or use 1 kW (non-DA) if the daytime site or antenna is different.

Take the FIM-41 to a location which provides a field intensity reading between 100 mV and 10 V at daytime power. It is necessary to have commu-

(continued on page 38)

Circle Reader Service 26 on Page 28

Measuring PSA Power

(continued from page 37)
nication between the transmitter site and the FIM-41 location either by telephone or two-way radio.

Place the FIM-41 on the tripod or mount. Calibrate the instrument and orient it for maximum reading in the usual way. Make note of the *exact* meter reading on the dB scale.

Then calculate the difference between licensed daytime power and authorized PSA (or PSSA) power in dB.

Switch the transmitter to PSA (or PSSA) power.

Read the field intensity on the FIM-41, making sure not to move the instrument or disturb its calibration. Note the difference from daytime power, in dB. If necessary, reset PSA (or PSSA) power to authorized value.

Use the same procedure for any other authorized power steps, starting with the calculation of the difference between licensed daytime power and authorized PSA or PSSA power in dB.

Logging the reading

After all power levels have been accurately set, it is easier to maintain these levels on a daily basis if a reference power reading is logged at this time.

If the station uses an RF attenuator for power reduction, log the RF current at the *input* of the attenuator. If the station uses a low power PSA/PSSA transmitter (such as LPB's), log the reference output meter reading (in percent) for each power level.

Calibration of the reference meter should be rechecked as needed; I suggest 90 days or six months as a reasonable interval. To do this, repeat the entire procedure outlined above.

Calibration information should be retained for at least two years to provide proof of compliance with FCC rules for determination of operating power.

This procedure uses actual radiated field to determine PSA and/or PSSA power; it therefore eliminates any error due to radiation from the transmitter or attenuator. This method is *not* specifically allowed by FCC rules, although it meets all criteria for this purpose.

In my opinion, the FCC will not question the use of this method of determining PSA or PSSA power if accurate records are kept and available for inspection.

Editor's note: Leroy Granlund began his broadcast career in 1956 with WMAQ. He worked as DE for Western Broadcast Service for 15 of his 20 years with the company and was most recently Senior Engineer at TCI.

For more information contact Dave Harry at Potomac Instruments: 703-589-2662. The author may be reached at 408-736-5503.

BUYERS BRIEFS

Delta Electronics' Splatter Monitor provides AM broadcast engineers with a means of measuring out-of-band emissions. A taut-band meter provides visual measurement, and a front panel speaker and headphone jack offer aural confirmation of the meter display.

An adjustable remote output is also available. Status output can be fed to the station's remote control equipment to notify the operator of an out-of-tolerance condition.

The Splatter Monitor is frequency agile, permitting measurements throughout the AM broadcast band. A 12 V power input and optional active antenna permit field measurements from a vehicle.

The synchronous detector permits measurement of both envelope and quadrature information.

Should objectionable splatter occur, an engineer can ascertain whether it is being caused by improperly adjusted processing (by measuring envelope) or misadjusted interstage neutralization (by measuring in the quadrature mode).

For more information contact John Bisset at Delta: 703-354-3350, or circle Reader Service 64.

Radio Design Labs' Amplitude Component Monitor, the ACM-1, is an AM noise meter which connects to the RF sample on an FM transmitter. A digital string display with 20 dB of range displays AM noise for transmitter tuning.

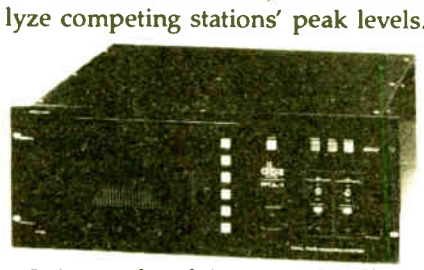
The unit interfaces with any remote control to sample and then read back a stable indication of AM noise.

An adjustable alarm threshold can signal the station operator when AM noise has increased beyond a level determined to cause reception problems.

The nature of AM noise measured can be examined by the engineer with the oscilloscope output. Audio and data outputs are provided.

For more information contact Jerry Clements at Radio Design Labs: 805-684-5415, or circle Reader Service 61.

dbx's new RTA-1 Professional Real-Time Analysis System allows broadcasters to analyze transmitter frequency response using the music being broadcast instead of test tones, as well as analyze competing stations' peak levels.



It is a 31-band (⅓ octave) real-time analysis system, and can compute the frequency response of a room or device using either music signals or its own uncorrelated pink noise. It is PC-interfaceable and menu-driven.

Features include averaging and pink-hold modes, multi-memory storage and manipulation, a color monitor and printer port. In addition, the system uses 3rd order (IEC class 3) filters, ISO centers and true RMS level detection.

Storage and manipulations such as averaging, subtracting and inverting are possible.

For more information contact Les Tyler at dbx: 617-964-3210, or circle Reader Service 67.

Sound Tech Series 3000

(continued from page 29)
nology system is a two-channel, alternate-reading device that offers true differential, electronically balanced inputs (100 kΩ, ±1%).

Two simultaneous real-time measurements can be viewed on individual LED displays or you can select test data in memory.

Analog meter

An autoranging analog meter is included for peak/null adjustments. To help in testing "unknown" signals, one of the LED displays becomes a 5-digit, 650 kHz frequency counter.

Level measurements can be displayed in volts, dBm (referenced to 600 or 150 ohms) and watts. Although the analyzer is a true RMS voltmeter, measurements can be made with average, RMS or quasi-peak detection characteristics.

The THD section has a residual distortion of less than 0.001% (10 Hz to 20 kHz) and a rather astonishing minimum level requirement of 30 mV. Readings can be displayed in either percent or dB.

Channel-to-channel phase differential can be measured and displayed in degrees or as a function of time.

Whenever bandwidth-limited tests are needed, the unit offers an impressive selection of "stock" filters: 22, 200 and 400 Hz high pass, and 15, 22, 30 and 80 kHz low pass. "A" weighting and CCIR filters are also available.

Storage capacity

What sets the Sound Technology unit apart from manual analyzers is its data storage capability: an internal memory stores more than 1200 lines of test data—up to 3600 measurements!

And it's simple to print test results—just connect a compatible printer to the analyzer's Centronics parallel port.

Front-panel "cursor" controls allow the user to "scroll" through the memory—"markers" are used to specify which part of memory you wish to print.

Since all data is automatically stored, it's impossible to make an error by not saving a test run. Besides the tabular printout, 22 different tests can be printed in graphic form *without* an external computer.

Two options are available for the analyzer: SMPTE IMD, to compliment the generator, and a feature called notch lock, which in the THD mode causes the filter to "lock" on frequency when the input signal falls below 100 mV.

Whether the generator and analyzer are used bench top, or split at remote sites, fully automated tests are fast, reliable and error-free.

The Sound Technology Model 3000 is truly a portable and comprehensive audio test system, offering performance capable of testing even 16-bit digital systems.

Editor's note: In addition to his responsibilities as CE for KOLA/KMET, Dennis Martin is also DE for House of Music in Costa Mesa, CA, a consulting engineer and a freelance writer.

For more information call Kent McGuire of Sound Technology at 408-378-6540. The author may be reached at 714-684-9992.

BUYERS GUIDE

CE Manages RF with I.F.R. Gear

by Lloyd Berg, CE
WDAE/WUSA

Tampa FL ... About a year ago I realized that I was attempting to operate a great deal of radio frequency generating and receiving equipment with very inadequate test equipment.

I had no idea if my many broadcast, RPU, two-way, TSL and STL transmitters were spectrally clean, or if my auxiliary service equipment was operating with proper modulation, or if the accompanying receivers were operating at rated sensitivity.

Almost equally important, I had no way to determine if my RF neighbors (both broadcast and non-broadcast) were on their assigned channels or if they were operating at variance.

Because the RF spectrum in Tampa—and nearly everywhere else—is extremely congested, interference is an ongoing problem. How does the modern communications engineer handle the task of RF management?

We had to find the proper tools!

A couple of years ago the I.F.R. company in Wichita, Kansas started marketing a combination communications service monitor and spectrum analyzer.

For years I.F.R. has manufactured high quality communications and test equipment for the aircraft industry. Their introduction of a quality and cost effective piece of RF test equipment that covers (almost) DC to 1000 MHz is long overdue.

This wonderful device is nearly perfectly tailored to the needs of the radio broadcast engineer. It covers the AM and FM broadcast bands, all remote pick-up, TSL, RPU, ICR and STL frequencies.

Its operation is completely synthesized and all parameters are entered on a keypad and by rotary switches. If you have a computer with an RS-232 port, all operations can be automated via this method.

The I.F.R. 1200-S consists of four basic units.

The RF signal generator covers 250 kHz to 9999.9999 MHz. The output level is calibrated between 0.1 μV and 25 mV. This is useful in checking or tuning the sensitivity and selectivity of all your remote pick-up receivers, TSL, STL links, filters, etc.

The built-in synthesized function generator can modulate this RF generator (either AM or FM) to produce sine, square, ramp and triangle waveforms, between 10 Hz and 99.999 kHz (plus DTMF tones).

This can be used to generate subaudible tone squelch signals for your two-way radio servicing, response testing, simulate 19 kHz FM stereo pilots or SCA carriers, etc.

The receiver/monitor can digitally tune and listen to anything between 0.1 MHz and 1 GHz at 2 μV sensitivity. Bandwidths are narrow, medium and wideband (200 kHz) FM, wide or narrowband AM, or SSB/CW.

This feature is extremely important when tracking down interference to your two-way, Marti, STL or other licensed channel.

The receiver is directly linked to the spectrum analyzer. The receiver listens to whatever signal is in the center of the spectrum analyzer's panorama. The spectrum analyzer displays 10 kHz to 1 GHz with bandwidths of 1 kHz to 10 MHz.

The spectrum analyzer is a CRT display of all signals within a 90 dB range in any selected portion of the RF spectrum. The strengths of all the various "off air" carrier signals are displayed as to frequency and intensity.

It is about the only device that will allow you to quickly and accurately check for spurs, harmonics, etc. on your transmitter and everyone else's transmitter in town. It is also useful for locating vacant channels that would be likely candidates to license for minimum interference auxiliary uses.

The unit operates on 110 VAC, or 12/24 VDC. By using the included cigar lighter plug it is possible to operate it as a mobile interference finding unit.

This feature is very valuable when you are trying to locate the source of interference that may be causing you problems or that is being caused elsewhere but includes your signal as part of the components of intermod.

Broadcasters have been used to generating RF. Most don't know much about receiving. This is an area that many engineers are going to have to master as stations convert from leased telco loops to station-owned STLs and TRLs.

In today's crowded RPU spectrum, reliable operation and policing is possible only with the help of a communications/spectrum analyzer.

We use our communication analyzer nearly every day. I honestly feel that a broadcast engineer cannot properly maintain the multitude of RF transmitters and receivers in his care without this type of equipment.

Editor's note: For more information contact I.F.R. at 316-522-4981. The author may be reached at 813-876-0455.

Circle Reader Service 13 on Page 28

DYNAMAX
invites comparison

When you evaluate cartridge machines, you need to look beyond the bells and whistles. With 35 years background in cartridge technology, we've built benefits into our cartridge machines that less experienced manufacturers haven't even considered, but professional users rely on every day. That's why we've compiled a short list of important items for your comparison. Get our complete list. Contact Fidelipac or your Fidelipac Distributor.

	DYNAMAX CTR124 $4000	OTARI CTM105 $4518
Manufacturing Location	Moorestown, NJ U.S.A.	Tokyo, Japan
Automatic selection of recording and playback level, bias and EQ	✓	
Automatic selection of discrete or matrix record and play modes	✓	
Automatic selection of stereo or mono record or play modes	✓	
Automatic activation of external devices (such as noise reduction equipment)	✓	
Automatic Fast Forward at beginning *or* end of secondary tone	✓	
Automatic audio muting at beginning *or* end of secondary tone	✓	
Dual rate, multi-function replay lockouts	✓	
Vari-Speed with tracking cue tones for fail-safe tone detection	✓	
DC servo capstan motor with separately removable electronic module for easy servicing	✓	
On-board audio mixer and switcher	✓	
Relay *and* logic tone sensor outputs	✓	
Patented splice finder unaffected by tape debris	✓	
Cleaning switch for easy pressure roller cleaning and diagnostic checks	✓	
Simplified report-by-exception blackout status panel	✓	
Signal-to-Noise Ratio (Ref 250 nWb/m, no tape)	≥1 dB	53 dB
Crosstalk, cue to program channel	Inaudible	Audible
Audio squelch in Fast Forward	Better than -70 dB	-25 dB
Cost of replacement stereo play head	$68.50	$195.00
12-tone on-board test oscillator	✓	
Active bias and signal mixing with no bias trap adjustments	✓	
Simplified constant current solenoid engagement mechanism with no microswitches	✓	
Ball-bearing pressure roller for constant stereo phasing	✓	
All IC's socketed for easy maintenance	✓	
Precision reference head bridge assembly w/no protruding screws for repeatable cartridge positioning	✓	
Micro-adjustable tape guides for easy alignment	✓	
Rack width required	1/2	2/3
Number of optional card extenders required for maintenance	1	3
Cartridge sizes accommodated	A, AA, B and BB	A & AA only
Microprocessors used	None	3
Manufacturer produces carts, tape and machines and is system-responsible	✓	
Manufacturer's years in related NAB cartridge manufacturing technology	35	zero
Installed base of over 6000 cartridge machines	✓	

DYNAMAX®
BROADCAST PRODUCTS BY FIDELIPAC®

Fidelipac Corporation ☐ P.O. Box 808 ☐ Moorestown, NJ 08057 ☐ U.S.A. ☐ 609-235-3900 ☐ TELEX: 710-897-0254 ☐ Toll Free 800-HOT TAPE

DYNAMAX products are designed and manufactured in the U.S.A.

Save for future reference

Circle Reader Service 3 on Page 28