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Buyers Guide  
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see pages 29-39

PO Box 1214, Falls Church VA 22041

March 15, 1988

Volume 12, Number 6

## Emmis To Buy NBC O&Os

by Alan Carter

**Indianapolis IN** ... Emmis Broadcasting, a privately-held radio group founded in 1981, signed a letter of intent 18 February to purchase five of the remaining seven NBC radio stations for \$121.5 million, according to Emmis President Jeffrey Smulyan.

Final sale is subject to a definitive agreement between Emmis and NBC's boards of directors. The purchase includes WNBC-AM and WYNY-FM, New York; WJIB-FM, Boston; WKQX-FM, Chicago and KYUU-FM, San Francisco.

Emmis already owns one AM and six FM stations: KPWR-FM, Los Angeles; WENS-FM, Indianapolis; WLOL-FM, Minneapolis/St. Paul; KSHE-FM, St. Louis; WQHT-FM and WFAN-AM, New York, and WAVA-FM, Washington.

Smulyan said the properties place Emmis into three new markets—Boston, Chicago and San Francisco—and give the company improved coverage in New York.

Emmis may "swap" WQHT and

WFAN in New York for stations in other markets in order to get approval from the FCC, he said. A broadcaster can own only one AM and one FM in a single market.

Emmis took over the two New York stations, then WHN-AM and WAPP-FM in August of 1986. The company changed the call letters of the FM to WQHT shortly thereafter, and the AM to WFAN—an all sports station—in July of 1987.

Sources report that Emmis now plans to swap dial positions between WQHT-FM and the WYNY-FM. Plans for the AM stations, however, are reportedly still undecided.

Smulyan said he does not have any

specific plans for the new stations. "We're just looking forward to trying to improve upon each property if we can."

Emmis was attracted to the stations for their "great signals in great markets," Smulyan said.

The deal with NBC Radio was consummated after "a few weeks" of negotiations, Smulyan said.

Still up for sale by NBC are WKYS-FM in Washington and KNBR-AM in San Francisco. NBC is currently negotiating to sell WKYS to another party. KNBR also was not part of the package, Smulyan said.

NBC sold WMAQ-AM, Chicago, to Group W/Westinghouse, which received FCC approval in January. The network

also sold its radio programming network to Westwood One last summer.

GE, which purchased NBC two years ago, obtained waivers at that time from the FCC in order to temporarily hold on to its radio stations in markets where it owns TV stations. The affected markets were Chicago, New York and Washington.

Smulyan founded Emmis Broadcasting in 1981 with the purchase of WENS-FM in Indianapolis. The company was named Radio Group of the Year in 1986 by American Radio.

Contact Emmis at 317-266-0100. The contact at NBC is Dom Giofre, 212-664-2540.

## Changes Are Few For Radio

**Washington DC** ... If broadcasters think new technology has changed the industry rapidly during the last 10 years, they may be in for a surprise when taking a look at what's to come.

Radio and television executives meeting here for a "Futures Retreat" in January concluded that change would come much more rapidly in the future than it has in the past, according to reports presented at a press conference following the two-day conference sponsored by the NAB.

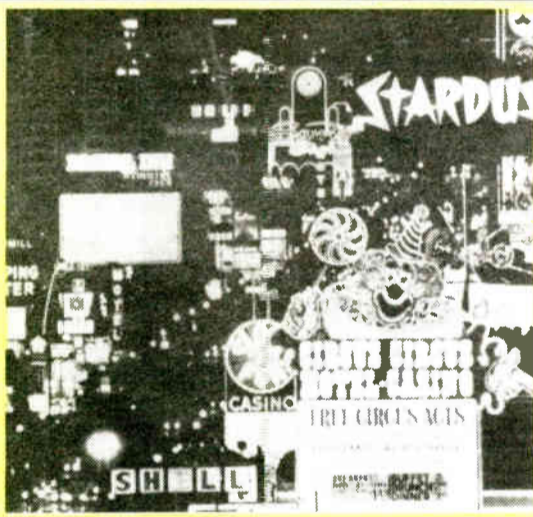
About 40 major industry players, including representatives from industry trade associations and the networks took part.

Even new technology of today has come about more rapidly than industry observers had projected, said NAB Executive Vice President John Abel. He cited VCR penetration as one example.

He also predicted that in the future, the public will not be as patient with new technology as in the past. "When a new technology hits in the future, its success or failure might be determined much more rapidly than what it has been in the past," Abel said.

Radio may have an easier time of it than television between now and the end of the next decade, many broad-  
*(continued on page 3)*

**NAB's 1988  
Convention  
returns to  
Las Vegas.**  
For details, see the  
supplement with  
this issue.



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Circle Reader Service 15 on Page 28

## Employee Buyout of Capitol

**Los Angeles CA** ... Capitol Industries has reached an agreement in principle to sell its broadcast cartridge division to a group of employees at the company's Winchester, VA, facility.

At press time, an announcement by Capitol said that the transaction was expected to be completed 1 March.

The Winchester group is headed by Nick Krassowski, vice president of operations for Capitol Magnetic Products Division, manufacturer of the Audiopak cart, Capitol said in a prepared statement.

The name of the new company will be Audiopak Corp. Production and shipping facilities will remain in the present location, Capitol stated, allowing orders to continue to be placed at the current address and telephone number.

Capitol Industries, which also owns Capitol Records, announced in December that it would close down its tape business in Winchester in 1988, including the cartridge manufacturing facilities at that location.

As part of the announcement, Capitol said it was consolidating its tape duplication part of the business at its Jacksonville, IL facility.

The decision came about as the result of losses in the company's cassette manufacturing division due to fierce overseas competition.

But interest surfaced for a possible purchase of the broadcast cartridge part of the operations, and Capitol Industries began talking with several interested parties, including Fidelipac, which currently produces and markets cartridges and back-lubricated cart tape.

Fidelipac had intended to buy the rights and certain manufacturing assets  
*(continued on page 6)*

# REGULATORY NEWS

## FCC Standardizes FM Algorithm

by David Hughes

Washington DC ... The FCC has indicated that it plans to designate the algorithm used in its computer programs as the "official standard" it will use for FM propagation calculations.

The Commission, which made the announcement in February, said that "establishing the algorithm as a standard would help resolve discrepancies in predicted field strength values and, thus, further the objective of providing efficient, expeditious service to the public."

The FCC decided to propose using its own algorithm standard in favor of those being used by broadcast engineering consultants because the other programs "do not always agree with each other or with the Commission's program because they are based on different algorithms," the FCC said.

While it says it has accepted some curve deviation in submissions in the past, the Commission stressed the importance of "precision and repeatability" for curves in future submissions.

With the widespread use of computers in broadcast engineering, the past methods of performing propagation calculations by visually reading curves that are plotted on graph paper in order to predict FM signal strength are outmoded.

"Today this procedure has largely given way to the use of computers to perform the same function more rapidly and precisely," the FCC said.

It added that the use of computer algorithms is more advantageous than the old manual methods because "the same value results each time a particular set of circumstances is presented, providing consistency in propagation calculations."

The digitized curves provided by computer come from a program which also contains an interpolation method that,

according to the Commission, "estimates values for points on the curves that fall between those that were stored."

The computer algorithm consists of this stored data, along with the description of the specific steps the computer performs when running the program.

Most consulting engineers contacted had praise for the FCC's proposal.

"I don't have any problem with the plan," said Jules Cohen, head of his Washington DC consulting engineering firm. "We are already using the FCC computer algorithm."

"It is nice to have a calculation that matches their algorithm," he added.

Bob du Treil, of Washington DC-based A.D. Ring/du Treil-Lundin-Rackley, also

said the plan was "a good idea."

While his firm has its own computer algorithm, it "emulates the FCC (program) pretty well," he noted.

However, du Treil said that he has heard some engineers complain that the Commission's computer program is unnecessarily complex. He indicated that he hopes that anyone with a personal computer will be able to access the FCC program.

The proposed algorithm also applies to TV calculations.

The item is contained in docket MM 88-56. Comment and reply comment deadlines were not available at press time. For more information contact Jay Jackson at the FCC: 202-632-9660.

## Hearings Imminent For FCC Nominees

Washington DC ... As of late February, the Senate had not yet scheduled confirmation hearings for two new FCC commissioners.

Nominated for two vacancies on the Commission are Washington DC-based attorney Susan Wing and FCC attorney Bradley Holmes.

However, FCC Office of Public Affairs Director John Kamp said that the hearings, the last major step in the commissioner selection process, would be held "very soon. They are imminent."

Both Wing and Holmes have responded to a series of questions submitted from the Senate, Kamp added.

If the two make it through the approval process, they would join Chairman Dennis Patrick and commissioners Jim Quello and Patricia Dennis, raising the number of commissioners from three to five.

The FCC has not had a full five member panel since April 1987, when then chairman Mark Fowler left to take a private sector position.

Wing, an attorney for nine years with the Washington DC-based firm of Hogan and Hartson, was nominated by President Reagan last December for one of the vacant commissioner's positions.

Wing will replace former FCC Commissioner Mimi Dawson, who became the deputy secretary of transportation in December.

Last November, FCC attorney Holmes was selected by the White House to fill the vacancy left by the departure of Fowler and Patrick's step up to the chairman's post.

Previously, Holmes had served as a legal aide to Patrick and then as a chief of the Mass Media Bureau's Policy and Rules Division. He joined the Commission in May 1984.

For more information contact John Kamp at the FCC, 202-632-5050, or the White House at 202-456-1414.

## FCC Clips

### New Legal Asst. Chief

Stephen Bailey has been appointed assistant chief (legal) of the Mass Media Bureau's Policy and Rules Division.

Bailey has worked with several FCC bureaus including the Special Relief and Microwave Division of the former Cable TV Bureau and the Mass Media Bureau. He has also worked with the Administrative Law Division, Office of General Counsel.

For more information, contact the FCC's news media information office at 202-632-5050.

### McKinney Gets Award

Former Mass Media Bureau Chief James McKinney became a fellow of the Society of Broadcast Engineers (SBE) in January.

McKinney, who had spent 24 years at the Commission, received the formal notification—a plaque—at a White House reception. In June 1987, McKinney became director of the White House military office.

SBE President Jack McKain, of the Kansas State Network and past President Richard Rudman presented McKinney with the award.

### Whitsett Joins Policy and Rules

Louis Whitsett has been appointed acting chief of the Legal Branch of the FCC's Policy and Rules Division. He joined the FCC in December 1986 as an attorney in the Legal Branch.

Before joining the Commission, Whitsett served as an assistant attorney general for the state of Colorado, representing the community college system. Between 1979 and 1981 he also worked as an attorney with the Washington DC law firm of Hogan & Hartson.

### Attorney Advisor Named

David Siddall has been named a senior attorney advisor in the Legal Branch of the Mass Media Bureau's Policy and Rules Division.

Siddall joined the Policy Division of the Common Carrier Bureau in September 1985. Before that he was a legislative attorney with the Congressional Research Service of the Library of Congress, serving as an advisor to the members and committees of the Senate and House of Representatives. For more information, contact the FCC's news media information office at 202-632-5050.

### New LA Office Phone

Effective in mid-January, the FCC field office in Los Angeles has new phone numbers. The main office number is 213-809-2096. The number for recorded information is 213-865-0598.

### Station Totals

As of 31 January 1988, the FCC said that there were 4,903 AM stations on the air. On the FM side, there were 4,014 commercial stations and 1,302 non-commercial stations. The total number of stations was 10,219.

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# NAB Super Radio In the Works

by Alan Carter

Washington DC ... The NAB has signed a \$25,000 research and development contract with consulting engineer Richard Sequerra to design what could be the ultimate radio, according to NAB officials.

Sequerra, a Long Island-based engineer who is well known for his receiver designs, said he plans to have a design

by the April NAB convention and a prototype by the fall radio show.

The NAB executive committee in December gave the go-ahead to develop a proposal for a "high quality," table-top, multi-function AM-FM receiver.

"It will be the first really good radio designed since the second World War," Sequerra said. The radio will be a table-top design which will include AM stereo and FM stereo, the NRSC standard,

FMX decoding, digital tuning, a rotatable AM antenna and a LED for maximum signal indication.

One additional feature will be continuous tuning, with no switch needed to go from AM to FM or back. Sequerra said there will be push buttons for AM and FM selections. Other features will include a high-quality amplifier and a hi-fi speaker system.

The design also will be wideband,

with a frequency response that will be flat to 15 kHz for FM and have NRSC deemphasis and rolloff to 10 kHz for AM, Sequerra said. It will have a 10 kHz notch filter for AM, and the bandwidth will be switchable between "wideband" and "narrowband" modes.

After the design is complete, Sequerra said he probably will build the radio himself. While declining to discuss the price of the receiver, he said it would be "competitive in price" with any good quality radio.

Sequerra said NAB approached him to work on the project after learning about him based on a fixed-tuned radio he built as a promotional item for a friend at a Philadelphia radio station.

"They came to me because they are looking for a sound that is a little different," Sequerra said. He maintains that the decline in quality of AM receivers since World War II is because engineers focused on FM and TV as their popularity rose.

Sequerra and the NAB said the radio will incorporate both Motorola's C-QUAM and Kahn Communication's ISB AM stereo systems.

The signal path will feed any stereo decoder, Sequerra said. He did not explain how this would be accomplished but noted the Sanyo multisystem chip is one option that is a possibility.

## Execs Predict Slow Change in Radio

(continued from page 1)

casters concluded, when examining the effects of new electronic gadgetry.

"Radio is in very good shape between now and then," said NAB Radio Board Chairman Jerry Lyman. "In fact, I would say radio is in very good shape up until 2000 because you don't see any significant technology that's coming in that's going to dramatically change the lifestyle use of radio."

"I felt that it was a very, very mind-stretching experience," said NAB Joint

Board Chairman Wallace Jorgenson of the two-day retreat. "We had speakers and discussions which led all the way from doomsday predictions to things are going to be great."

Able, however, pointed out that the executives did not leave with a bleak prediction for 1995, the time period to which the retreat focused.

The broadcasters examined the growth of cable and how the business grew some 300% in the last six years, Jorgenson said. The industry leaders also dis-

cussed the impact of telephone companies offering cable service. Other topics included fiber optics and satellite delivery.

The participants took part in an "unscientific" survey with questions on audience levels, cable homes, fiber optics and AM stereo in 1995. They compared the findings to that of a similar survey of broadcasting and advertising executives.

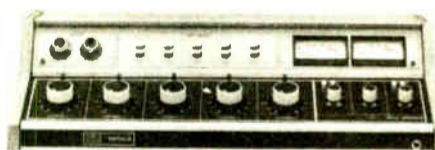
"It was not a meaningful kind of survey in that the sample size was so small," Jorgenson said, "but it was just interesting to see how one group of executives interviewed separately, and with the same questions, and we reacted. We were amazingly close. There was very little disparity."



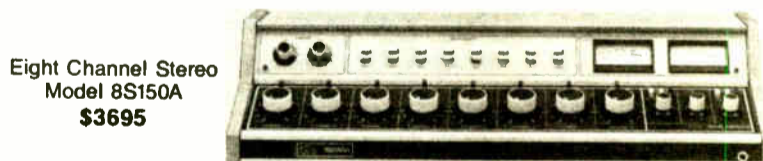
(l to r) Jerry Lyman, Wallace Jorgenson and Ben McKeel discuss the recent NAB Futures Retreat.

## 15 Console Models Mono or Stereo

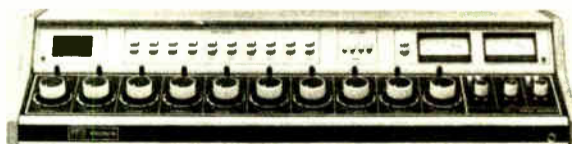
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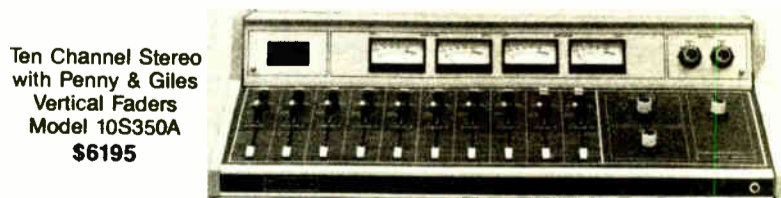
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### AM BROADCASTING - HIGH FIDELITY Are these terms mutually exclusive?

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Surprisingly, many broadcasters may not know that the correct answer to this question is no. Large sums of money are spent each year to purchase new transmitters, new studio equipment, new audio processing equipment and to modify antenna systems for improved AM sound. Unfortunately, until now, there has been no such thing as a professional quality AM monitor receiver. As a result, the perceived fidelity of an AM signal has been severely restricted by receiver performance.

Potomac has developed the SMR-11 Synthesized Monitor Receiver which will let you hear and measure the quality of your transmitted AM signal ... perhaps for the first time. Features include: Crystal Stability; 60 dB Signal to Noise Ratio; Audio Frequency Response  $\pm 0.5$  dB, 20 Hz to 8 kHz; Total Harmonic Distortion less than 0.2% (95% Modulation) at audio frequencies above 40 Hz ... please write for complete descriptive brochure.



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See Us At NAB Booth 1108

Circle Reader Service 2 on Page 28

See Us At NAB Booth 303

Circle Reader Service 29 on Page 28

# Meet You On the Vegas Strip

by Judith Gross

Falls Church VA ... Put on your walking shoes ... it's NAB convention time again. First reason to be happy about it? It isn't in Dallas.

So hopefully there will be no snow (remember last year's show?) ... no major prizefight to crowd the hotels (three years ago, in Vegas) ... no hotel strike (four years ago).

Just lots of glitzy neon, tacky decor and an occasional broke broadcaster who couldn't pass up the allure of the casinos (not anyone we know).

There are lots of important questions as a major portion of the industry heads

out to greet familiar faces and meet some new ones.

What are the hot products of the show? Is this the year digital finally makes a strong showing for radio? Will R-DAT be a success? And has anyone figured out what those colored ribbons the NAB staff wears on their badges stand for?

☆☆☆

One late breaking word from a very reliable source was that the featured speaker during the convention will be none other than President Reagan himself, who was slated to speak from the convention rotunda on Sunday. (Bonzo

goes Vegas?)

There are some very exciting new products this year. Certain exhibitors were being secretive but the ones who gave a sneak preview had pretty noteworthy things scheduled for debut.

☆☆☆

Check out R-DAT, which will make a big showing with new pro players by Tascam and Sharp, and automation systems by Concept Productions and Systemation, plus formats from some music syndicators.

BSW is actually giving away a new Sony PCM-2500 pro R-DAT player worth \$5000. Stop by their booth and register to win.

Also in automation, stop by Schafer Digital's suite and take a look at Paul Schafer's consumer Beta system to record stations' entire music libraries and run spots, IDs, etc.

CDs are still going strong. Allied Broadcast will have the Denon CD cart player and there will be new players from Tascam, Shure and the updated Studer to see.

Bradley Broadcast will have the new second generation Telos from Steve Church.

Lots of new consoles are on tap, including offerings from Radio Systems, Harrison, Wheatstone, Ram and Arakis. And Broadcast Electronics will have its new Mix Trak 90.

Advanced Micro-Dynamics and Hallikainen & Friends will be showing new remote transmitter dial-up gear.

In phone equipment, Gentner will show its digital hybrid. Allied will show



the new contest computer, which gets the DJ the correct caller automatically.

Delta will have its brand new splatter monitor for AM.

Look for Pacific Recorders & Engineering to demonstrate its Dolby SR modules, now a product for use with cart machines.

Target Tuning was expected to have its AM stereo walkman-type frequency-locked radios ready for the show.

Lots of excitement in transmitters this year as well. Harris will add to its digitally modulated AM transmitter line with the DX-25, a 25 kW model. Nautel will have a new solid state 10 kW model for AM.

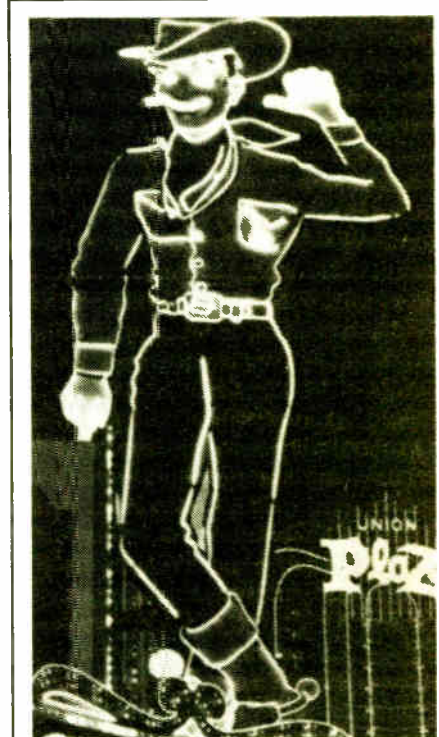
QEI will debut its brand new FMQ line. Vector Technology is now in the transmitter business, too, so its new line will be on display.

And keep in mind that CCA has bought the remains of CSI Electronics.

One last item of interest will be Pinzone's anti-skywave antenna for AM, which is also the subject of a technical paper.

And there's going to be lots, lots more. So see for yourself.

Don't forget to stop by the Ham Radio reception on Monday, 11 April from 5:30-7:00 PM in the Hilton Ballroom C.



Las Vegas Glitz

You'll see lots of old pals including your friends from RW

☆☆☆

Earwaves asked a small sampling of industry players what their favorite eatery is in Las Vegas. Their answers:

Glenn Clark, Texas: "One of the two best steaks I ever had was at The Steakhouse at Circus Circus (the other was at the Black Hawk in Chicago). But you have to reserve at least four or five days in advance, otherwise you won't get in until the convention is over."

Dave Burns, Allied Broadcast: "The Chateau Vegas on Desert Inn Road. I like the food, service and atmosphere. They have a violin player who is a concertmaster from Europe who is superb."

Ed Williams, NAB: "The restaurant at the top of the Landmark Hotel. Our staff goes out to Vegas early to set up and we work really hard. We like to go someplace where we can really relax. It's not terribly expensive and there aren't usually a lot of people around. You feel like you're up on top of the world."

Ron Frillman, Harris: "The Chateau Vegas has good seafood in an elegant surrounding. Then there's the Alpine Village across from the convention center. They serve great plates of wurst, huge kettles of thick dark German chicken soup and there's a rathskeller with a piano bar and German beer."

Elaine Jones, Gentner: "A real sleeper is The Steakhouse at Circus Circus but then The Wharf on Sahara has great seafood and another great steak place is The Flame."

Art Constantine, Fidelipac: "The Greyhound Bus Depot. They serve a great bowl of chili. There's atmosphere and many new faces. It was a tough choice between that and the mission."

So go, see what's happening in the industry and have a great time. Then when you get back (or if you don't make it) tune us in for the most timely report after the show.

And watch out for those one-arm bandits.

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.

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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).

Don't give up yet

Dear RW:

I share the sadness of D. Evans (*Readers' Forum*, 1 February 88) at the status of AM radio. Like reader Evans I am a long-time AM supporter.

I started as "the Kid" in Philly radio in the mid-60s, moved to programming, management and eventually consulting AMs. I DX'd stations and have acknowledged DXers from across North America. I have devoted my career to AM.

But unlike reader Evans, *I'm not ready to give up on AM!*

Agreed, precious few AMs are programmed for listeners. It seems more are choosing "the course of least (programming) resistance" today. We may never again see/hear the powerful personalities we heard as kids, but we're not hearing them on the FM's either.

It's hard to believe we are being forced to consider the AM band as a prosthesis for FM. We wouldn't have to consider this image if we encouraged quality AM programming by letting local stations' management know of our displeasure at their choice of homogenized syndicated programming.

For several years, as an ancillary activity to my own programming activities, I have been forming an AM-only owners/programmers group. Think of it as a "Chamber of Commerce" (if you will) to promote and assist those AMs which care to remain active and serve their listeners with exciting locally-

oriented programs.

Our loosely-knit group is called the "AM Programming Society." AMPS includes active and retired broadcasters from management, programming, engineering and promotion levels.

(Yes, a few members mumble something about having worked for an FM but we avoid drawing attention to those unpleasant incidents in our chums' histories.)

To date we have relied exclusively on in-house financial support and for referrals to member stations where our services might be marketed. Members enjoy substantial reductions from our non-member fee schedules.

Have we improved AM's overall complexion? Who can say so soon? We've only been active for a few years and the syndicators had a pretty good head start.

Have we been actively trying to maintain quality imaging and programming on the AM dial? You bet!

Should any of our readers be interested in AMPS we'd be pleased to send along a fact sheet and membership application. Just drop me a line at: Box 3, Palmyra NJ 08065-0003.

Alan C. Swan  
Broadcast Consultants, N.A.  
Palmyra, NJ

Broadcasters are gearing up for what promises to be the biggest NAB convention ever.

As the gathering returns to Las Vegas some 700 exhibitors will display their wares in 380,000 square feet.

There are 27 technical sessions scheduled—12 for radio—and more than 150 papers to be presented. It's a staggering convention.

This year there will be a clearly defined audio/radio exhibit area, which will help attendees plan their time at the show more efficiently.

But the largest amount of growth in the convention is on the TV side, which once again raises the question of whether or not the NAB should be staging separate radio and TV shows.

Since a fall NAB radio show already exists, NAB has the potential to break out the spring radio-only exhibitors and encourage them to support a show focused exclusively on radio.

Two NAB Shows?

The association has tried to increase engineering attendance at its fall show in recent years, but has been unable to attract a majority of radio equipment vendors.

Instead, the national SBE convention, which draws many radio attendees, has lured many exhibitors for the sole reason that they want to target mostly engineers.

This fall the SBE show and Radio '88 are only a week apart, so attendance at one or both is sure to suffer.

Splitting the NAB's spring show could offer many benefits. For one, radio attendees wouldn't have to wade through hundreds of TV exhibits to find what they want to see.

Exhibitors could be assured of a target audience. Those who currently go to the spring and fall shows wouldn't have to either pay double fees or eliminate their participation in one of the shows.

In addition, attendees wouldn't have to either foot the expense of going to several shows or choose which one to attend.

The NAB's research on whether or not there should be a separate show for radio is inconclusive but there is support for the idea.

NAB should reexamine this issue again after the Las Vegas show is over. Maybe it's time for a change.

—RW

Guest Editorials: Kahn Patent

Kahn: On Patent Law

by Leonard Kahn

Westbury NY ... You all know my opinion of *Radio World* (some equate RW with Really Warped). Speaking of warped, did you see the latest "Fair is Fair" commentary? Don't you engineers just love being lectured by a lay person on engineering.

But even greater than RW's reporters' ignorance of engineering is their profound ignorance of patent law. The reporter obviously didn't know what the Patent Office meant when it found that my early patent was "material" to the examination of the later issued Motorola patent.

RW should have at least had the "smarts" to have asked a patent agent or lawyer to explain it to them before they had the arrogance to "explain" the legal situation to you. (Not a Patent Office Examiner that cannot, by law, even comment on fraud or inequitable conduct for reexamination cases.)

The situation is, if Motorola's patentee or his attorney knew about my patent before they filed their patent, they are in serious trouble. And we have conclusive proof that both of them knew of my patent prior to filing!

No matter what the Patent Office does in the future, Motorola's patent is now "tainted" by the official "material" ruling. The patent can never again be used to block multisystem radios.

It also can be the basis of an anti-trust action because this is clearly patent misuse. The "material" finding by the US Patent Office is probably the most serious problem Motorola has run into in the entire AM stereo competition. No matter how the PR people try to alibi the situation.

Forget RW's profound ignorance of the law, how about their sloppy journalism. *Sony never used Motorola's stereo chip*, they used their own IC based on my design.

"Fair is Fair" as the AM industry is being raped!!! Anyway, you can be certain this matter will not be resolved in trade papers.

P.S. It will be amusing to read *Radio World's Really Warped* (continued on page 6)

Onders: On Fairness

by Edward A. Onders

Greenlawn NY ... We are concerned with the obvious bias of the staff member who authored the editorial comment captioned "The plot sickens" which appeared in the *Earwaves* section of the 15 January edition of *Radio World*.

Free enterprise and fair competition in the marketplace are one thing; but biased journalism which may unfairly influence marketplace decisions is something altogether different and inherently offensive.

Permitting a nationally distributed industry publication such as RW to be used in this manner is, in our opinion, inappropriate, particularly since the "plot" affects a large segment of the industry served by your publication (AM broadcasters).

Having carefully studied Mr. Kahn's December 3, 1987 filing with the FCC, including its supporting documents, his concern over the apparent adverse effect on the AM stereo marketplace of Motorola's patent enforcement activities seems justified and his request for an investigation, reasonable.

If Motorola's patent is invalid, as Mr. Kahn alleges, and Motorola's enforcement of this patent against receiver manufacturers has, in fact, prevented multi-system AM stereo receivers from being sold in the US, then we hope you would agree that this should be exposed and remedied.

The FCC's initial decision in March 1982 (unanimously reaffirmed on January 14, 1988) that broadcasters may choose from among competing AM stereo systems was, and still is, obviously based on the assumption that the marketplace is free and the competition is fair.

We believe Mr. Kahn has consistently sought to ensure that these fundamental conditions exist in this market.

Responsible businessmen and journalists support the concepts of "free enterprise" and "fair is fair," but the key words here are *free* and *fair*.

What seems to have been missed in RW's reporting is the (continued on page 6)

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# Capitol Plant Bought by Staff

(continued from page 1)  
of the Audiopak cartridge line and move those operations to its Moorestown, NJ facility, while retaining the Audiopak name.

But word released by Capitol in late February said an agreement had been reached with the Winchester-based group instead.

"Naturally we're disappointed," said Art Constantine, VP of marketing for Fidelipac. "However, the cartridge business is doing very well and there's plenty of business to go around. We wish Nick Krassowski good luck with his plans for the new business venture," he added.

As part of the agreement, Capitol said

production will stay on track to keep an adequate inventory of carts during the transaction. Orders were to be shipped by the new company beginning 1 March.

However, the Winchester real estate and plant had already been sold to Henkel-Harris, a nearby furniture manufacturer.

The new company will stay at the current Winchester location until a short-term lease Krassowski has with new owners of the building and land expires, he said.

Krassowski said that "at this time" he plans to keep the operations in Winchester, about 50 miles outside Washington, DC. Between 40 and 60 people work



The Capitol tape manufacturing plant in Winchester, VA.

in the cart division, and Krassowski said he plans to keep the same number of people on staff.

An 18-year veteran with Capitol, Krassowski said he would be president of the

new company. He declined to reveal who the other members of the buy-out group are or the number of people involved. He also would not discuss the purchase price or terms of the deal.

Krassowski was very optimistic about the transaction. "Everybody here is enthusiastic and ready to get on with business for ourselves," he said.

In addition to the Audiopak carts, the new company will manufacture lubricated tape for use in reloading eight-track duplicators and syndicators, Krassowski said.

The company has rights to use the Capitol name "for a period of time," Krassowski said, until existing inventory is depleted.

At press time, the new company was also trying to obtain the NAB convention exhibit booth that was supposed to be reserved for Capitol Magnetics, as well as the former company's convention priority points.

Call Capitol Industries at 213-871-5131.

## Rochester Radio Report

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## More Kahn

(continued from page 5)  
account of the FCC's 3 to 0 turn down of the NTIA's proposal to protect Motorola's pilot and Texar's attempt to start the entire AM stereo FCC matter all over again.

I will bet you a \$25 "Secret" unit that it comes out as a great PR victory for RW's favorite advertiser, Motorola.

Leonard Kahn is president of Kahn Communications. He can be reached at 516-222-2221.

## Onders

(continued from page 5)  
important fact that Mr. Kahn was not simply complaining about Motorola's enforcement of its patents to prevent multi-system AM stereo receivers from being sold in the US market.

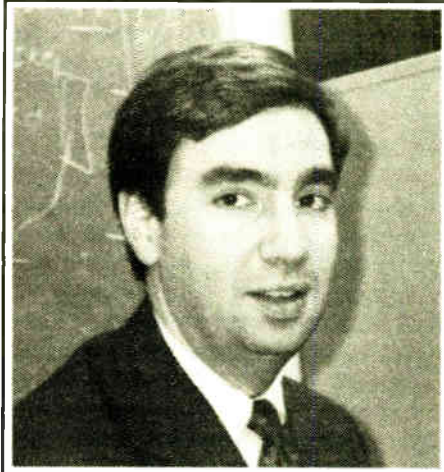
Instead, his complaint alleged that this was unfair because the patent being asserted is not valid. Furthermore, Mr. Kahn took appropriate action to substantiate his claim by requesting the US Patent Office to reexamine Motorola's patent.

When a person is criticized, as the RW editorial comment seems to do of Mr. Kahn, for attempting to ensure fair competition and for exercising his right to petition the Government for an investigation of possible unfair competition, one must wonder what motive lies behind the criticism and whether freedom and fairness no longer have meaning at RW.

Edward Onders is associate general counsel of Hazeltine Corp. He can be reached at 516-261-7000.

# Rau Addresses Radio's Future

Washington DC ... In February, RW conducted an interview with Michael Rau, who in late 1987 became VP and acting head of the NAB's Science and Technology Department. In an hour-long talk, Rau addressed some of the immediate concerns of his department and looked at some long-term goals for radio.



NAB VP/Science and Technology  
Michael Rau

**RW:** Will we see a difference in how the Science & Technology Department is managed, now that you've taken over from Tom Keller?

**Rau:** I'm a different person than Tom. I probably will manage the department differently.

**RW:** How?

**Rau:** I'm very sensitive to industry concerns, and I put a lot of faith, and have had a lot of success, in the committee process coming up with and executing plans. I feel very comfortable doing that.

I intend to work a lot with our existing committees, create new committees as needed and phase out old committees as they are not needed. We'll take on initiatives that are do-able and profitable, and try to make some improvements in the industry. It's a big job, but we've got to move the ball forward.

**RW:** Have you filled your previous position of director of spectrum engineering and regulatory affairs?

**Rau:** I'm actively interviewing and have interviewed about a dozen people.

**RW:** Will you increase the number of people on the S&T staff?

**Rau:** The two principle long-range goals of NAB are government relations and science and technology. I want to build the most competent and expert engineering staff here at NAB. I'm going to build the staff over the next several years and get the best people I can find.

**RW:** In your assessment, what has been accomplished in improving AM radio and what still needs to be done?

**Rau:** I think what we've seen in the last couple of years and what we've started with the NRSC (National Radio Standards Committee) process and the AM improvement program at the NAB is we've been trying to do all we can do from an industry standpoint.

Where we need to go, I think, is mostly with government action. There is only so much that the industry itself can put together, execute, organize and administer. There are some things that we cannot do.

It is only the government that controls the allocation of AM stations, the assignment policies that stations are allocated by, and it seems clear to me that we need a reversal of some of the policies that

have led to the current status of AM broadcasting today. That's really basically the tone of our filing at the FCC for the AM technical review.

That will be the tone of our continued filings this year. We think it's time for the FCC to take some action to improve existing service and reduce interference.

**RW:** What brought about this message? It seems pretty strong.

**Rau:** I would say that it is a strong message. Definitely, the tone of our pleadings has become a little bit more strong in probably the last six months. It simply reflects our position that there just are some things that really only the government can do.

**RW:** Can you be specific?

**Rau:** Specifically, we've asked the FCC to freeze acceptance of applications for new AM stations. We can't do that; the government has got to do that. It doesn't make any sense when the government (the FCC) on one hand agrees that its standards and policies are faulty and so, therefore, issues a Notice of Inquiry.

Then, another part of the agency is still allocating, still doing process on applications that are being filled pursuant to the old standards.

We're serious about this. You're looking at a whole industry here at stake down to 24 or 25 percent of the listening audience.

It's not only all the NAB members and the owners' interests, it's also the interests of all of the services, programming, technical, sales products that affect the industry. It's also the receiver manufacturers. This is serious, and I think it deserves very serious attention from the very top of the FCC.

**RW:** If the FCC instituted a freeze on applications for new AM stations, at what point would NAB recommend it be lifted?

**Rau:** First we need a satisfactory set of technical standards and policies that will assure no more degradation of the AM

band. The policies will have to permit a future improvement of the band, and these policies should be of a long-term nature for 50 or 100 years.

No one is going to just simply change AM broadcasting overnight. It took a long time to get here, and it's going to take a while to turn things around. I have to add that there are lots of AM stations in many markets doing just fine and even are the top rated stations.

We're not dealing with an industry corpse here. We're dealing with complicated and multifaceted problems. What we want to do is help the stations that need help and insure the future of the stations that are doing well.

**RW:** Do you see the possibility that no more AM stations would be allocated?

**Rau:** That's a possibility. I think if the standards established out of this Notice of Inquiry are such that very few stations could be allocated, I think we have to accept that.

In 1934 when the Communications Act was passed, the lawmakers were looking to a vast open prairie of essentially virgin spectrum and trying to craft laws that would permit the colonization of that spectrum, and I think we have a case now where all the spectrum has been used in the AM band.

I think that as a technical matter, there is the possibility that one day the spectrum will be filled, and that is something the Commission should accept. If they want to allocate more spectrum for AM broadcasting, which in fact is happening with the expanded band, then that

is fine.

The standards adopted should not permit the continual encroachment of AM service by simply jamming more AM stations on the band. Station, after station, after station—that is just not a way to preserve service for the public.

**RW:** On the matter of making things better for AM, isn't the AM stereo issue always going to be a stumbling block to AM improvement?

**Rau:** It didn't hinder the development of the NRSC standard. The problem of AM stereo is an enigma to everyone. And I don't think it's really possible to forecast what AM stereo's future may be. You have people who are very bullish on AM stereo and you have people who are bearish on AM stereo.

**RW:** Will NAB ever take a definitive position on AM stereo?

**Rau:** I would like to think that maybe one day NAB would be able to take a stand, so to speak, on AM stereo. We in the past endorsed multisystems. We definitely promote AM stereo. We demonstrate AM stereo.

**RW:** At what point do you think NAB would feel comfortable taking a position on AM stereo?

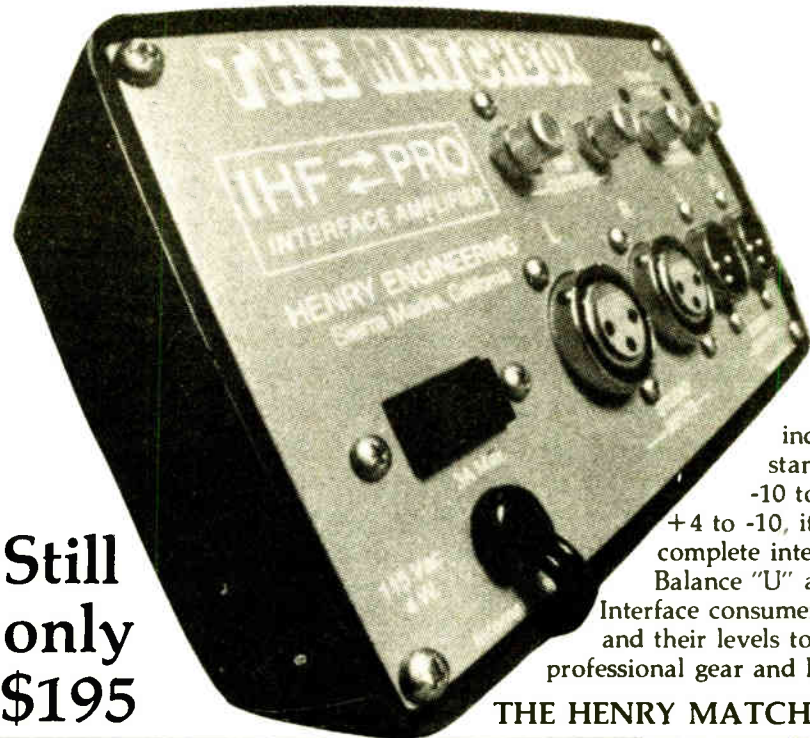
**Rau:** As long as there is a marketplace in AM stereo systems, we will not take a stand.

**RW:** Is there any concern over conflict of interest with the NAB supporting the FMX (continued on page 8)

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Circle Reader Service 23 on Page 28

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# The Future of AM and FM Radio

(continued from page 7)  
system and one co-creators being NAB Chief Scientist Tom Keller?

**Rau:** I think it's very important for the industry to know that NAB's backing of the FMX system is because it's viewed as a technological improvement for FM broadcasting. If another technology came by, or if a mutually exclusive technology came by or were submitted to us, and if it proved superior to the FMX technology, we would have no reservation to back another technology.

**RW:** NAB's support is more than just backing. Doesn't the association have an investment in the project?

**Rau:** We are a very small contributor to FMX, actually Broadcast Technology Partners, through our for-profit subsidiary, NAB Technologies Inc. Any revenues that we would get from FMX receivers hopefully would be put into our technology center and our testing center to re-invest those proceeds back into the industry.

But I can't stress strongly enough that it just happened to be one of our staff people who invented this technology. It didn't have to be that way, but it was that way. If there were another technology that came on board and was superior to FMX, I don't think NAB would have any problem endorsing a different technology.

I think it's important to realize that our backing of FMX is premised on the belief that it's an improvement for FM broadcasting. If the industry for some reason doesn't want it or doesn't like it, then it's going to be fine with NAB.

**RW:** The NAB has filed a Petition for Rule Making asking the FCC to make the NRSC standard mandatory. With the FCC having created a mood of deregulation, how can the NAB get the Commission to enact a new regulation?

**Rau:** There is always the possibility that the FCC will not endorse the NRSC standard on ideological grounds. If the Com-

mission wants a marketplace in preemphasis standards and abandons it, then that's what our government wants.

I think it would be a very serious mistake for the FCC to decline to do anything on the NRSC standard. It took so long and it was such a difficult process to get the standard established, and here's a chance to really make a substantive improvement in AM broadcasting.

We've given the FCC an opportunity to participate in that improvement, and I think it would be disastrous if the Commission declines to act on the NRSC standard. But there are people at the FCC who very fervently believe in not having any standards. All I can say is such a view is a naive view of broadcasting.

“

*As long as there is a marketplace in AM stereo systems, we will not take a stand.*

”

**RW:** When will a receiver be on the market with the NRSC standard?

**Rau:** Probably by the end of 1988 in selected models, but not in quantity until 1989 or even later. The NRSC is embarking on a certification mark program. I think that is really almost the key to marketing an NRSC receiver. I'd almost like to get the certification mark program completed so that it's there for the introduction of NRSC receivers.

**RW:** Now that the NRSC came up with the standard, what is next on the agenda?

**Rau:** We have the RF mask proposal. The deadline for filing comments on the RF mask introduced at the NRSC meeting in Anaheim was March 11. We have had comments that were written by all major transmitter manufacturers as well as some other equipment manufacturers.

We hope that at the NRSC meeting at the NAB convention, we will be able to announce a RF mask standard. I can't guarantee that because it's a complicated issue. I think we need to have a couple of other meetings.

Beyond that, the NRSC has the AM certification program. There also are tremendous FM issues that have not been addressed yet—everything from base plan standard, to IF protection standards, to possible joint programs to reduce FM multipath and certainly to FMX.

**RW:** What efforts are underway to prevent the "AMization" of FM?

**Rau:** Preventing the future degradation of the FM band, I think, is one of our biggest challenges right now. We're faced with a system of allocating stations that does not fully protect the existing service. In fact, FM stations on the air are not protected from interference from new stations or major changes at existing stations.

We have a lot of work to do in the FM area. It's hard to really know how to respond to the question. I think probably the ball is in the FCC's court at this point. We're expecting a proceeding to be started with lower power FM stations and FM translators in determining what the proper role for these stations are in the US system of broadcasting.

NAB has filed petitions on FM translators, we have the Class C III, the Class A upgrade proposals. We're looking at maybe 600 new Docket A construction permits being granted. It's just a very, very big challenge.

This is a matter that receives a lot of discussion here at NAB. We have our FM transmission subcommittee, but I believe, at the present, the first initiative should be the FCC. We're probably going to be in a reacting role to the FCC.

**RW:** What are some areas you give a high priority?

**Rau:** One high priority is to get as many

Class A stations upgraded to 6 kW as we can without degrading service of other stations. Another priority is to continue our study of FM propagation, terrain roughness and antenna characteristics so that we are prepared to comment on proposals to change FM standards.

**RW:** There is a proposal filed by Radio New Jersey to create a second FM band, which has been called "FM2." AM daytimers and other AMers with coverage problems would use it. Is the plan workable? Can spectrum be found to make a second FM band?

**Rau:** We've talked about the issue of an FM2 band. Frankly, it hasn't received a lot of support from our board of directors. There are some problems with the proposal and certainly some questions as to whether the spectrum can be re-allocated.

There are also some questions on whether all the AM stations would get a chance to go to the new band or only some, and then how do you decide which ones go and which ones don't.

**RW:** There is a plan filed by a group of New Jersey Class A FMers that calls for a blanket power increase from 3 kW to 6 kW. The NAB board of directors in January voted to back power hikes only on an individual basis. What is your assessment of the New Jersey plan?

**Rau:** The radio board endorsed the FM subcommittee plan for selective power increases for Class A stations consistent with a mileage separation plan that is, in fact, in existence with Class B and C stations. Unfortunately due to technical reasons, this plan will not benefit many stations in New Jersey.

So as a result, the New Jersey broadcasters association was asked to come in and address our executive committee in March. Also the New Jersey petition for rule making was put out for public comment by the FCC, with comments extended until March. I anticipate we'll be filing.

I'm not sure that we would actively oppose the New Jersey proposal but we wouldn't endorse it either.

**RW:** Do you see a place for compromise between Class A's and B's?

**Rau:** I think that the Class B stations feel that the subcommittee plan is a compromise because they started from the position of not approving any increase in Class A power, and ended up approving an increase but consistent with a mileage plan that protects existing service.

Of course the New Jersey Class A broadcasters take a different view and feel that the Class B stations didn't give enough, and in issues like this where station classes are fighting each other, NAB is in a very difficult position. We have members that are Class A's and members that are Class B's, and we're for our members.

**RW:** Looking ahead, one of the significant aspects of the NRSC is that it brought receiver manufacturers and broadcasters together. Do you see the potential for this happening again?

**Rau:** I think there are literally dozens of issues where receiver manufacturers and broadcasters can work together for the benefit of both industries. It's important to keep in mind that these joint standards projects take a great deal of time.

The NRSC standard was nearly two years in the making, and it's really still developing. It literally takes a long time  
(continued on next page)



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# AM Improvement Study in Gear

by David Hughes

San Francisco CA ... AM noise levels and protection ratios will be the key issues in a study currently underway for the NAB.

The study is being put together by Harrison Klein who previously produced a report on overmodulation for the NRSC which helped formulate the NRSC standard.

Klein, an engineer with San Francisco-based consultants Hammett and Edison, will provide a progress report on the

## Rau, cont'd

(continued from previous page) to get two rather large industries to agree on a single course of action that benefits both.

There's no question that the NRSC process has given us a mechanism, the contacts and the relationships to work on mutual problems. There is great opportunity for future work, and I think the NAB will be in the forefront of that work and exploiting these relationship that we've developed.

We have to choose our battles very carefully. What we want to work on has to be the most beneficial issue. That is the real challenge.

RW: Is there any thought about splitting the annual convention because it is so large?

Rau: We always get letters and phone calls from people who would like to see us do something different. But the letters seem to be almost divided down the middle between the people who would like to see us split the show and the people who would not.

As far as we're concerned, from the research we've done and the people who we speak to, we don't see any need to make any big changes. The convention this year is huge. The number of papers is up 30% to more than 150 technical papers. The indoor exhibit is up 21% from 286,000 square feet to 360,000 square feet. There are 50 new companies exhibiting this year.

We do a lot of research on this. People, by and large, are pretty happy with this.

RW: What is the future of radio?

Rau: I think radio has a great future. Radio has survived all kinds of new technologies, and I think it will survive forever.

There's nothing to worry about. The largest concern now is this encroachment and interference caused by the addition of new stations and faulty technical standards. Once that is squared away, the long-term future of radio is guaranteed.

\$20,000 study in an AM improvement session during the Las Vegas NAB show, slated for mid-April.

The study is due to be completed this spring, according to Klein.

The NAB, the National Radio Systems Committee (NRSC) and the joint FCC/industry-based Radio Advisory Committee (RAC) will be incorporating the study's results into their comments on the second phase of a FCC Notice of Inquiry on AM technical standards, he said.

Comments on the second phase of the overall inquiry, which was released last year and looks at a wide range of issues such as skywave and groundwave

propagation, and interference criteria, are due in June.

The study is looking at three areas, Klein indicated. First, it will take a look at the "latest data" on AM noise levels in the US, both man-made and atmospheric, he said.

"We want to generate updated values for minimum usable field strength (values)," Klein noted.

Secondly, the study is examining protection ratios, in light of the NRSC's plan to change AM bandwidth to conform with the standard's 10 kHz stopband specification.

"The 30 to 40 year old standards are not correct any more. We need new tests

using new models of receivers, transmitters and processors," he said.

And, lastly, the study will examine root sum square (RSS). Even though it was examined in the first part of the comments on the Notice of Inquiry, which were due in February, Klein said that the NAB wanted to file additional, more detailed comments during the second round of comments.

Klein's NAB paper, entitled "Revising FCC Technical Standards for AM Improvement," is scheduled to be presented during the first of two AM Improvement sessions at the Las Vegas convention.

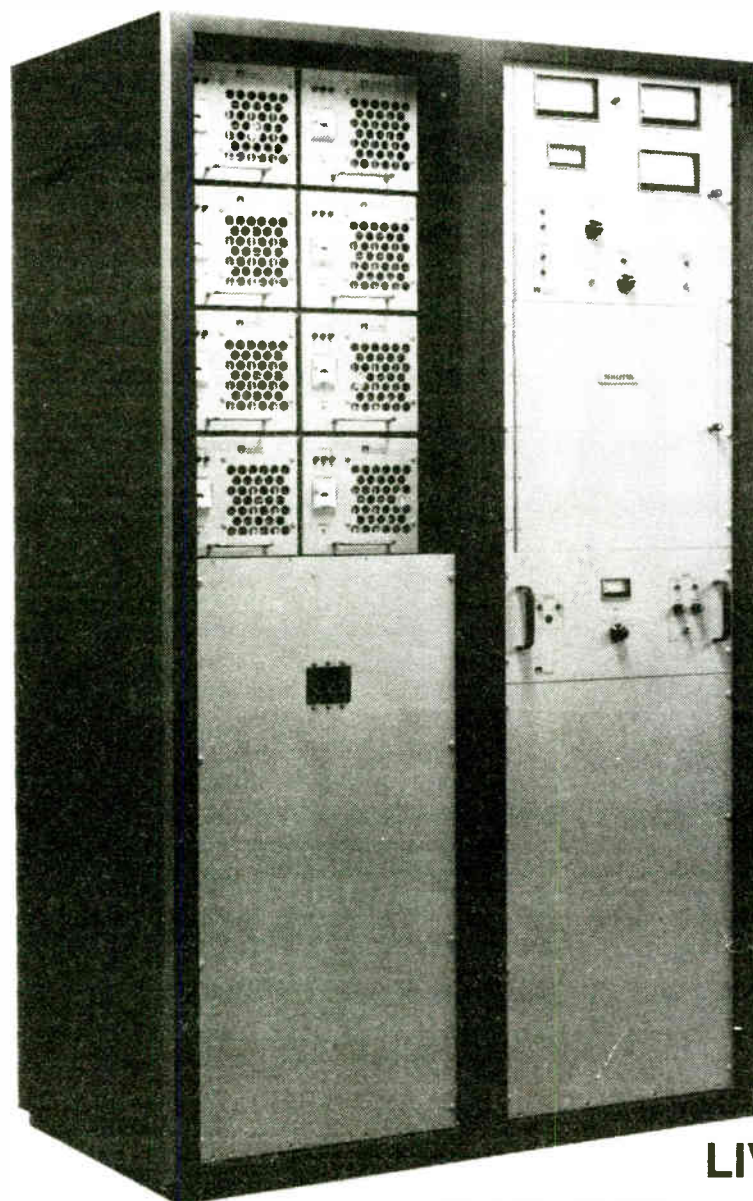
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# The Cutting Edge of Editing

by Tyree Ford

Baltimore MD ... Over the last few years the topics for *Producer's File* have resulted from a direct encounter with a new piece of equipment, a philosophy or a technique.

While it can be stimulating to hang around the cutting edge of change, it's also a good idea to reconsider the basics periodically. This month we'll take a close look at the cutting edge of the editing blade.

If you've honed your editing talents to such a fine edge that the material covered here is less than earth shaking, consider passing this article along to someone less experienced than yourself.

While removing mistakes may be the main reason for editing tape, customization, special effects, timing and circumstance are not far behind. Regardless of your reason for cutting and splicing tape, having the right tools is essential.

## Sears splicer

My first splicing rig came from Sears Roebuck. It consisted of a metal trough with a plastic insert on which to lay the tape. Two metal arms with pads flipped down to hold the tape in the trough.

Between these two arms was a sliding cutting head. In its first position the head would cut the tape diagonally. In its second position a pair of blades would trim the excess splicing tape.

The blades went dull in about a year, about the same time they cut completely through the plastic in the trough. The rig was very difficult to hold still. Those little arms never held the tape quite still enough.

There are some larger, more sturdy versions of this kind of cutter around, but they need designated counter space. In applications where you're simply adding head or tail leadering, given that you have the counter space, these larger devices work well.

My problem with them is that, especially for very precise editing, I feel I have more control with the blade in my hand.

Because most of my editing is critical,

and because I edit on several machines, an unattached non-magnetic metal Editall block is easier to deal with.

The splicing blocks affixed to the face plates of some reel-to-reel decks are a step in the right direction.

Even though the one on the Revox PR99 can't do butt splices, it does have its own fixed-position diagonal cut blade. Because the blade is fixed, you're less likely to sliver off pieces of the plastic block.

This gets to be a real problem with free standing plastic blocks. As you nick away the razor slot, the gap gets wider and wider. After a while this causes the angle of your cuts to vary.

When that happens, your splices don't meet precisely, which results in noisy splices. There's another less obvious cause of noisy splices—magnetized blades.

I once had a heart-stopping experience while assembling a 1/4" two-track master tape for an album project. The splicing blade rig on my PR99, which I was not using, had somehow become magnetized.

As the tape was positioned in the Editall block, which was resting on top of the input level controls of the PR99, a loop of slack tape draped over the lever of the PR99 block.

Just touching the tape to the top of the lever was enough to impart an audible

## Producer's File

"thump" on the tape. Fortunately, the thump occurred in a quiet section between cuts and could be spliced out.

### Using the right blade

It surprises some folks I know to find out that I've been using the same cutting blade for 18 years. It's a one-sided blade with a two inch cutting edge. It's about half the height of a standard one-sided razor blade.

It was given to me by a tape cutting friend who liked it because it was a surgical blade and kept its edge, and because it felt good in his hand.

If you find the standard one-sided razor blade unwieldy, check out a surgical supply store, a hobby shop or an art supply store for your personal weapon.

You may find disposable blades work best for you. I've found a few wipes along a honing stick used to sharpen carving knives is all it takes to keep my blade on edge.

Sharp blades are essential for cutting tape. Dull blades result in stretched tape and uneven cuts, both of which prevent precise tape splices.

### Using the right tape

If you're planning on doing a lot of editing, consider using 1.5 mil tape. It's easier to cut and easier to handle. The thinner the tape, the greater the chance it will stretch.

The percentage increase in thickness of a spliced section, including the thickness of the splicing tape, is smaller with 1.5 mil tape ... a fact your tape transport might appreciate.

It should be obvious that eating pizza and splicing tape are activities that should not occur simultaneously. Even without pizza, the human grease which exudes through our pores can screw up an edit.

Those marks on the back of the tape will come in contact with the oxide side  
(continued on page 17)

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# The Engineer as Salesperson

by John Cummuta

**Downers Grove IL** ... "Nothing happens until somebody sells something."

That's an age-old axiom in sales, and it's usually true that axioms get to be age-old because they're correct. That's the case here.

If you've been in commercial radio for more than a week, you probably feel like everything revolves around the sales department.

That may not be true in the biggest stations where sales are practically automatic—based on position in the latest ratings.

But for most other markets it usually seems like selling is all there is to the station. If your experience is in non-commercial radio, then it probably still feels like everything revolves around sales.

## Engineering— Manager

The only difference in non-commercial circles is that it's called fund raising or budgeting, but it means the same thing: getting money in the door.

### 100% sales

Sure, you could say that without programming and engineering there would be nothing to sell.

The purpose of this article is not to belittle the contributions of all the other departments in your station. It is rather, to put everyone's perspective into realistic focus.

Without sales there would be no need for programming, engineering, news, bookkeeping or any of the other important functions around the station. "Nothing happens until somebody sells something."

However, if you're feeling like my point is that salespeople and their jobs are more important than your job, or those performed by others at your station who are not in sales, you are wrong.

What I am saying is that you and those other people, regardless of their department or title, are in sales. You are all salespeople, therefore you are all critically important.

### The engineer as salesperson

The key to understanding your part on the sales team is to better understand the true nature of selling.

Sales is not simply twisting business owners' arms until they relent and agree to run a schedule on the station.

Unfortunately, it does happen that way far too often, but that's not sales. That's some extremely poor excuse for the proud profession of selling, and shouldn't even be considered in a serious treatment of the subject.

Sales is, when broken down to its basic components, a two-part activity: technical and personal.

The first part entails the technical side of the sale. That is the solving of the client's immediate problem/s.

If the client didn't have a problem, or your station didn't have a solution to a real client problem, there would be no basis for doing business and therefore no sale.

So let's assume that the client has a need, usually for more customers, and

you have ways of meeting those needs.

This is the place where most engineers enter into the sales picture. It is typically when someone says, "Can we do that kind of remote?" or something similar that they call in engineering.

However, the minute that engineering person walks through the door, he or she ceases to be an engineer and becomes a technical salesperson—there to help meet the client's needs.

It is unfortunate that too many engineers come from the "we can't do that" school. It almost seems like it becomes a technical challenge for them to find

ways to shoot down every compromise or proposal to try something new and different.

The engineers who realize that they *are* in sales themselves become part of the team, and look for ways to creatively get the job done.

Like the Navy Sea Bees, the successful engineer/salesperson has a "can-do" attitude.

These individuals look for ways to say, "Yes," rather than, "No." They contribute ideas as opposed to those who shoot at the ideas offered by others like clay pigeons at a skeet range.

The sales-team engineer also looks for less-costly or more-efficient ways of accomplishing the sales goal or activity.

Many times salespeople propose a certain type of activity for a client simply because that's the only way they've ever seen it done, in their experience.

But your experience may be much greater, or you may know of a new technical capability that your station recently acquired. The key here is to listen carefully, and ask positive questions designed to find out exactly what it is the sales department is trying to accomplish.

*(continued on page 17)*



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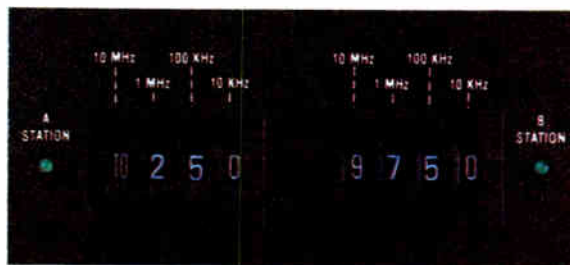
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# Modulating Carriers with PWM

by W.C. Alexander

Dallas TX . . . Pulse-width modulation (PWM) had its beginnings in Europe in the early 1960s.

It seems that everyone in the industry had been searching for a better way to amplitude modulate a carrier at high power levels for 40 years, and PWM was another ingenious development to come out of the era.

Conventional PWM used in those days consisted of a circuit using a series pulse-width modulator in the positive side of the PA plate supply.

The main disadvantage of conventional PWM in which the B+ to the PA anode is modulated is stray capacitive switching losses.

Sometime later, Collins Radio came out with an ingenious way to overcome these capacitive losses by putting the pulse-width modulator in the negative side of the PA plate supply and grounding the positive side of the supply.

This went a long way toward overcoming the problems associated with modulating the B+ line, but introduced a whole new set of problems as a result of necessarily operating the PA grid and

cathode circuits at a high potential with respect to ground.

Harris later found a way around these problems by grounding the negative side of the PA plate supply and series-feeding the PWM to the PA cathode.

Conventional PWM anode efficiencies can approach 92% and carrier tube anode efficiencies are about 74% at all levels of modulation.

## Single modulator

Besides greater efficiency, another advantage conventional PWM has over class B plate modulation is that only one

modulator tube is used.

This leads to still greater AC to RF efficiency because energy is not needed to heat the cathode and supply bias to the other modulator tube.

Perhaps the main disadvantage comes in the area of the PWM filter.

The PWM switching frequency is typically 70 kHz. This frequency was chosen so as to stay within the -35 dB window between 30 and 75 kHz removed from the carrier frequency.

Nevertheless, a multipole PWM filter must be used in the RF output stage to remove unwanted 70 kHz products from the output, and this filter causes considerable transient distortion as a result of its inherent phase non-linearity.

## Solid state PWM

Pulse width modulation is particularly well suited to solid state designs because of the much lower voltages involved.

Each of the three major manufacturers have different methods of approaching PWM. The differences are illustrated in Figure 1.

Harris utilizes a four-phase pulse-width modulator as shown in Figure 1a.

This system samples at a 70 kHz rate. For a modulating frequency of 10 kHz, seven samples times four phases for a total of 28 samples are taken per cycle.

This results in reasonably low distortion, but the amount of distortion is necessarily frequency dependent.

Quite simply, the lower the frequency of the modulating signal, the greater the number of samples that are taken per cycle and thus the lower the distortion at that modulating frequency.

The PWM (called pulse duration modulation or PDM by Harris) takes place in the positive side of the PA supply.

Harris uses a conventional "H" bridge in its PA circuit with an IRF 340 300 V MOSFET and no external rectifier. A PWM filter is used in the output circuit.

## Single PWM

A single pulse-width modulator is used in the PA supply of Nautel transmitters as shown in Figure 1b.

This system samples at a 70 kHz rate. Distortion is generally higher with this scheme, since the sampling rate is relatively low and fixed.

For a modulating frequency of 10 kHz, seven samples are taken, whereas at 1 kHz, 70 samples are taken. Again, distortion is reasonably good at lower modulating frequencies but increases in proportion to the modulating frequency.

Nautel uses a conventional "H" bridge in its PA circuit with an IRF 130/140 MOSFET and a Schottky diode. The drain voltage is 70 V.

## Lead and lag

Continental, as the last to enter into the solid-state arena, uses a completely different scheme for its PWM as shown in Figure 1c.

The PA circuit uses two conventional "H" bridges in a "lead" and "lag" configuration. The PWM takes place in the RF circuit driving the lead and lag bridges.

An IRF 140 and Schottky diode is used in the PA circuit, and the drain voltage is 70 V.

Modulation takes place in a comparator/flip-flop circuit. RF is compared to audio, and two pulses of a 180° duration are generated. Where these pulses overlap is the modulation content.

The sampling rate is dependent on the carrier frequency. Two samples are taken for each RF cycle.

(continued on page 26)

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# What is the Sound of a Notch?

*Editor's note: Last year, the National Bureau of Standards was tasked by Congress to determine whether a proposed notch at 3840 Hz, placed in digital source material, would harm the sound quality of the material.*

*The notch is part of the Copycode system, designed by CBS Records, and would trigger a device proposed for R-DAT recorders, rendering them temporarily inoperative and therefore useless for digital-to-digital copying. Home recording groups have protested this proposal, while its supporters maintain it would be an effective deterrent to copyright infringement.*

*Soon the Bureau will release its report on the matter, drawn from exhaustive testing and statistical analysis. In this Special Feature, RW reporter Alex Zavistovich took the NBS listening tests and compared his reaction with other participants.*

by Alex Zavistovich

## Part I of II

Gaithersburg MD ... Building 233 on the grounds of the National Bureau of Standards (NBS) is a modest, single-level research laboratory, with pastel-painted cinderblock walls. From the outside, it could just as easily be a high school in suburbia.

Inside, however, Building 233 houses some of the latest in digital audio technology and a study has been undertaken, at the request of Congress, to determine what impact there would be on the quality of digital source material encoded with a notch in the audio spectrum.

This so-called Copycode notch would, its inventors say, prevent the use of R-DAT machines in digital-to-digital piracy—from R-DAT to CD, for example.

The inventors also say the notch is inaudible. Their opponents say it is not

only audible, but subtly changes the fundamental components of the sound—pitch, amplitude, and timbre—which it encodes.

A lot is riding on the test results. The NBS report may give consumer R-DAT companies the "go-ahead" to debut products in the US.

Or it may be the last fortress of protection for recording companies, who want to avoid a repeat of the vinyl-to-cassette recording which has hurt them in the past.

## Special Report

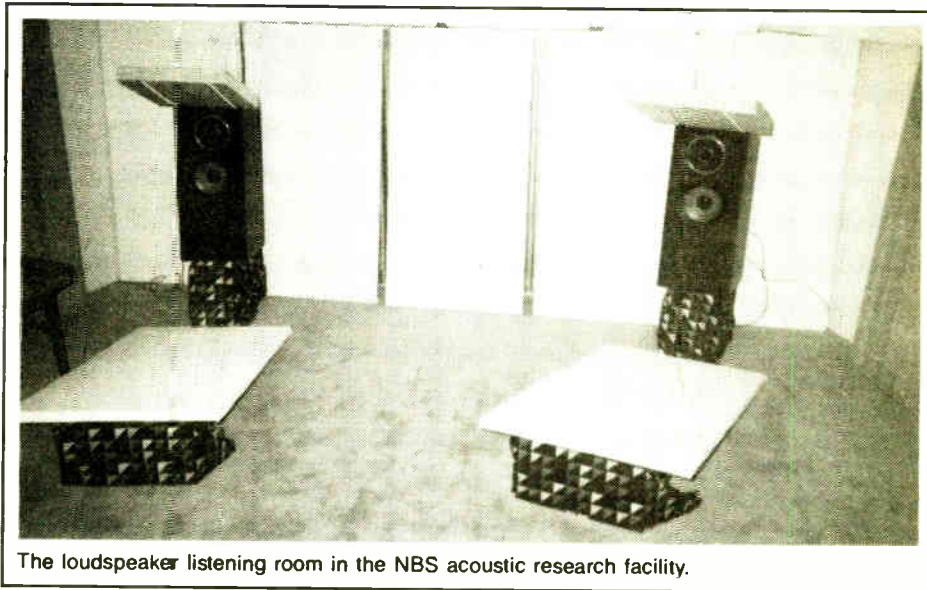
I was able to participate in the NBS study, a "blind" listening test, to judge for myself. I found it interesting to compare my reactions with engineers and other listeners.

My participation in the Copycode testing came about as a result of a general invitation mailed by the National Bureau of Standards (NBS) to RW. Similar requests were sent to companies including engineering firms, radio stations and broadcast equipment dealers.

Although I am not an engineer, I am a classically trained pianist, self-taught on five other instruments, and a home recordist. I have also performed and co-produced an independent album, a single, and two cassette albums, with another record in the works.

I had been reporting on developments in the Copycode controversy since June 1987, and was developing an understanding of the issue. RW's editorial staff therefore decided I was well-enough qualified to represent the paper in the tests, and I happily agreed. I was anxious to hear the effect of the notch on digitally recorded material.

However, on 7 January—the date I was



The loudspeaker listening room in the NBS acoustic research facility.

to have taken the test—Washington was hammered by a surprise snowfall which closed federal government offices, including the NBS. Other commitments took me out of town for a week and prevented me from rescheduling the tests for a later date.

Reluctantly, I decided I had to find another way to report on the audibility of the technology, instead of my own listening.

After a few days of phone calls, I was able to locate several people who had al-

ready taken the test.

The first of these was Morgan Burrow, an engineer for the Washington DC-based consulting firm of Mullaney Engineering.

The test was preceded by a hearing exam, he said, after which a sample tone at 3840 Hz—the frequency removed by the notch—was played, presumably to accustom the listeners' ears to it.

Then some 25 fragments of classical and popular musical selections were

*(continued on page 14)*



Entrance to Building 233, where the NBS study of Copycode was conducted.

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# Listening to the CBS Copycode

(continued from page 13)

played for the listeners, each lasting up to 10 seconds.

Each excerpt was played in an A/B pair, and four permutations for each of the 25 samples were randomly presented: A-only encoded, B-only encoded, A and B encoded, and neither encoded.

Thus, the listener had to hear a whopping 96 repetitions of the selections, and on top of that, could hear each separate selection three times, just to be sure.

The listeners' job was simple: to determine, for each A/B pair, whether A was the same as B, or different. The listeners had their choice of headphones or loudspeakers during the test, Burrow said.

Despite all the combinations, which took some three hours to get through, Burrow maintained that the difference between an encoded and direct signal was, in his opinion, "obvious."

In most cases, he said, the encoding "upset the spatial presence" of the recorded material, producing an extra ringing or some frequencies which should not have been there.

Burrow admitted that the strength of the effect "depended on what spectral material was there." However, he added that "if you knew what to listen for, you heard it."

"(The notch) should have been made in the subaudible or supraaudible fre-

quencies," he continued, "but to have it produce such an obvious change in the upper frequencies, it (Copycode) should be trashed."

Another participant in the NBS test was Paul Blakemore, a sales representative for Maryland-based Bradley Broadcast Sales. He described the test as "grueling and exhausting" (a complaint I heard pretty often), but agreed that, overall, the encoding was "audible."

Still, Blakemore seemed to feel that the notch was less obvious than Burrow had perceived it to be. There was no timbral difference, he said—only a difference in the "feel" of one selection over the other.

In some instances, Blakemore added, the notch appeared to produce a "loss of transparency and freedom in the sound."

Those differences, however, had "philosophical and technical ramifications for the recording and broadcasting industry," he said.

"If there has to be copyright protection, it must not have an effect on the sound of the recording, because that has an equal effect on artistic intent," he commented. "And, frankly, as a consumer, I wouldn't want this particular scheme on any tape, record, CD or anything else I might buy."

After hearing these and several other reactions to the notch (also decidedly negative), I turned to the NBS itself, to see if I could get any advance word on

how the test results were coming.

The people I spoke with, after all, had not been given their scores on the test; I wondered whether they were really hearing all they thought they were.

Dan Flynn, of the NBS Acoustics Department, was project manager for the Copycode test. Although he would not tell me how the results were tracking, he did give me some additional in-

formation about the technical side of the test preparation and administration.

The musical segments were excerpted from CD or from a Kurzweil digitally sampled synthesizer, Flynn said. All the CDs were copied digitally to tape.

However, because the CBS Copycode encoder is an analog device, the digital recording had to be converted to analog, passed through the encoder, and then reconverted to digital.

Every effort was taken to assure that no clues were given as to which sample was doctored other than the encoder itself, Flynn noted.

For playback, a McIntosh 7270 power amplifier was used; the tape medium was a Sony DMR 4000. Listeners participating in the test were allowed to choose between a booth where Stax

just been completed was called the "serial" study. A "parallel" study had yet to be completed. I jumped at the chance to make up for the first-hand experience I thought I had lost, asking if there was room for another participant.

At first, Flynn seemed to balk somewhat. He explained that the first test had been intended for people with a more general listening background; the second test was meant for experienced sound and recording engineers.

I assured him that my background as both a classical and contemporary musician, as well as my technical writing background seemed to qualify me. Flynn agreed, and I was scheduled for an early morning session the following week.

Next time: Audible or not? The results surprised me.



NBS Engineer Dave Evans demonstrates Sony digital equipment used in the test.

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# Simple Digitized Sequencing

by Bill Higgs

Louisville KY ... Necessity, they say, is the mother of invention. That may or may not be true, but this little project grew out of financial necessity.

An automated FM station I service was missing too many newsfeeds from their network. The sales manager was complaining of visions of red ink.

Never mind that the AM jock was the one dropping the ball; the hue and cry came to the engineer (as always) to make his life and the sponsor's image better. And do it cheaply!

An older, rather "dumb" cart machine was used at this facility to tape the network feeds. Unlike more modern models, its total smarts consisted of a couple of transistors, several diodes and a relay.

The thing stubbornly refused to recue itself in record mode. Simply put, something was needed to put EOM tones on the cart, take the cart out of record mode and recue it in playback mode.

This is easier said than done when the network only gives one chirp tone at the end of the feed.

## Simplifying the design

The first version of this gadget was built up with TTL chips. Six of them.

With enough bypassing, voltage regulation and the right weather conditions, it could sometimes be persuaded to work.

I had to build a separate power supply for it, since at the time they did not have 5 V available anywhere in the studios.

It was soon decided that any future versions of the circuit would be simpler and more dependable.

Single-chip solutions have always had the air of elegance about them. They also can be expensive, or use hard-to-find parts.

The circuit shown in Figure 1 is the closest I could come to a single-chip solution (would you believe two chips?)

while avoiding exotic silicon.

For those of you in the boonies, most parts are available at your local Radio Shack.

## Complex components

The circuit uses a 4017 decade counter clocked by a 555 timer. The innards are complex, but the practical application is simple: the ten output pins go high in sequence.

## BottomLine—Broadcaster

An enable input is provided to allow the count to be disabled, and by tying this input to one of the outputs, we can make the chip count up and then stop.

By proper selection of components associated with the 555 timer, the count can be made anything from one every ten seconds to 500 kHz or so. This range should cover most any application!

Very little is critical about the construction. The component values given provide an adjustable pulse rate centered at about one per second.

Other applications require different values; feel free to experiment. Larger values give slower pulse rates; smaller give faster.

The diagram shows an adjustable resistor, but a fixed resistor can of course be substituted. I prefer tantalum capacitors, which seem to be more stable over time. Use sockets for the IC's.

## Plain or fancy

Build it up as plain or fancy as you wish. Perf board works fine. The schematic shows a "deluxe" version, complete with rotary switches to select the sequence of events.

The LEDs are not necessary, but the other diodes should be retained in order to allow outputs to be wired together and protect the chip.

The transistor shown is an open collector circuit which goes to ground when the output of the chip goes high.

The chip can drive TTL directly; it runs off 5 V but will work fine on anything between 3 and 12 V.

The count starts when the reset pin is pulled high—shown here by a pushbutton. If you wish to start the count from

a logic chip, the pulldown resistor can be eliminated.

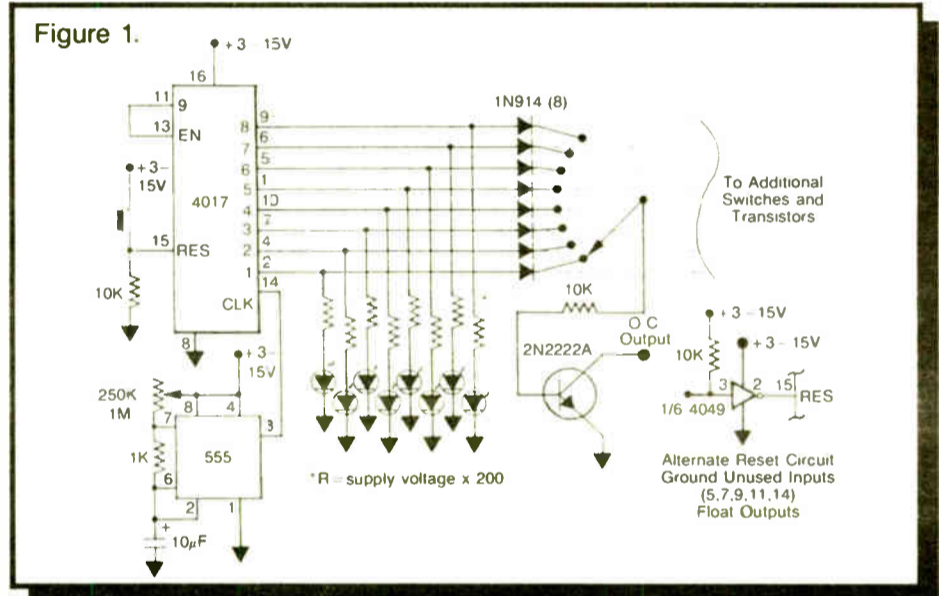
If the count needs to be started from a low-going pulse, one section of a 4049 can be added before the reset pin. The other five inverters can be used at the outputs. Oh well, three chips!

## Multi-use

This little gizmo can be used anywhere several things need to happen in rapid (or slow) sequence, and only one pulse (or finger) is available.

Although the original application was for a balky cart deck, it is being used in production to sequence decks and help tighten up cart dubs.

Hook a Sonalert to outputs 1, 3, 5 and 7 (use the diodes!) and you have a tone beeper. Tie several outputs together (again, diodes) and put a fixed length 25  
*(continued on page 17)*



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**Q.** Which manufacturer offers formal technical training?

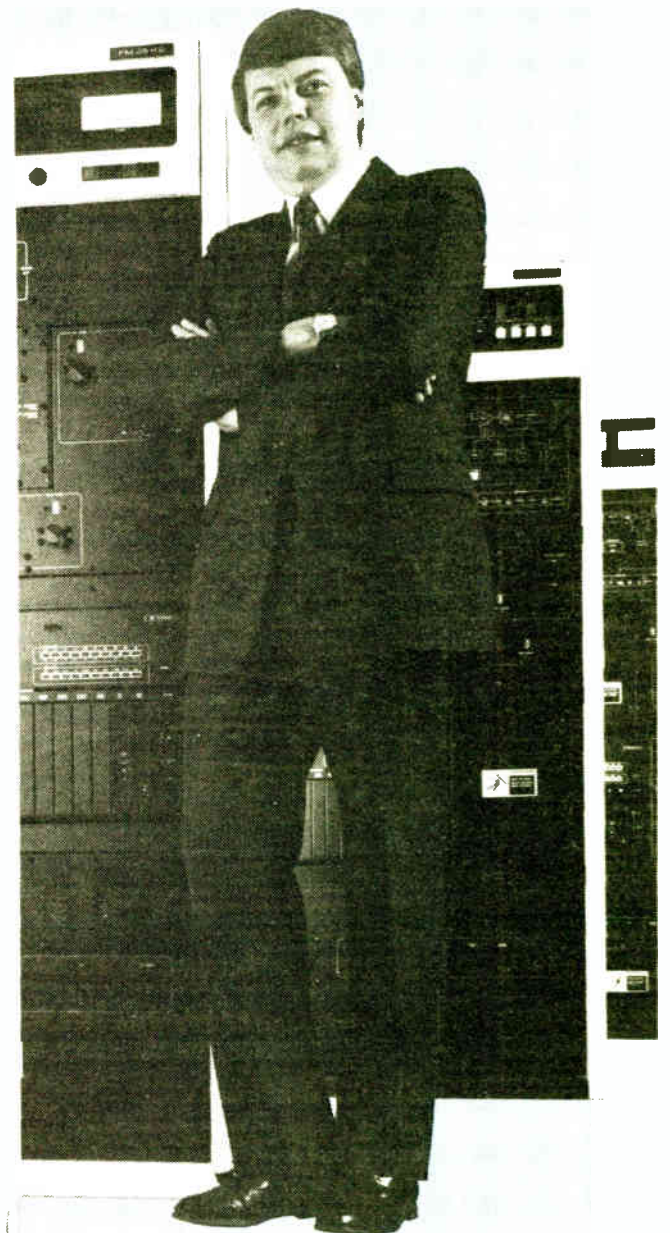
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Ronald C. Frillman  
Manager — Domestic Radio Sales  
Harris Corporation, Broadcast Division

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# The CE's Role in Station Sales

(continued from page 11)

If you come up with what you consider better ideas, offer them constructively and not in a manner that puts the original proposal down as stupid.

Be careful, the original idea may be one that the client suggested. Give any supporting documentation or explanation that shows that your real concern is to accomplish the team's purpose more efficiently, not to change it.

## Second key element

The other major factor in successful sales is the personal relationship between representatives of the station and the client.

Many salespeople miss out on lucrative contracts because they concentrate on the problem-solving activity of selling, the technical side if you will, and they neglect to build strong, caring, personal relationships with their customers.

Many a salesperson has lost an account completely to a person selling an inferior product or service, only because the other person had the skills and took the time to develop a strong, personal bridge to the client.

Without this relationship building and maintenance, any business is in jeopardy of being lost. The personal side of selling is at least as important as the technical or problem-solving side.

## Relating to clients

As an engineer, you may have frequent opportunities to relate to clients. Whether it's simply talking to someone in the waiting area or going out on location for a remote, you are making an impression. Consider what kind of impression it is.

Remember, every time you talk to a client, you are a salesperson.

# Digi-widget

(continued from page 15)

Hz tone on automation tapes.

Do the same with a slow pulse rate and time your EBS generator. Build one with a battery and LEDs for the GM to play with . . .

Total cost for the digital widget (wigital digit?) will probably be well under \$10. If you find a unique use for it let me know and I'll be happy to share it with other readers.

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

I remember an incident at a very big account's grand opening of a new location. We had a remote broadcast going, and our special guest was the star quarterback of the local professional football team.

It was a big deal with literally thousands of people cramming around. It made us look really good, until one of the engineers decided to make a phone call back to the station.

He just went behind the sales counter and started rummaging around for a phone. When questioned he was cool, almost arrogant. After all, he was wearing a station teeshirt. Didn't this idiot store clerk know how important he was.

It turned out that the idiot store clerk was the wife of the business owner. We lost the future remotes and thousands of dollars.

Oh, but that's okay, because the engineer found the phone and made his call.

## Understanding sales

It is critical for every person at the station to understand his or her relationship to the company's sales efforts that I suggest everyone be allowed to attend any station sales training seminars.

I also strongly recommend supplying the non-sales department personnel

with instructions to actually assimilate the knowledge contained therein.

If they need any motivation, simply remind them that while they might sleep better at night if we save the whales, they'll eat better every day if you save the sales.

If you are working for a broadcast operation of any kind, you are in sales. The sooner you recognize that and develop your skills in that area, the sooner you'll be making profitable contributions to both the stability of your employer's business and the potential of your own career.

*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.*

# Laying the Groundwork of Editing

(continued from page 10)

when the next revolution of tape is wound on the reel. To this end, some folks use a pair of very thin white cotton gloves so as not to leave grease marks on the tape.

## Splicing tabs or splicing tape

There are three kinds of splicing tape generally used in the 1/4" tape format. The first is white, about half an inch wide and comes on a roll like cellophane tape.

In most cases, this tape is used with the splicing rigs with the hold-down-arms first mentioned in this article.

Using this type of tape with an Editall type block requires that you trim off the excess splicing tape very carefully so that none of it extends past the upper or lower edges of the recording tape.

Failure to trim these edges can cause them to catch on the transport tape guides thereby shifting the tape out of alignment as it passes over the heads.

The second kind of tape also comes on a roll. It is pre-cut to just less than 1/4" so that, when correctly placed over the splice, it never comes in contact with the edges of the recording tape.

Splicing tabs are pre-cut sections of the same width attached to a longer plastic handling strip. If you haven't tried these yet, you can get a box of 250 for under \$10. Some folks love them, others prefer the other kind.

There are also several adhesives used on splicing tape. For most production work you'll probably want to use the removable polyester kind, Scotch 67 or something similar.

This way if you don't like the splice you can open it up and do it again. Simply turn the tape over to the oxide side, and bend the tape right at the joint line.

Carefully lift one of the pointed corners with a finger nail, then grab it between your finger tips and slowly sep-

arate that piece of tape from the splicing tape. Do the same for the remaining piece.

Although everyone may have a favorite marking device, if you're just starting out try a white china marker. They're not soft enough to gum up your playback head, and they leave a nice visible white mark on black back-coated recording tape.

Remember, it's always a good idea to keep the tape heads as clean as possible. After an editing session, clean the heads, the head housings and the guides to make sure you leave a clean machine for the next person.

If the studio in which you are working doesn't supply you with the right splicing tools, get your own.

Seasoned Production Rats who share studio space with others who like to bor-

row but not return have learned to keep their editing gear in a small box somewhere out of sight.

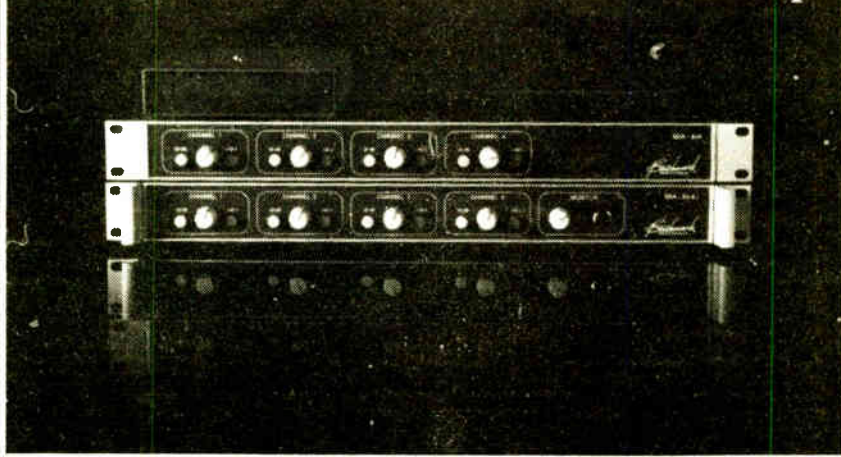
It is the sign of a thoughtful staff and a good studio boss when blades, tape and markers remain in supply and in sight.

Now that you're armed with the right equipment, you're ready to cut tape. With a little practice you'll soon gain the confidence you need to amaze your friends with your ability to rearrange or create new realities in audio.

In the next *Producer's File* we'll talk about the why, when and where of tape cutting.

*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.*

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# Reducing SCA Multipath Woes

by Eric Small

Brooklyn NY ... Judging by articles that appear and from listening to the promoters of various new schemes, operating with an SCA should take no more effort than switching on an SCA generator.

Well sometimes it's that easy, but often there are gremlins that need to be chased out of the system first.

Hopefully I can point out many of the gremlins others have encountered and provide some solutions to eliminate them. The first of these is multipath.

Multipath causes most crosstalk. Great SCA applications that work well in the lab and in carefully staged field tests often work poorly in the real world.

The real world contains cars and tall buildings and mountains—all things that reflect FM signals like mirrors.

The urban "canyons" created by high-rise office buildings are an especially difficult environment for SCA. Wall Street in New York City is a famous example of such an urban landscape.

Locations exist in the real world that are multipath free, but such places are rare.

Technically, multipath is the arrival of the same signal at the receiving antenna at different times and from different directions.

The most direct signal arrives first and is generally (but not always) the strongest, followed by one or more signals that travel longer paths because they have been reflected off objects.

Generally each successive arrival decreases in amplitude but this is not al-

ways the case.

The best way to visualize multipath is to look at it as ghosts on a television picture.

An antenna rotor with a directional antenna feeding a TV set will provide a great deal of information on which to build an intuitive understanding of multipath.

The quality of masonry (brick, cement, cinder block, etc.) as a reflector at VHF varies tremendously with whether its surface is wet or dry.

My measurements indicate that this effect can change reflectivity as much as 25 dB at 100 MHz. This vast change in reflection coefficient with moisture accounts for many stories of 'odd' SCA

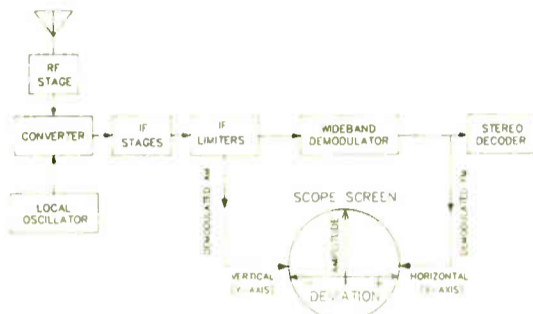
When a roof-mounted directional antenna will not provide a sufficiently multipath-free signal, the site can sometimes be saved by a novel multipath cure.

By adding RF attenuation at the antenna input to the receiver, it is often possible to adjust the level of the incoming signal so that the receiver ignores the multipath.

For this method to work reliably the signal strength must remain stable.

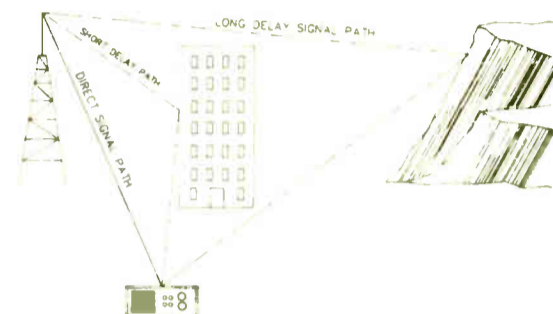
The need for stable signal strength is

Figure 1. Diagram of Multipath Signal



The signal paths shown provide a simplified view of how multipath is created at a receiver. The signals following longer paths arrive microseconds later than the direct signal. This causes selective cancellation of the signal at the receiver—multipath.

Figure 2. Hookup for a Multipath Indicator



The test set-up shown here allows an XY oscilloscope connected to an FM tuner to display a multipath indication. Horizontal (X) deflection is the wideband composite signal with full deflection at 75 kHz. Vertical (Y) deflection is the AM component on the signal. An AM component is created by multipath.

Certainly it will convince anyone that a directional antenna (Yagi or log-periodic) is the solution to most multipath reception problems.

SCA operators know that a roof-mounted directional antenna, carefully aimed for minimum multipath, produces a clean signal almost anywhere.

One unpredictable aspect of multipath affects all VHF reception: it makes reception vary with the weather and season.

performance during wet weather.

When the path between the transmitting and receiving antennas is blocked, often the only way to get a clean SCA signal is to use a "bank shot."

This is a reflection off an object that receives direct illumination by the signal. It's important that the performance of such reflected paths be checked during both wet and dry weather to insure reliable operation.

Various other types of antennas—indoor and outdoor—work with varying degrees of success. Outdoor whip antennas are popular, and in locations without too much multipath they work well.

Indoor antennas, whether whips or Yagis, usually have problems because objects moving around in their near-field cause great changes in their characteristics.

People within about ten feet are the worst offenders, but cars and trucks pose a problem over greater distances. Indoor directional antennas are more susceptible to near-field problems than whips.

The best way to insure reliable SCA operation is to provide an outdoor directional antenna mounted in the clear with an unobstructed path to the transmitter.

Many variations from this approach are possible, but each carries the potential for increased multipath and its associated crosstalk.

why an outdoor directional antenna should be employed if this technique is to be used successfully.

In practice the technician doing the installation uses a cable TV-style adjustable RF attenuator to find the attenuation needed to provide the best sounding audio output.

That value is then permanently installed using inexpensive attenuators. Cable TV barrel-style attenuators are ideal for the purpose as they are cheap and readily available.

The design of an SCA receiver greatly affects its susceptibility to multipath. Some makes and models of SCA receivers work well under multipath conditions, while others are regarded as "dogs."

This in spite of such receivers working equally well in all other respects. Always try several brands of SCA receivers when attempting to cure a multipath or crosstalk problem.

The parameters of multipath are difficult to identify and measure. They include the amplitude, phase and azimuth of each individual arrival.

Under worst case conditions in an urban area there can be scores of separate arrivals.


And even if all the parametric information were available, determining the impact of any individual arrival on the per-

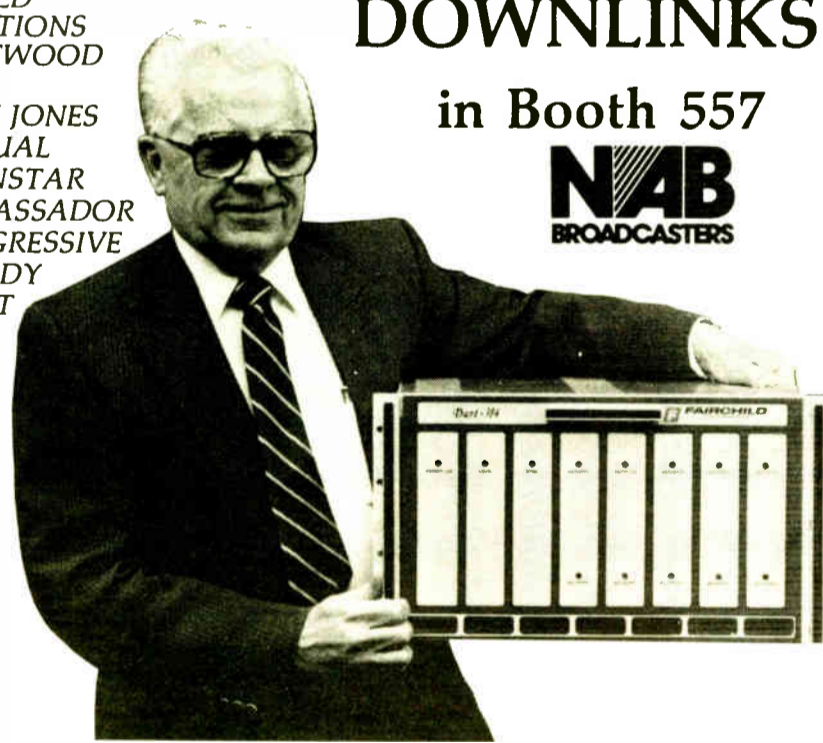
(continued on page 21)

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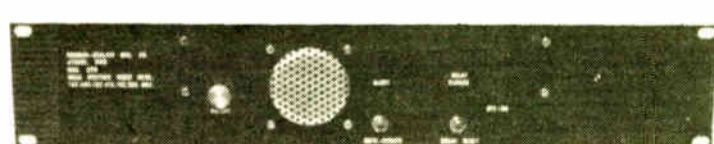
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# Impedance and Power Supply

by Thomas Vernon

Harrisburg PA . . . When the term "impedance" is mentioned in regard to transmitter specifications we usually think of properly coupling the source to the load, or perhaps the audio input impedance.

But the impedance of a transmitter's power supply is an important specification too. Not knowing this can result in seemingly random transmitter outages involving failed plate transformers, chokes and rectifier stacks.

## Station Sketches

These failures seem to occur most often in older transmitters that have been improperly upgraded in the field with solid state rectifiers or plate transformers.

This month's column will look at transformer impedance and how it must be taken into consideration when replacing components in the power supply.

In addition to the familiar specifications of primary and secondary voltage and current, impedance must also be taken into consideration when selecting a replacement transformer or upgrading the power supply.

Usually this information appears on the data sheet as "full load percent impedance" or percent regulation.

This figure is an indication of the regulating ability of the transformer—its ability to maintain specified voltage with a varying load. It is largely a function of the amount of coupling between primary and secondary windings of transformers.

Equation 1.	$\%Z_{IL} = \frac{V_L}{V_{NL}} \times 100$
Equation 2.	$\text{short circuit amps} = \frac{(kVA)(100)}{(kV)(\sqrt{3})(\%Z)} \times 1.414$
Equation 3.	$\frac{(10)(100)}{(2.5)(\sqrt{3})(1)} \times 1.414 = 326.5 \text{ A}$
Equation 4.	$\frac{(10)(100)}{(2.5)(\sqrt{3})(7)} \times 1.414 = 46.6 \text{ A}$

Typical figures for percent regulation run between 1% and 10%, with the lower numbers being better. A good AM plate transformer would have 3% to 5% regulation.

This information is not always included in data sheets for older transformers, since mercury vapor tubes were less sensitive to current surges than their solid state counterparts.

If this information cannot be obtained from the manufacturer, there is a method to determine transformer impedance in the field.

It's important to have this information in hand before redesigning the power supply because your choice of rectifier diodes and circuit breakers will depend on it.

A hastily chosen transformer in an AM transmitter may not be able to handle the current demand on modulation peaks, resulting in carrier shift and distortion, in addition to the problems mentioned earlier.

To determine the percent regulation of a transformer in the field you will need a Variac, DVM and an AC ammeter. To begin, disconnect the secondary leads, apply power and measure the unloaded secondary voltage. This value we will call  $V_{NL}$ .

Please note that you cannot rely on specified secondary voltage, as the line voltage in your area may run above or below the specified primary voltage of the transformer.

Next label and remove all wiring from the transformer. Now short out the primary windings, and wire the Variac, DVM and AC ammeter as shown in Figure 1. Increase the voltage to the transformer while observing the ammeter.

When you reach the specified current rating of the secondary, stop and note the voltage. This is  $V_L$ . Note that you may have to use a 230 VAC supply on some transformers to reach the specified current.

Now that we know the loaded and unloaded voltage ratings, these values can be plugged into the formula in Equation 1 to get our full load percent impedance.

By knowing the percent regulation, plate voltage of the transmitter and kVA rating of the transformer (found on the ID tag or spec sheet) we can work our way through one more formula to calcu-

late how many amps the rectifiers must have during short circuit conditions, as shown in Equation 2.

This will give us good numbers for single phase transformers. For three phase supplies, do not multiply the result by 1.414.

Here's an example. Assume we have a transmitter with a plate voltage of 2.5 kV and the plate transformer is rated at 10 kVA with a full load impedance of 1%. Putting these numbers into our formula we get the results shown in Equation 3.

Now let's do the same thing, only with a transformer having 7% regulation, and take a look at what happens in Equation 4.

As you can see from the results, full load impedance specifications have a profound effect on rectifier requirements. This may make it easier to understand why those replacement diodes oc-

asionally give out.

These formulas do not take into account the leakage reactance of the transformer, but at 60 or 120 cycles, this is not an important consideration.

The most important diode specification related to transformer regulation is surge, or short circuit current. This value must exceed the short circuit ampere rating of the transformer by a suitable safety margin.

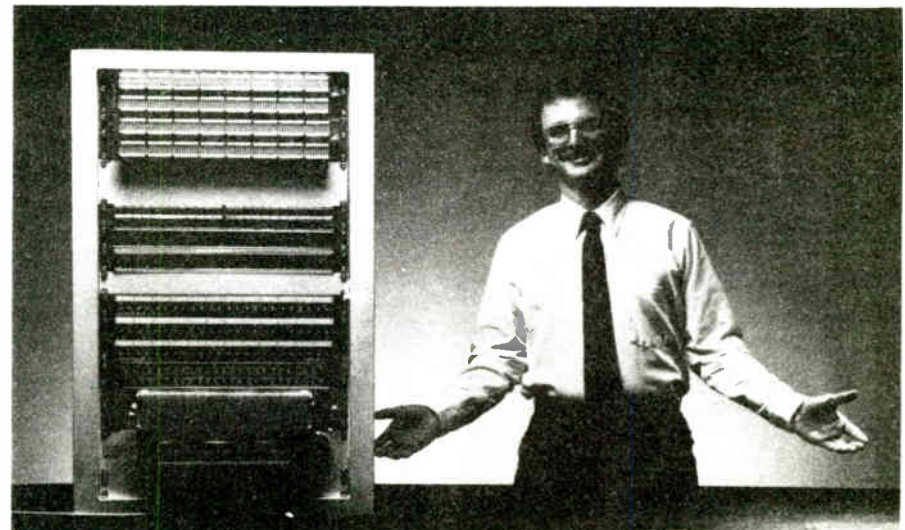
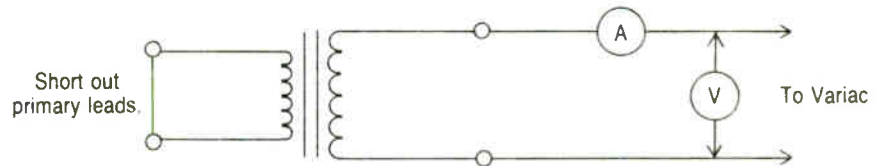
This surge current is specified for a finite length of time, sometimes one cycle (16.7 ms) or four cycles (67 ms). Any short circuit which is sustained for longer than the specified time will probably destroy the rectifiers.

This time element leads nicely into the next design consideration, circuit breakers.

If the circuit breaker doesn't open when overcurrent conditions are sustained for longer than four cycles, then it doesn't do much good. Such incompatibilities sometimes occur when mer-

*(continued on page 21)*

Figure 1. Determining the percent regulation of power transformers with a voltmeter, ammeter and Variac.



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# Transmitter Power Impedance

(continued from page 19)

cury vapor tubes are replaced by solid state rectifiers.

Most circuit breaker data sheets have a graph of percent of overload versus time to open. Usually the higher the overload current, the faster the circuit breaker reacts. Typically they will open in four cycles at rated current.

Going back to our earlier examples, we found that a 2.5 kV plate transformer specified at 1% regulation yielded a short circuit current of 326.5 A and a similar transformer with 7% regulation would have a current rating of 46.6 A.

With the 1% transformer we could use rectifiers rated at 326.5 A (plus a suitable safety margin) with a four cycle breaker. Similarly, our 7% transformer

would require rectifiers with a short circuit rating of 46 A.

Some engineers try to solve the whole problem by using faster circuit breakers, but this also has some bad side effects. Circuit breakers which open quickly are more prone to false trips due to short duration transients.

From the above discussion we can see that full load regulation of power transformers, short circuit current time for rectifiers, and time/overload curves for circuit breakers are all specifications which must be taken into consideration when power supplies are modified.

The engineer must think of the power supply as a system and not individual

components.

Low impedance transformers yield good regulation, require high current rectifiers and average circuit breakers. High impedance transformers, on the other hand, give poor regulation, can operate with low current rectifiers but require fast acting circuit breakers.

Sometimes transmitters with well-regulated supplies are unfairly blamed for poor carrier shift specifications, when the problem is really with the AC being supplied to the transmitter.

It is easy to determine if the problem is with the AC supply or the plate supply. Connect a DVM across the AC input to the transmitter and measure the

voltage during unmodulated carrier conditions. Now modulate the transmitter to 100% using a 400 Hz tone.

If the voltage has dropped more than 5% there are problems with the utility supply. This could include such things as pole transformers which are too small, or insufficient wire size. In many instances installing line regulators can improve the situation.

Poor regulation can also be caused by transmitter efficiency problems. If difficulties remain after the power supplies are put in order, the tuning, loading and bias adjustments would be the next area to look into.

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

## A Gremlin In the SCA

(continued from page 18)

formance of an SCA presents a formidable problem in analysis.

A coarse, mostly qualitative technique does exist for measuring the impact of multipath.

The instantaneous FM peak deviation is displayed against the instantaneous AM component of the same signal.

This is done by applying the composite wideband (demodulated FM) to the horizontal (X axis) input of an oscilloscope and a demodulated AM output from the same receiver to the vertical (Y axis) input.

The result is a real time display of multipath. Many high-end consumer FM tuners have outputs suitable for creating a multipath display.

The function is often called "Scope" or "Multipath" with two jacks usually labeled H and V or X and Y.

Sometimes the output for horizontal display is call "Wideband" or "Demod." It is the composite wideband signal before the stereo decoder.

The output for vertical deflection is a wideband AM demodulation of the signal. It is usually derived from an early IF/limiter stage in the tuner.

An expanding and contracting horizontal line with no vertical component indicates a signal is being received with no multipath.

Any multipath that would degrade the received signal will cause a wiggle in the line. The location of the wiggle along the horizontal deflection indicates what frequency range of baseband signals is being affected by the multipath.

The amplitude (vertical component) of the wiggle is a rough gauge of the severity of the multipath.

This technique must be classed as qualitative because there is no generally accepted method of calibrating the display, and the pattern depends greatly on the characteristics of the receiver.

However, the method remains very useful in adjusting an SCA system for minimum multipath and for estimating the impact of what multipath is present.

*For a complete discussion of SCA, a copy of a 24-page booklet is available from Modulation Sciences at NAB Booth #4544. Eric Small is president of Modulation Sciences, he can be reached at 718-625-7333.*



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# Reradiation in Yagi-Uda Antenna Design

by Ron Nott

**Farmington NM** ... We've been looking at effective field strengths for AM and FM. Last time we looked at what happens when there are reradiating effects.

But there's one antenna that actually welcomes reradiation.

The Yagi-Uda antenna, commonly known as a Yagi, and having variations such as the log periodic antenna, utilizes the reradiation effect in the form of parasitic elements.

When such a parasitic element is placed in the near field of a dipole (known as a driven element), it will intercept the EM field from the driven element, transducing part of it to electric current.

If the parasitic element is made of low loss material and it is the proper length, it will transduce the current back into an EM field, radiating it with a time lag with reference to the driven element field.

By proper physical spacing between the elements, a 360° lag may occur in one direction, which means that the field from the parasitic element will be in phase with the one from the driven element in that direction.

In the opposite direction, a near 180° (or odd multiple of 180 degrees) relationship will occur so that a receiving antenna will integrate the two fields with zero or nearly zero output voltage.

These effects provide the well-known directivity of the Yagi antenna. More parasitic elements may be added to en-

hance the effect and it can be seen that a 10-element antenna, for example, can have a very complex analysis if drawn graphically.

Don't forget that the EM fields are still there off the "back side" of the Yagi.

## Reciprocity

Applying the "Law of Reciprocity" when the Yagi is used as a receiving antenna rather than a transmitting antenna, the directive effects will be basically the same, and for the same reasons.

As an EM field enters the front of the Yagi, each parasitic element will transduce part of it to current and then back to radiation with a time lag to it.

If the antenna is well-designed and

constructed, each of these sub-fields will arrive at the driven element in phase (or at 360° multiples) with the original EM field.

Each will then contribute its vector of current, all of which are integrated into a stronger signal to the receiver antenna terminals.

Proximity to the earth or reflective objects can have deleterious effects in performance, whether transmitting or receiving.

## Integration effects

All antennas composed of multiple elements derive their effective pattern shapes and increases or decreases in gain by the effects of integration within the receiving antenna.

The fields may be modified in effective strength by controlling the ratios of power and the phase angles fed to a set of transmitting antennas.

They can have their phase relationships affected by phase shift networks

and length of transmission lines.

The geometry of placement of the elements can be utilized to get certain effects. The results are always "effective fields" and not necessarily the true EM fields.

We have all been conditioned to accept an antenna and some form of electronic detector as the only method of "receiving" EM energy.

Since we now know that the EM fields are still there at full strength in what we call nulls, what kind of a device would it take to detect them there?

It might be a very interesting instrument.

Since we can be in powerful EM fields without being able to detect them with conventional instruments, we might be moved to wonder if the new rules governing non-ionizing radiation are adequate.

Ron Nott is the president of Cortana Corp. He can be reached at 505-325-5336.

# A Look at AM Broadbanding

by Tom Osenkowsky

**Brookfield CT** ... Let's begin our discussion of broadbanding by defining the two types of bandwidth considerations we'll be dealing with ... pattern and load bandwidth.

In a DA system we would prefer to see identical radiation patterns at the sideband frequencies (say ±10 kHz) and at the carrier frequency.

Such a system would exhibit the best possible fidelity especially in the minima directions.

We will see, however, that as the fre-

quency is varied the element spacings, heights and line lengths change due to the change in wavelength. Our capacitors and inductors also change in reactive value in inverse proportion.

These considerations are referred to as pattern bandwidth.

## Symmetry

Load bandwidth is the more common reference to flat or symmetrical common point or transmitter output impedances as seen at the sideband frequencies.

Exactly where symmetry occurs is of the utmost importance. As a starting point consider the ideal amplitude modulation system as shown in Figure 1.

We see the relationship as that of carrier to sideband power and voltage (field strength).

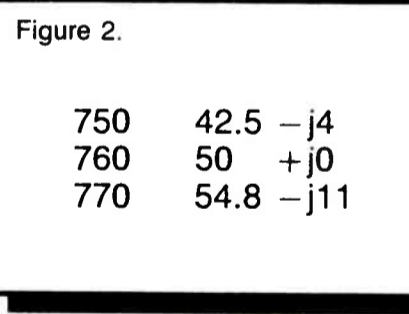
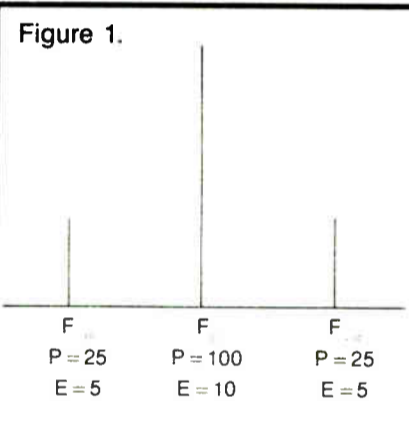
If a DA system had a radically different pattern shape at the sideband frequencies, we could expect severe distortion to occur due to the improper balance of sideband powers.

This is the reason a distorted signal is heard while driving through a DA null. The carrier frequency is more attenuated than the sidebands and overmodulation occurs.

Distortion in an AM signal will happen when sidebands are symmetrical at

the point of generation (the plate of the final amplifier tube/s for instance). We will go into this in a much deeper analysis at another time.

(continued on page 26)



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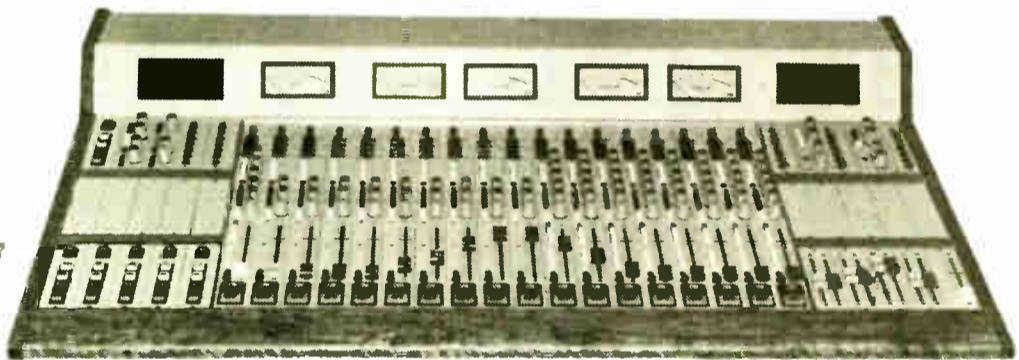
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# Complying With FCC OST 65

by Leroy Granlund

Sunnyvale CA ... If you have occasion to build a new broadcast station or to make changes (at the transmitter site) for an existing station, you'll be faced with the task of demonstrating full compliance with the terms of FCC's newest environmental hurdle, known as OST Bulletin #65.

This bulletin establishes "voluntary" guidelines for safety pertaining to RF radiation hazards for station employees and for the public as well.

The bulletin is available from the Government Printing Office, and should

be obtained and read by every broadcast station licensee and all members of the engineering staff.

Ultimate liability for compliance falls upon the licensee. However, as in all technical matters the engineering department will usually assume the responsibility.

In the case of an AM station, the Bulletin defines an RF radiation hazard as one (or both) of the following:

- An electric field of 632 Volts per Meter (V/m) or more.
- A magnetic field of 1.58 Amperes per Meter (A/m) or more.

The Bulletin states that areas of RF

radiation hazard may be determined by direct measurement or by "prediction", using one of two methods provided in Appendix D of the bulletin.

In that appendix, Table 1 lists the *maximum* radius of hazard area around any type of antenna at each standard operating power level.

Also in the bulletin are Figures 1 to 3, graphs for determining the radius of hazard area around vertical radiators of 0.1, 0.25, and 0.5 wavelength, for any AM broadcast frequency and operating power level.

There are problems regarding the use of either of the above methods because

Table 1 must account for unusual antenna configurations and therefore shows distances much greater than the actual hazard area for typical broadcast antennas.

Also Figures 1 to 3 show field strength only to 100 V/m and 0.26 A/m, and FCC engineering staff currently states that the graphs may not be extended to the required limits.

As a result, if you choose to predict the hazard area, your fence will cover a much larger area around the tower than is current practice, and many stations will be faced with the prospect of acquiring or clearing land around the tower for a larger fence.

This can be expensive and in some cases it is not possible. It is therefore desirable to measure the actual hazard area, to be protected by a fence of more reasonable dimensions.

## Direct measurement

Bulletin #65 also gives some information regarding direct measurement of the RF radiation hazard area, including some suggestions for applicable equipment.

But equipment of this type may prove to be quite expensive and also difficult to find.

In most areas equipment suitable for direct measurement would not be available through rental agencies or other local sources.

The industry standard for field intensity measurement in the AM band is the Potomac Instruments Model FIM-41, and many stations either own the instrument or can easily borrow it from a nearby station.

Please note that the PI FIM-41 will not make the required measurements without the use of special methods. The maximum scale of the FIM-41 is 10 V/m—a far cry from the 632 V/m needed for direct hazard area measurement.

Also, Bulletin #65 requires measurement of both electric field and magnetic field, which is also beyond the scope of the FIM-41 as normally used.

I have developed some techniques however, whereby the FIM-41 can be used to determine RF radiation hazard areas in compliance with OST Bulletin #65.

The FIM-41 is calibrated in terms of Electric Field Strength, expressed in V/m, but it is actually measuring magnetic field.

It makes use of a loop antenna, which responds *only* to the magnetic portion of an electromagnetic wave.

The FIM-41 is intended for use in the far field only, and it therefore uses the standard free-space impedance value of 377 ohms.

This allows the meter movement to be calibrated in terms of V/m, and it is a very precise tool when used in the far field. Again, the near-field measurements required by Bulletin #65 involve special techniques described below.

Some engineers have modified the FIM-41 to allow direct measurements to 632 V/m.

However, this invalidates factory calibration of the instrument and in my opinion should *not* be attempted by the average engineer.

In addition, modification is not needed for the measurement method I'll be describing.

In order to keep the measurements within the 10 V/m range of the FIM-41 it is necessary to adjust the field to be measured to a lower value.

This requires a stable adjustable source  
(continued on next page)

"FM radio has become a ratings war in which we are the casualties by being subjected to a poor excuse for clean accurate music."

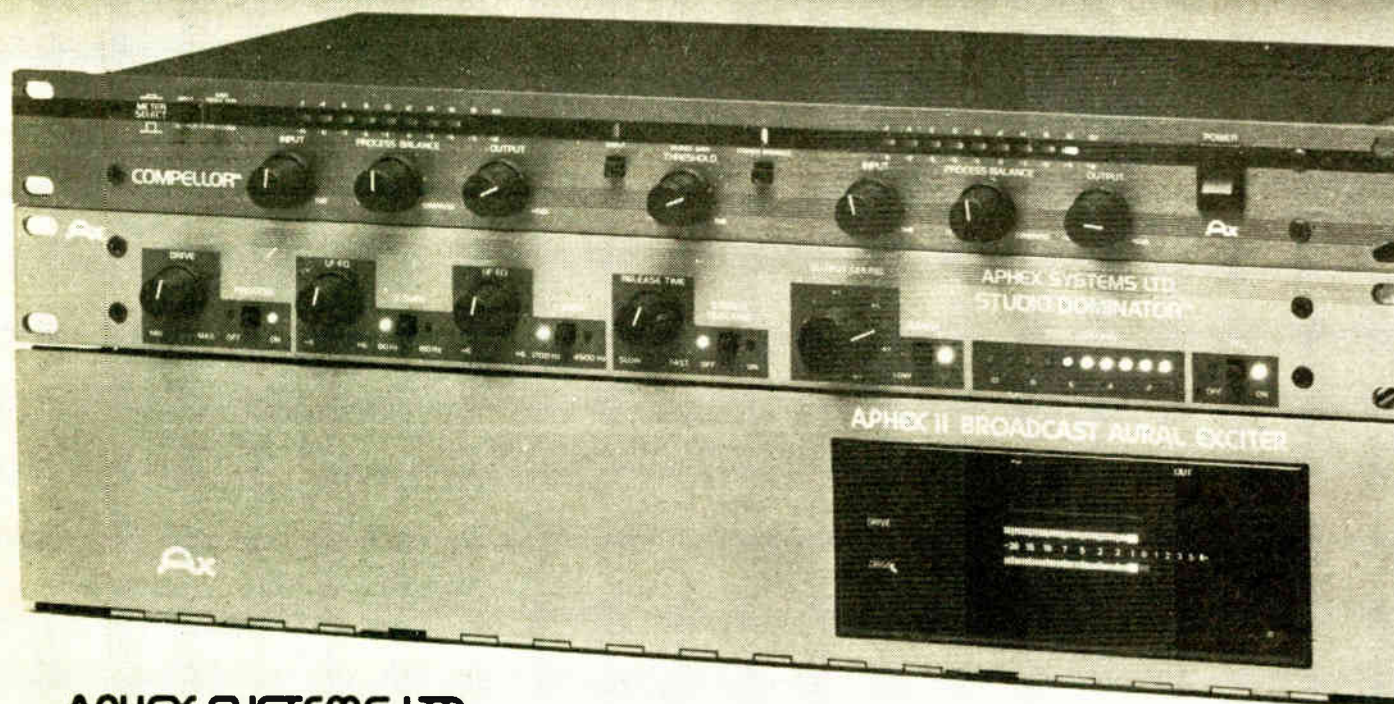
Thomas J. Koch, *The Audiophile-File*

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# Staying in RF Limits

(continued from previous page)  
of RF power on the operating frequency, which can be substituted for the regular transmitter signal.

The transmitter can be used, if its output is fully adjustable down to a few milliwatts. However, a signal generator is more practical in most cases.

It is not necessary for the RF source to be equipped with an accurate output meter, as the FIM-41 can be used to adjust power very accurately.

Signal sources manufactured by PI or Delta Electronics for use with an RF bridge are satisfactory.

The signal generator should provide a power level of 40 to 60 dB below the main transmitter (a maximum output of 50 mW to 5 W is quite satisfactory).

Output power and frequency should be stable, at least for periods of an hour or so.

Measurement of magnetic field in terms of A/m in either near field or far field with the FIM-41 is quite easy.

Simply make a measurement at each location per the manufacturer's instructions, and record the value shown on the meter scale as "Volts per Meter".

Be sure to convert lower scales from mV or  $\mu$ V to V as necessary. Now divide each value by 377 in order to obtain A/m.

## Near field readings

Use of the FIM-41 to measure the true value of the electric field is self-evident—simply follow the manufacturer's instructions.

But this method will not produce accurate results in the near-field of the antenna.

For better accuracy at close range, the FIM-41 may be used with a short "monopole" antenna connected to the external input jack.

This may be a solid or telescoping rod antenna approximately 50 cm (20") in length, attached to a type BNC (male) coaxial connector.

The exact length is not critical because it will be calibrated during the measurement procedure using the instrument's loop antenna and calibration oscillator as a standard.

It should be noted that the meter will give higher readings as its position above ground is increased.

A height of 6' (or two meters) will give satisfactory results for the purposes being discussed.

Also calibration will change (using the linear rod antenna) depending on the tripod or mount used to support the instrument.

A wooden tripod or ladder will require a different calibration compared to a metal tripod or a hand-held meter.

In any case the calibration procedure shown below will assure accurate data if the meter support structure and height remain unchanged during the measurement process.

## Getting set up

The FIM-41 should be checked for normal operation and accurate calibration prior to this or any other critical measurement plan.

It is also necessary to provide a tripod or other stable support to keep the instrument in a fixed position during the process.

Ideal height is 6' above the ground, and a wooden (or aluminum) step ladder is quite adequate.

Under windy conditions, rope or strapping tape can be used to secure the meter to the support. Final meter calibration should be done with the instrument in position on the tripod or support.

During the initial steps of the calibration process, the station should be in normal operation, with the transmitter power output adjusted to exactly licensed value.

The FIM-41 should be set up in a clear location where the meter reads between 0.5 and 10 V/m when calibrated in accordance with manufacturer's instructions and oriented for maximum reading on the mount.

Note the exact reading on the FIM-41 scale, in V/m and dB. Be careful not to disturb the meter position or calibration during the balance of the procedure.

Next, install the rod antenna on the meter's external input jack. The rod should be as nearly vertical as possible.

Switch the meter to "external input" and note the new, lower reading on the scale.

Typically, the reading will be 20 to 40 dB lower with the rod antenna.

## Conversion factor

Note the exact difference in dB from the previous reading with the meter's internal antenna. This is the "antenna conversion factor" to be used for the electric near-field measurements.

Now remove the rod antenna and switch the meter back to "internal input". The previous reading should be restored; if not, repeat the entire calibration procedure.

Next turn the transmitter off and disconnect it from the antenna system. Substitute the low-power signal source

previously described, and adjust to exact operating frequency.

Adjust power output to obtain a reading on the FIM-41 which is exactly 40, 50 or 60 dB lower than that observed from the transmitter.

If the signal generator has an output meter, note the reading so that constant output can be maintained during the balance of the measurements.

Also, if the signal source is not crystal controlled, a frequency counter should be used to make sure it does not drift in frequency during the measurements.

Calibration is now complete and you are ready to make measurements.

## Measurement method

Remove the FIM-41 from its location and set it up at the first location to be measured.

The same tripod or mount used for calibration must be used for all measurements.

Test locations can be marked in advance, and contours calculated, or the meter can be moved to locate actual 632 V/m and 1.58 A/m contours.

For purposes of illustration we will assume that the test signal is exactly 60 dB below the transmitter signal.

The 632 V/m contour will now read 632 mV/m, and the 1.58 A/m contour will now read 632 mV/m also.

This is because the FCC uses 400 ohms for free-space impedance, rather than 377 ohms.

When using the rod antenna for elec-

tric field measurements be sure to add the "antenna conversion factor" to the readings.

For example, if the factor is 20 dB, a meter reading of 63.2 mV/m on the rod antenna is actually 632 mV/m, which is equivalent to 632 V/m when the transmitter is in use instead of the signal generator.

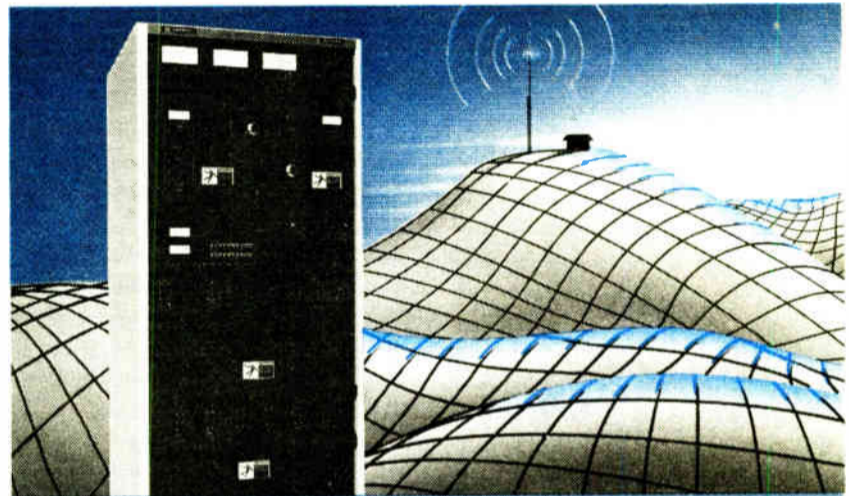
For magnetic field measurements, use the internal (loop) antenna only with no antenna conversion factor.

Using the previous example of a signal generator which is 60 dB lower in level than the transmitter, divide the FIM-41 readings in mV/m by 400 to find the magnetic field value in A/m for full transmitter power. (Note that a reading of 632 mV/m indicates a field of 1.58 A/m.)

This measurement procedure and the PI FIM-41 will help you to comply with OST Bulletin #65, but only if you become thoroughly familiar with the Bulletin's requirements.

*Lee Granlund was DE for Western Broadcast Service for 15 years and most recently senior engineer at TCI. He invites engineers with specific questions or problems concerning OST Bulletin #65 to contact him at 408-736-5503.*

*Radio World would be interested in hearing other station's experiences with the Bulletin. For a complete step-by-step procedure and additional information contact Dave Harry of Potomac Instruments: 301-589-2662.*



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### ALLIED

# Pros and Cons of PWM Filters

(continued from page 12)

Therefore, at a modulating frequency of 10 kHz, 200 samples are taken, and at a modulating frequency of 1 kHz, 2,000 samples are taken. As with the two competing systems, distortion is lower at lower modulating frequencies.

Perhaps the main advantage of this system of PWM is that no PWM filter is

needed to remove 70 kHz products.

As stated above, PWM filters cause transient distortions as a result of their inherent phase non-linearity.

PWM filters also must necessarily filter down into the upper audio-frequency range, and therefore at higher modulating frequencies such distortions are more apparent.

Perhaps the biggest problem with PWM filters is that they must be operated into a matched load to function properly.

If the load resistance goes low and no feedback is used, the transmitter is starved on modulation peaks. To remedy this condition, one must either reduce the modulation level or the power.

If the load resistance goes high, too much voltage is stored in the filter and this causes distortion.

Harris and Nautel solid-state transmitters generally work well into a VSWR of 1.2:1 or less. Continental's new transmitter works well into a much wider range of load impedances because no filter is used.

Solid-state transmitters have come a long way from the early days. High reliability has become possible with state-of-the-art rugged circuitry and sophisti-

cated protective circuits.

If properly operated and maintained, solid-state transmitters can provide a clearly superior on-air sound to the sound of their vacuum tube sisters.

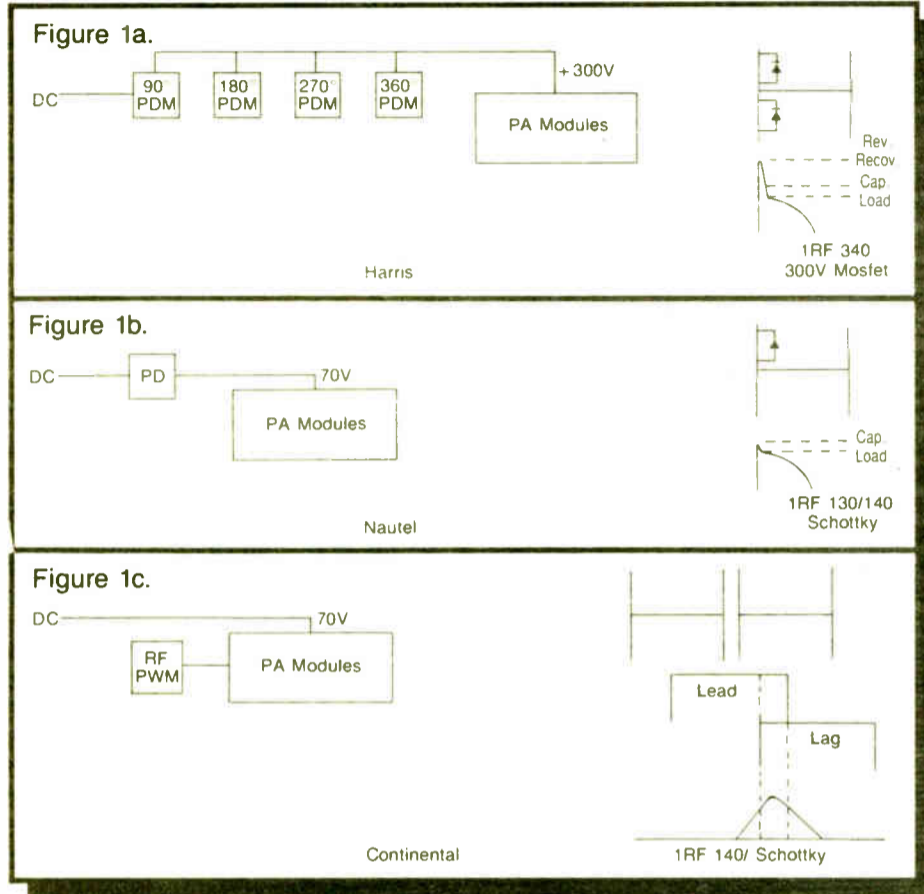
This is particularly important in this day when the emphasis on the AM band seems to be shifting toward high fidelity and stereo.

Stereo performance is considerably better with the new solid-state rigs, since they were designed with stereo performance and low IPM in mind.

Whether solid-state will ever completely replace vacuum tube output stages in broadcast transmitters remains to be seen.

But with the improvements in the field and on the drawing board, it seems that the 1990's may see many more cold and dark filaments.

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



## AM Bandwidth Concerns

(continued from page 22)

Figure 2 shows a typical transmitter load impedance sweep. One can easily see that the sideband powers would be unequal as would the relative field intensity as observed on an FIM or spectrum analyzer.

Most importantly, distortion would be heard and loudness lost on a conventional envelope detector such as used on the majority of AM radios today.

Later on we'll observe that this load is actually not that bad for the particular case in question.

and in the major lobe, or about 1.5 miles from your Non-D in the principal community of interest.

The MP should exhibit at least 20 dB of max-to-min signal ratio and be clear of obstructions, etc.

Measure and record the field intensity at the carrier frequency. Now measure and record the field intensity at +10 kHz and -10 kHz of carrier.

Be sure that the meter is held in the same position and recheck calibration for each measurement.

Repeat the above for each mode of operation (for each pattern).

In next month's discussion we'll see how to use this information to broadband your system. We'll also begin to examine matching networks and their properties.

*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.*

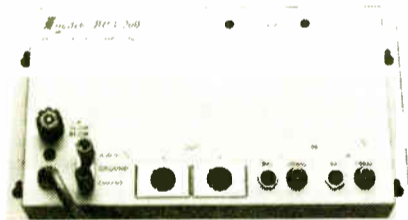
### The 10 kHz test

A popular method of determining if your station has adequate bandwidth is the 10 kHz test. Here's how it's done.

First modulate the transmitter with a 10 kHz sine wave at about 50% or better modulation.

Then choose a good monitor point which is about 15 times the spacing of the farthest elements in your DA system

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## CRL TECH TIPS

# NOISE PROBLEMS?

**you need dynafex noise reduction**

**PROBLEM:** Radio station is unable to broadcast remotes from some locations using a MARTI Remote Pickup Transmitter because of noise.

**SOLUTION:** More transmitter power or dynafex noise reduction.

Here are the results using a Marti RPT-30 and the CR-10 receiver and a dynafex DX-1 unit.

SIGNAL IN	S/N WITHOUT noise reduction	S/N WITH dynafex noise reduction
1.5 microvolts	- 30 db	- 48 db
10 microvolts	- 48 db	- 63 db
100 microvolts	- 53 db	- 72 db

**DATA:** Reference + 10 db at 1000Hz.  
Measurements conducted by Marti Electronics.



**CRL Systems - Less than \$700. 1-800-535-7648**

# Keeping Your Transmitter Clean

by George Riggins

Long Beach CA ... Ever thought of how many cracks, crannies and holes there are in a transmitter cabinet? Ever stopped to do a thorough cleaning job on the interior of the transmitter?

As the part time relief I never had to take soap and water to the insides of the old RCA 50G, but I know others who did.

The chief scheduled the task twice per year. We also had a full set of spare tubes and a second modulator.

The implied thought—"do not let the absence of parts keep the station off the air."

But that is only part of the story.

## Exhaust dirt

A couple of months ago, Ray Klotz, KZLA, was speaking of the time it took to keep the insides of the FM transmitter clean.

He started finding all of the places that the exhaust fan was pulling dirty air into the cabinet.

Ray, being like most of us, started figuring out a way to keep the dirt out and his hands dry.

Ray finally decided that he would try to pressurize the cabinet and let the air go out of the cracks and crevices and filter the air before it got to the insides.

He assembled a fan and plenum chamber, added a filter section that would take out particles down to about three microns and installed his creation.

(It takes a little more volume to pressurize the cabinet than to pull the air out because of the back pressure of the filter.)

The filter element costs about \$90 and the LA basin needs to be changed about every nine months unless we have a brush tire in the vicinity of the transmitter location.

The difference in cost of cleaning the transmitter two times per year at about 12 man hours of time per cleaning and wiping a little dust out is about eight hours per session.

This has paid itself back in less than a year. The added benefits are better

cooling of the final because more air goes through the fins than before and longer life for the final.

Been having problems with dust on the lens of the CD player? Why not try



positive pressure in the studio and get rid of the vacuum cleaner.

May take the door a second or two longer to close, but that is a small price to pay for fewer problems in the studio.

How about an outside mounted wet or

dry vac?

KABC reports that by closing off the return air vents from the studio and installing a vac in an unused closet next to the studio, they have cut problems caused by dust to almost nothing.

The dust was coming down through the cracks in the acoustic ceiling and then the cleaning service was just spreading the dust further.

## Noiseless effort

The room can now be cleaned while on the air. No noise because the vac is in the next room all the same as a central vac system.

The hose connection is interlocked with a relay to turn the vac on when the

hose is inserted into the wall.

Plugging the holes does more than keep out our long slender friends and the little furry things that like to keep warm in the winter. We can also keep some of the dirt out at the same time.

Yes, I was fortunate, as a part timer I did not have to get my hands wet or scratched by the sharp edges of the sheet metal on the inside of a transmitter cabinet.

Ever had someone on the phone ask "what is a multimeter?" There are some very good meter stories out there waiting to be told. Until next time ...

*George Riggins has experience in radio and electronics dating back to the 1930s. He is also a licensed ham operator and has had his own broadcast sales and service company, Riggins Electronic Sales, for over 20 years. He can be reached at 213-598-7007.*

## Comtech's 3.8 Meter has the Extra Performance Margin Needed for Crystal-Clear Audio Reception. Why Settle for Less?

Major network affiliates all over the country are specifying Comtech's 3.8 Meter Antenna. The reason is simple: No other antenna in its size category can deliver a gain of 42.9 db at 4 GHz.

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face tolerance unequalled by mesh or other home-type antennas. The result is higher efficiency, optimum side-lobe performance and increased gain. This is the extra margin of performance that only a Comtech Antenna can provide. That's why literally hundreds of Comtech 3.8 Meter Antennas are operating today at radio stations throughout the U.S.

So why settle for marginal performance when you can have a performance margin today and in tomorrow's 2° spacing environment.

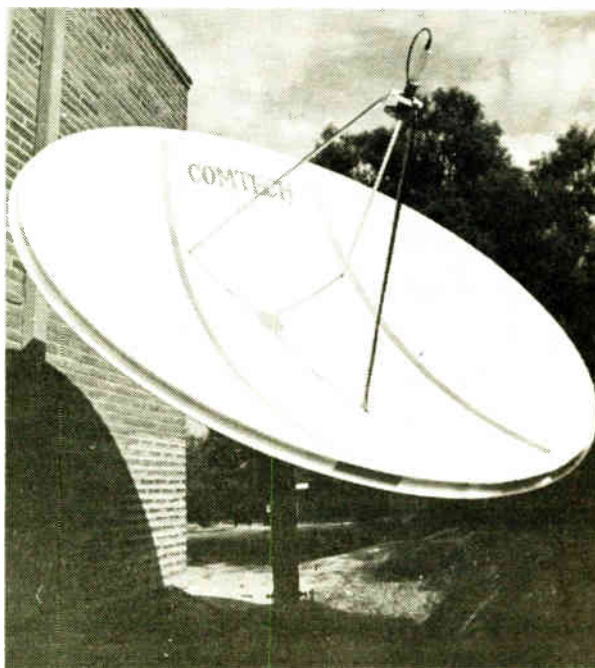
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Tucson, Arizona  
3.8 Meter Antenna Installation

## 57 Years Ago in RW

*Editor's note: The RW of today and the RW of old fortuitously share the same name. The RW of old was printed for a period of time in the 1920s and 1930's, when radio was first becoming popular.*

*The current version of RW that you hold in your hands has been around (in various forms and names) for over ten years.*

## Shakespeare Used Some Radio Lingo

Shakespeare, though he wrote three centuries before radio, said:

"Ah, stand by."—Anthony and Cleopatra

"Take up some other station."—Coriolanus

"His lecture will be done ere you have tuned."—Taming of the Shrew

"And my dial goes not true."—All's Well That Ends Well

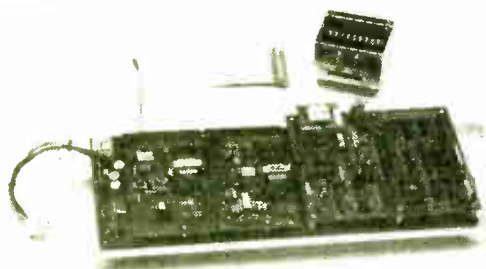
"'Tis no matter how it be in tune, so it makes noise enough."—As You Like It

"And those musicians that shall play to you hang in the air a thousand leagues from hence."—Henry IV.

Reprinted from Radio World, July 1931

# 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



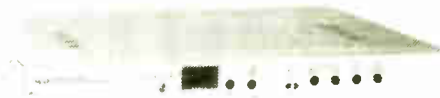
### Dial access control

Moseley's new MRC-1600 Dial Access/Voice Response (DAVR) option monitors and controls transmission facilities through any DTMF telephone.

The DAVR will notify up to 9 predetermined phone numbers of any change in status or telemetry data that triggers an alarm. A voice synthesizer reports the events.

Through the DTMF keypad, the user can monitor and control the standard 32 Command outputs, 16 Status and 16 Telemetry inputs.

For more information, contact **Dave Chancey** at 805-968-9621, or circle Reader Service 55.



### SCA generator and demodulator

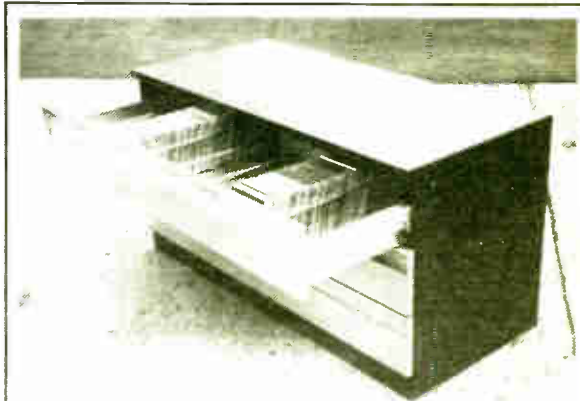
Marti Electronics has introduced the Model SCG-10 subcarrier generator and Model SCD-10 subcarrier demodulator.

Audio processing options allow selection of preemphasis of 0, 75, 150 or 225  $\mu$ s. Optional encode and decode boards can be plugged into the units for audio companding of the system.

The SCG-10 and SCD-10 have illuminated panel meters for use in initial setup and troubleshooting. Other features include automatic muting with adjustable level and delay on the generator.

Signal operated squelch relay with auxiliary contacts on the demodulator is also featured.

For more information, contact **M.E. McClanahan** at 817-645-9163, or circle Reader Service 51.



### Disc storage

Broadcast Disc Storage's "Security" bulk storage rack provides storage space for 960 Jewel-Boxed CDs in a 3-drawer cabinet constructed of heavy gauge steel.

Drawers have full suspension slides and store 320 Jewel Cases each. Each drawer may be locked independently.

For more information, contact your regional **Allied Broadcast Equipment** representative.



### Spatial enhancer

Orban Associates' new Model 222A stereo Spatial Enhancer is designed for use in AM and FM stereo broadcasting to add dimension and depth to a station's stereo image.

The device uses patent-pending technology to detect and enhance psychoacoustic directional cues present in all stereo program material, resulting in increased brightness, transient definition and clarity.

Because it operates only on attack transients, the 222A does not increase reverberation or sensitivity to vertical tracing distortion in disc playback. It is fully mono-compatible.

The Orban spatial enhancer has both stereo inputs and outputs and is ordinarily placed in the program line prior to the audio processing gear.

For more information, contact **Sid Goldstein** at 415-957-1067, or circle Reader Service 53.



### Audio phase corrector

Broadcast Devices, Inc.'s new RIGHTRACK APC-200 audio phase corrector allows the user to correct phase errors in almost any stereo tape source.

Azimuth errors are electronically corrected for maximum monaural frequency response performance. The unit can be interfaced with playback media such as reel-to-reel, cassette, videotape and PCM decks. It can also be interfaced with broadcast cart recorders.

Unlike other phase correction devices, the APC-200 is a manual, user-controlled device. It can double as an in-the-rack piece of test equipment. The RIGHTRACK phase corrector's internal oscillator and metering allow for careful adjustment and monitoring of the tape system's performance.

For more information contact **Bob Tarsio** at 914-737-5032, or circle Reader Service 57.



### Headphone DA

Stewart Electronics has introduced a four-channel headphone distribution amplifier, the HDA-4. Each of the four outputs will deliver up to 1 W of output power, regardless of the impedance of the headphones.

The HDA-4 is designed to be connected to the headphone output (cue) of a mixer. A master level control allows simultaneous control of all four outputs, and individual level controls allow independent control of each phone.

A 1/4" stereo signal thru connector on the rear panel allows multiple HDA-4s to be driven from a single signal source. A stereo/mono switch allows the HDA-4 to send monophonic signals to both channels of a headset.

The unit is housed in a 19" rack-mount chassis.

For more information, contact **James Ruse** at 916-635-3011, or circle Reader Service 52.

## Subscription/Reader Service Forms

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March 15, 1988 Issue Use until June 15, 1988

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| E. Network/group owner       | J. Other                        |

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| C. Engineering        | F. Other (specify) _____  |

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008	028	048	068	088
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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
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# BUYERS GUIDE

Microphones, Turntables &amp; CD Players

## KNIX Cues Up with Studer

by Mike Malo, CE  
KNIX-FM

**Phoenix AZ** ... Nearly three years ago we decided to put CDs on the air at KNIX. In order to take full advantage of the CD format, carting them was out of the question.

We bought two Studer A725 CD players because we felt that the machines were the easiest to operate. Also, at that time the Studer was the only machine that used four times oversampling.

### User Report

We quickly realized that the cue point, as dictated by the data information on the CD, was different for each selection. This was a problem. The jocks could no longer just insert a cart, push a button and expect immediate audio.

We developed a procedure to cue the selection using the frame advance keys. Only then were the segues tight and consistent.

Soon the "joywheel" idea was offered as a solution. You cue to the audio back and forth as you would a record. That still required an extra step for the DJ.

After that, another company introduced a machine that would cue to music. It worked well, but in our listening tests it did not sonically compare with the Studer.

Then we learned that Studer was redesigning its CD player. The company

queried broadcasters throughout the industry to find out what features would be most desirable.

The overwhelming response was "make it cue to music!" Other desired features were a parallel remote control, single function keys and full time autostop.

By this time we were airing 50% of our music on CD, so we were very anxious to get our hands on the new machine.

Finally our local Studer dealer called and said he had the new A727. "Bring it over!" I said.

The A727 flawlessly cued the CD to the track selected—every time. The start time is so fast that the audio begins before the switch bottoms! We ordered four machines immediately.

The design engineers at Studer added some great new features to the A727. One is full time or defeatable autostop, which causes the machine to pause at the end of the selection.

Another is an exclusive start review/end review mode that allows the user to push a button and hear the start as long as the button is held, or another

KNIX CE Mike Malo loads the A727 Compact Disc Player, Studer's second generation machine incorporating features suggested by broadcast engineers.



button to hear the last eight seconds of the track. The laser pick-up then returns to the cue point. The DJs love it.

Unlike the A725, the transport mechanism now stays within the machine, which eliminated the problem of ribbon cables flexing during the loading process and possibly becoming intermittent.

Also added to the A727 was a rear panel RS-422 interface; a clock input on

BNC jacks for user-supplied varispeed, plus a clock output so that machines can sync to each other; a 25-pin D-plug for parallel remote which includes tally for lamps; and balanced and unbalanced digital outputs on XLR and RCA jacks.

The audio output is available on balanced XLR connectors, fixed level. Also provided is unbalanced audio on *(continued on page 36)*

## Moving to Higher Quality Mics

by Marlene Petska Lane

**Falls Church VA** ... Microphone manufacturers are very happy with the radio marketplace these days. It seems that broadcasters have become interested in higher quality products and more

sophisticated techniques—and it's starting to show.

"Stations are putting more emphasis on quality microphones," says Ivan Schwartz, broadcast/production market-

### Industry Roundup

ing specialist for Electro-Voice. "We've seen it in sales and in our discussions with broadcasters over our prototypes," he adds.

Manufacturers say that more stations—especially classical music stations—are leading the way towards the use of "non-traditional" mics once used only in recording studios.

"Stations are beginning to realize that the old traditional choices are not compatible with the rest of the signal processing and broadcast chain," says Mike Solomon, national sales manager for Beyer. "And they're now much more prone to try new things," he says.

One of these new "things" is stereo miking. While a few stations have produced field work in stereo (using spaced pairs of mics), most have little or no experience in this area.

But interest in stereo field production appears to be growing, and manufacturers are responding by producing a new breed of microphones developed especially for this purpose.

"I've been getting more and more questions and more and more phone calls about stereo miking, especially in the last year," says Solomon.

Currently, there are two types of ste-

reo microphones. The M-S, or Mid-Side is essentially made up of a cardioid mic (for the mid signal) and a bidirectional mic (for the left and right, or side signal) normally crossed inside one case.

The two signals are typically combined through a mixing device designed specifically for the M-S concept. The result is then fed into a traditional tape recorder or mixing console.

The X-Y stereo configuration usually uses two cardioid mics angled out anywhere from 90° to about 130° at their *(continued on page 37)*

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Also articles from Shure on its new PDP1000 CD Player, Henry Engineering on the LogiConverter and Keith Monks Ltd. on the RCM Record Cleaning Machine.

## RAMSA WR-8428... a tool for the digital age.

Extensive market research with state of the art post-production facilities has resulted in a powerful new console for audio-for-video and broadcast applications, the RAMSA WR-8428. It has the capability for post-production/recording operations of today along with provision for tomorrow. Its modular construction allows a variety of configurations, including multitrack recorder applications. Input/output versatility can accommodate up to 28 stereo inputs and up to 6 fader controlled stereo outputs. Two twenty-four track recorders can be utilized during the mixdown process. Optional output matrix configurations facilitates four channel surround mixes, monitor functions, and mix-minus requirements. State of the art circuitry assures transparent sound, adequate dynamic range, and trouble free interfacing with associated equipment.

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## BUYERS GUIDE

## WJOY Jumps for the EV RE-20

by Dennis J. Snyder, CE  
WJOY/WQCR

Burlington VT ... It was 1979. I had been planning, and at last had received the funds, to build the "great" on-air studio for WJOY-AM. I could now pull the plug on the old studio and enter the 1980s.

Each day the staff would venture into the old studio area to view the progress. They grew more anxious as my

human-engineered design encompassed both the new and former studio equipment.

Then the big day came. I purposefully

## User Report

installed the old former microphone that served us with sufficiency for several years. I intentionally hid in my office the

"icing on the cake"—an Electro-Voice RE-20 mic.

The former station owner and general manager, who had started at WJOY as a sports announcer, was in the studio along with several members of our on-air staff.

An hour before we went on air, I removed the old mic and installed the new EV RE-20. Then I handed our former owner the headset, turned on the microphone module, and motioned him to-

ward the mic.

He spoke a few words and then said, "Wow, I just might go back on the air." For the first time in his lengthy broadcast career, he could really hear the sound of his voice.

The comments from the others who tried it were filled with approval.

### Packs a punch

The RE-20 was chosen because it has a very warm sound. It delivers the punch that announcers have come to expect. When used up close, the bass-boosting effect doesn't exist and excessive sibilance is contained.

It will hold its pick-up pattern characteristics (60°) of either side and out to 14° of its front (0°) axis. This serves us well when the mic is used by a less experienced announcer or a guest.

The construction of the head of the EV-20 allows for disassembly to clean any smoke or other pollutants out of the screen and filter.

The high attenuation from the back axis (180°) was ideal for our application. It rejected the reflections off the large window in front of the announcer's position.



Electro-Voice RE-20 Dynamic Cardioid Microphone

Because the RE-20 weighs 1 lb, 10 oz, it does require heavy duty springs for support.

I would recommend the use of the shock mount hanger, EV Model 309, for minimum ambient noise pickup in a production or FM studio.

### Keep it flat

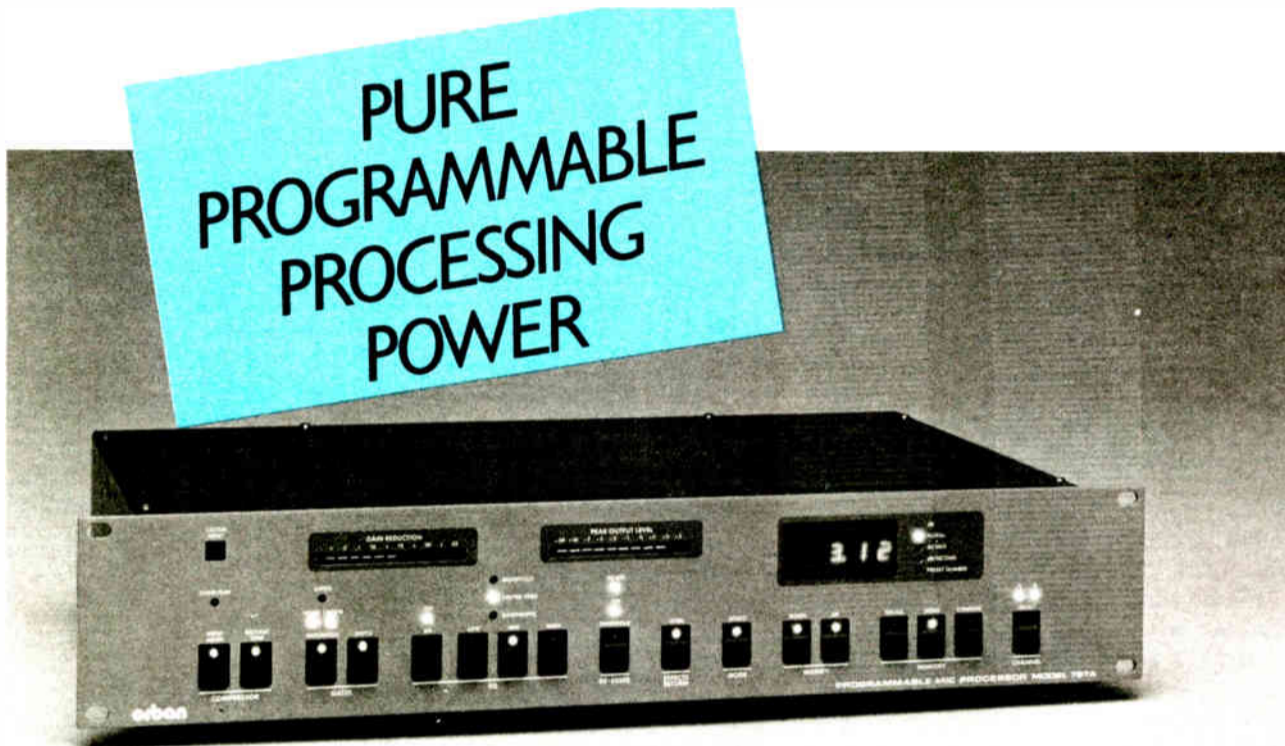
Being a true cardioid microphone, it does not require an internal or external power source. I would recommend, however, that the bass tilt feature that was incorporated into its design for long-reach applications be defeated.

If gremlins happen to come in the night and move the switch to the filter position, you may spend several hours in the processors, etc., looking for the missing bass response. A dab of silicone in the switch will make it stay in the flat response position.

We now have nine RE-20s placed throughout the station. Our needs were the same in the production studios, conference room and our WQCR-FM on-air studio. Quite frankly, the on-air staff is uncomfortable using anything else.

*Editor's note: Dennis Snyder also serves on the board of directors of the Vermont Association of Broadcasters, and is chairman of the Vermont State Emergency Communications Committee.*

For more information on the RE-20, contact Ivan Schwartz at Electro-Voice: 616-695-6831. The author may be reached at 802-658-1230.



### Introducing the new Orban Programmable Mic Processor

- 3-band parametric equalizer with "constant-Q" design and full notch filtering capability
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- De-esser controls excessive sibilance

#### And it's programmable.

- 32 memory registers store complete control setups for instantaneous recall
- Effects send and return (with programmable return gain) simplifies integration of external reverb or other processors
- Built-in connectors for remote control, MIDI, and future serial interfaces
- Optional second-channel slave for dual-mono or stereo operation (Model 787A/SL)
- Standard line-level input; optional Jensen transformer mic preamp with 48V phantom powering
- Security lockout code prevents unauthorized tampering with presets

Orban's powerful, new 787A Programmable Mic Processor provides an efficient way to optimize the sound of your DJ and newsroom mics and then recreate these setups every day for maximum punch on the air.

The 787A combines clean-sounding, Orban-quality analog processing with the control and programmability made possible by contemporary digital technology.

Complete settings can be stored in any of 32 different memory registers for instantaneous recall at the beginning of each airshift, or in a different studio at some later date. The 787A is also the perfect tool for processing commonly-used talent in video and film post-production work.

Call or write today to find out more about Orban's powerful new Programmable Mic Processor, an efficient and consistent way to optimize your mic channel and talent for maximum impact on the air.



### Orban Associates Inc.

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**BUYERS GUIDE**

# Neumann TLM-170: Wide Range, Quiet

by Tom H. Jones, Pres & GM KNXR

Rochester MN ... Quality-minded broadcasters have come to know the benefits of using condenser microphones at their on-air and commercial production announce positions. The transparency, cleanliness and smoothness of a condenser mic makes for an ever expanding group of diehard users.

The Neumann U-87 model has probably been the most popular and most often used condenser mic for announce purposes during the past 15 years.

Several years ago, however, the Neumann organization of West Berlin, Germany, introduced a completely new studio microphone which might eventually replace the venerable U-87.

## User Report

It is called the TLM-170. The "TLM" stands for "transformerless mic." It is Neumann's first microphone with no internal output transformer.

An active output stage replaces the usual impedance matching transformer. The entire design is new and the results are audible. We have had two of the TLM-170s in use at our station for several years now.

The TLM-170 uses a recently designed double-membrane condenser capsule which is somewhat smaller (1.1" diameter) than previous models.

This capsule was first used in the Neumann model U-89. The design is unique in that all of the exposed surfaces of the capsule, including the diaphragms, are at zero potential.

The new capsule also has quite a linear polar response up to 10 kHz. As a result, you'll notice very little coloration of sounds picked up off axis.

The TLM-170 provides five pickup patterns selectable by a small rotary switch on the back of the mic. Two other tiny switches are also located on the rear of the unit. One is for low frequency roll-off with the 3 dB point at 100 Hz. The other provides a 10 dB overload pad.

The mic may be powered by any phantom supply voltage between 20 V and 52 V.

The unit is less than half the size of a U-87 and looks curiously like a miniature version of the much-sought-after and now discontinued Neumann model M-49b of the 1950s and '60s.

One of the most impressive qualities of the TLM-170 is its low self-noise (14 dB-A).

When we began limited use of PCM digital recording at our station in 1984, we became aware of the importance of low self-noise in mics.

Some of our favorite mics, while sounding good, placed a veil of subtle, microphone-generated noise on the digital tapes. This does not happen when using the TLM-170.

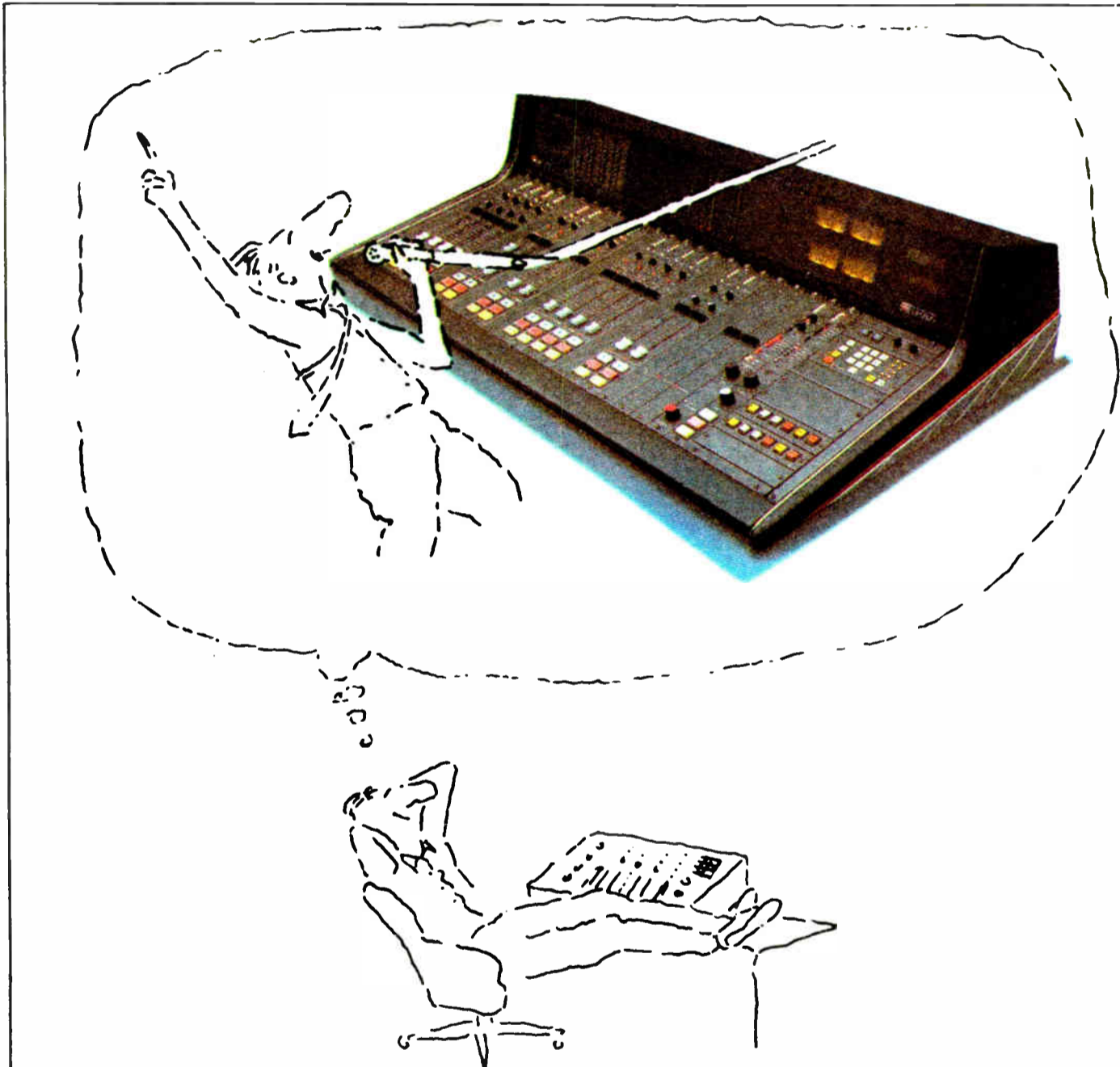
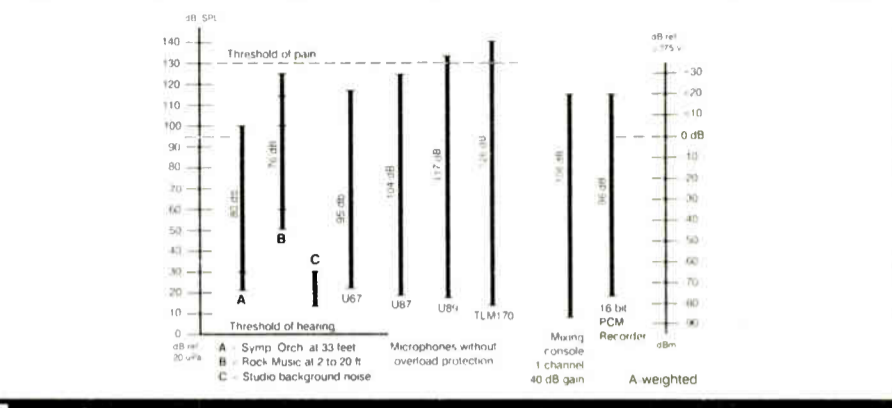
This mic also boasts a dynamic range of 126 dB relative to its A-weighted self-noise level. This means the TLM-170 will

accept sound sources up to 140 dB SPL without the use of an overload protection switch.

A very efficient voltage converter inside the microphone permits the impedance matching amplifier to produce an amazingly high output level without distorting.

(continued on page 34)

Figure 1. Dynamic range of several sound sources and studio devices.



# IMAGINE

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## BUYERS GUIDE

# Shure's New Pro CD Made for the Studio

by John Phelan, Mktg Mgr  
Shure Brothers

EVANSTON IL ... Shure Brothers' compact disc player, the PDP1000 (PDP for "Professional Disc Player") was designed with the on-air radio person in mind.

The features of the unit, as well as the layout of the controls, lend themselves to ease of use in the hectic environment of a live radio station. In addition, Shure has included the necessary interfaces for an automated station.

The PDP1000 is a two-unit-high rack mount device which can interface directly with audio consoles or automation systems. The transformerless balanced outputs are capable of achieving +20 dBm at full digital output, and are adjustable over a 20 dB range.

This allows the station to set the level to match the nominal operating level of other devices in the studio. A set of unbalanced outputs is also provided for monitor or cue systems. The unbalanced outputs are fixed at 2 V at maximum digital signal.

A 15-pin connector allows the PDP1000 to be interfaced to a variety of outside circuits for control or monitor of

the status of the machine.

The Pause or Play buttons and their tally lights are brought out to this connector so that the PDP1000 can be controlled from the board for fader starts and stops.

The tally light circuits are of the open collector type so that indicator lights on the board can follow the LEDs on the front of the PDP1000. Programming can

## Technology Update

be remotely accessed through a data input so that the PDP1000 can be programmed from an automation computer or wired remote control.

A contact closure is available for an End-of-Message indicator. This closure is selectable by a DIP switch and monitors the index number of the disc.

The closure can be set for anything from zero to nine. There can also be a second EOM circuit if needed.

The front panel serves not only as a rack mount but as an effective control panel. The large Play and Pause buttons allow for easy operation while on air.



Shure PDP1000 Professional CD Player

Programming is straightforward with a 16-button keypad that will also open and close the drawer mechanism. The Auto Cue and Auto Stop functions are selectable from the front panel, and once selected they will stay in that mode when the unit is powered up.

Auto Cue directs the machine to the selected track and then starts the search for the downbeat of the music. Upon detection of the downbeat, the PDP1000 goes into the Pause mode and holds at the beginning of the music until it is told to Play.

Auto Stop will keep the PDP1000 from playing through a disc from the selected track. When activated the PDP1000 will play only the track or tracks selected and stop. It will not play through to the end of the disc.

Tracks play in the order in which they are selected and can be set to either cue at the beginning of each track (Auto Cue) or to play selected tracks in succession.

The front panel display gives a constant readout of the track number being played, the elapsed time, the index num-

ber, whether the PDP1000 is in the Play or Pause mode, and whether or not a CD is actually in the machine.

Complete Scan and Skip functions, both forward and backward, are incorporated into the front panel controls.

In the digital domain, the PDP1000 features a 16-bit linear processor running at double oversamplings for precise audio reproduction.

It also has dual digital filters and dual D/A converters for a minimum of inter-channel phase shift and steady stereo imaging. Following the output of the converters, the PDP1000 has analog filters assuring the smoothest audio possible.

A three beam laser allows the PDP1000 to track badly scratched discs even those that a single beam laser rejects.

The PDP1000 has been designed from the ground up to be a broadcast compact disc player. It eliminates the need to transfer CDs to carts for on-air play.

*Editor's note: For more information on the PDP1000 contact the author at 312-866-2523, or visit in Las Vegas NAB booth 203.*

# On time. On budget. On air.



The Tascam 42B makes other 2-track recorders seem downright slow.

That's due in part to an ingeniously accurate tape handling system, and in part to Tascam's unique head technology. (Its heads provide sync response fully equal to repro, so you don't waste time rewinding to make audio decisions.)

And because the 42B probably offers more features per dollar than any equivalent machine, it makes everything else seem downright expensive, too. (+4 dBm balanced inputs and outputs, plus easy-access calibration are just a few of its standard features.)

For more information, call or write about the Tascam 42B today. It's a new and vastly improved way to keep meeting your deadlines.

And your budgets. **TASCAM**

## BUYERS GUIDE

# Beyer's M 500 Mics the Rock

by Kirk Harnack, Owner  
Kirk Harnack Engineering

Memphis TN ... When Rock 98 (KWLN-FM) in Memphis selected microphones for its new studios, we examined all the usual favorites for on-air use. Mics from the usual array of "on air" or "announcer" types were considered.

## User Report

We finally selected the Beyer Dynamic M 500, a microphone never used before by the air staff nor the engineers. However, a recent comparison in an RW article reported both air talent and engineers had given this mic high marks for naturalness and accuracy.

Additionally, we purchased four of the Beyer mics for what just one of another of the mics we compared would have cost.

Beyer developed this microphone for "pop vocalists and instrumentalists," giving special attention to quick transient response and a bright sound.

The polar pattern is hypercardioid and

the transducer is the ribbon type. Also featured are a four-stage integral blast filter and a rugged, all-metal case.

After whispering, talking, shouting (and occasionally burping) into these mics for a year, we've discovered their strong and weak points.

The notable weak point is that the "blast filter" isn't as effective as we'd like. Announcers still must use care when pronouncing "Ps" at close range. Otherwise a healthy "pop" will slam the VU meter into the red scale.

On the plus side, the Beyer M 500 is

very accurate and "natural." We detect scant coloration; the mic simply sounds strikingly "real."

Transient response is comparable to a condenser mic. Beyer achieves this quick response with a pickup ribbon less than 1" long and weighing only 0.00034 grams.

The transducer mass is therefore a fraction of that of the speech coil and diaphragm of a moving coil microphone.

I think the mic sounds best when close-talked with a soft voice. High frequency response is peaked from 5 kHz to 10 kHz by nearly 8 dB. By close-talking, the prox-

imity effect boosts bass response (100 Hz to 150 Hz) also by nearly 8 dB.

Beyer designed the mic for rough handling and "extreme" atmospheric conditions (rain, dust, halitosis, etc.). This is unusual for a ribbon mic and quite a welcome quality.

Other, more expensive microphones can claim a "warmer" sound, but the Beyer M 500 offers accuracy and a bright, airy feel at a more reasonable price.

*Editor's note: Kirk Harnack Engineering is a nationwide broadcast installation and troubleshooting firm.*

*For more information on the M500, contact Mike Solomon at Beyer: 516-935-8000. The author may be reached at 901-529-0098.*

# The TLM-170 Captures Clean Audio

(continued from page 31)

Figure 1 shows how the TLM-170's dynamic performance relates to a modern mixing console and to a PCM 16-bit digital recorder. Also notice the progress that has been made over the past 20 years when the TLM-170 is compared to several of its predecessors.

A digital recorder with an A/D converter of 22-bit resolution would be required to handle the full dynamic range potential of the TLM-170.

The frequency response of the unit is very smooth sounding without coloration. There is no hint of the condenser "sound" characteristic of earlier capacitor type mics.

There is not the slightest trace of "spit-tiness" when used by either male or female announcers. Its flat response lends itself well to the use of equalizer or aural exciter enhancement on a given announcer's voice without undesirable artifacts.

It is difficult to describe how a mic sounds. The low end of the TLM-170 sounds subtly different from some of Neumann's earlier models. A certain tightness and solidity characterizes its bottom end.

The Neumann TLM-170 is truly a state-of-the-art, digital-ready studio mic. Its

colorless sound, low noise and tremendous dynamic range make it ready to challenge any task.

While it's expensive, don't discount it as overkill for radio announce purposes. If the vocalists you are airing from LPs and CDs on your station are singing into TLM-170s, there is no reason your announcers should not sound as good and use one too!

*Editor's note: Tom Jones is founder and manager of KNXR. He has 29 years of experience in broadcasting and professional sound recording, and is a member of AES.*

*For more information on the Neumann TLM-170 contact Russell Hamm at Gotham Audio: 212-765-3410, or your regional Allied Broadcast Equipment representative.*

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**BUYERS GUIDE**

# TX-990 Offers Flat Response

by Steve Keating, CE  
KTWV-FM

Hollywood CA ... Radio program formats ranging from traditional to "new wave" are enjoying the benefits of digital audio technology in the form of CDs and, most recently, digital audio tape. Both offer reproduction performance characteristics that render acetate-vinyl discs virtually obsolete.

A significant exception are those recordings which, for whatever reasons, are not available in a digital format.

For these, a handful of manufacturers have produced devices capable of reproducing vinyl-disc recordings with the highest possible fidelity.

## User Report

One such "device" is the electronic amplification circuitry, which is required to raise the minute signal level generated by the cartridge up to a level sufficient to match normal line levels.

The circuitry must also adhere as closely as possible to a standard frequency-sensitive curve established many years back by the Record Industry Association of America (RIAA).

This RIAA curve deemphasizes the high frequencies which are preemphasized in the disc mastering process and is intended to reduce playback hiss.

The Pacific Recorders & Engineering TX-990 is one such "transcription preamplifier" designed specifically for high end professional applications.

The unit features very low levels of noise and distortion, flat frequency response (based on the RIAA curve) and high output level capability.

Internal DIP switches mounted on the PC motherboard allow for an unusual range of adjustment for circuit compatibility with all impedance and capacitance characteristics of magnetic phonograph cartridges.

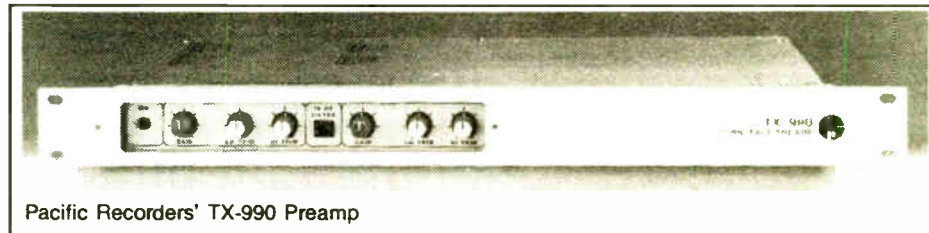
Equalization is accomplished in two feedback-controlled stages, and the critical input amplification stage uses a 990-type discrete operational amplifier which has an uncommonly low noise level.

The gain control is located after the first stage of equalization but prior to the second stage which allows acceptance of a wide range of input signal levels. Nominal is 5 mV at 1 kHz; maximum is 1 V rms at 1 kHz.

Behind a removable smoked plastic security cover on the front panel are output level controls as well as high and low

frequency trim controls for the left and right channels.

A sub-sonic cutoff switch rolls off (at 18 dB per octave) any material below 16 Hz in either channel, and a red LED indicates proper power-supply operation.



Pacific Recorders' TX-990 Preamp

Rear-apron connections include gold-plated, RCA-type phono connectors for inputs from a magnetic cartridge, another set of RCA-type connectors for unbalanced output applications, a 6-pin Molex female connector for balanced output interconnect and an IEC primary input power receptacle.

The unit is designed to operate from 120 VAC, 50 or 60 Hz power mains. An internal toroidal power transformer and bipolar regulated DC supply rails yield a minimal radiated hum field and stable, low noise supply potential.

Reproduced frequency response is within  $\pm 0.5$  dB from 20 Hz to 20 kHz. SNR is better than 72 dB referenced to a +8 dBu output level with a 1 kHz, 5 mV,

600 ohms source impedance sinewave.

Total harmonic distortion is less than 0.005% at any frequency between 20 Hz and 20 kHz. Intermodulation distortion is less than 0.01% using the SMPTE standard and the RIAA curve.

Rise time is 10  $\mu$ s and square wave response has no overshoot or ringing. Nominal output level is +8 dBu; maximum is +26 dBm into a 600 ohm load,

both channels.

Those who demand the highest possible performance from a preamp with maximum control over reproduced parameters, not to mention excellent reliability backed up by efficient customer service, should take a close look at the Pacific Recorders TX-990.

*Editor's note: Steve Keating has also been the station's operations manager for three years, and was a part of the pioneering efforts of KTWV's "Wave" format introduced a year ago.*

*For more information on the TX-990, contact Anders Madsen at PR&E: 619-438-3911. The author may be reached at 213-466-9283.*

Put the Tascam CD-501 next to any other broadcast compact disc player, and you'll find there's no comparison.

Nothing can compare to the purity, clarity, and accuracy of its sound, thanks to breakthroughs like Tascam's proprietary ZD Digital Circuit and double oversampling.

And in the split-second, high-speed, high-pressure world of the broadcast professional, it's the only machine you can depend on, 100% of the time.

Which figures, since the CD-501 is not an adapted consumer deck, but a highly-engineered system that's built for broadcast. Nothing else offers its combination of professional features, including 19" rack-mountability, balanced outputs, and a hard-wired remote that lets you completely control and program either of two decks in any mode.

Call or write for more information on the CD-501. Find out about a new, higher level of digital quality. And digital toughness.

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## BUYERS GUIDE

## PA-1 is WKSZ's Silent Partner

by Douglas W. Fearn, CE  
WKSZ-FM

**Media PA ...** In this day of compact discs and digital audio recorders, a phono preamplifier seems rather dull and old-fashioned.

With the low price of high quality audio integrated circuits, it would seem that anyone with an IC manufacturer's data book could design a good preamp.

But maybe it's not that simple. For one thing, phono cartridges are designed to work into a specific load and a specific capacitance. The load impedance and capacitance has to remain constant over the entire audio frequency range.

Also, the RIAA curve (equalization) must be accurate. The RC circuit used to obtain the equalization must not reflect back to the cartridge a load that changes with frequency. There must be sufficient headroom to accommodate peaks while maintaining an adequately low noise level.

#### Silent partner

The Radio Systems PA-1 Phono Preamplifier has been around for about five years, and we have been using five of them almost since they were introduced.

There have been no failures nor any maintenance required at all.

The PA-1 was among the first transformerless preamps available. I am not entirely convinced that transformers are all that bad but I cannot say we have had

any interfacing problems with our PA-1s.

We occasionally use click and pop filtering devices between the preamp and the console input, and some of these are consumer-type units with unbalanced inputs and outputs. With proper wiring of the patch panel jacks, we have not experienced any problems.

### User Report

The input loading on the PA-1 is 100 pF. With typical cabling between the cartridge and preamp, this results in the correct load on the cartridge.

For longer runs or different requirements, the PA-1 instruction book explains how to change capacitor values to obtain the correct loading.

The level control is past the input stage, eliminating the possibility of loading changes with level trimming.

#### RIAA equalization

The RIAA equalization occurs in the output stage of the preamp, effectively isolating the cartridge from changing loads. Doing it this way requires adequate headroom in the first stage.

Radio Systems says the PA-1 can take 300 mV at any frequency before overload, and I have never heard any evidence that the preamp was clipping.

Some phono preamps have adjustments to trim the equalization, usually

with the intention of improving the overall cartridge/preamp system response.

Radio Systems chose not to do this, instead making the PA-1 conform to the RIAA curve as closely as possible, including the sub-sonic filtering which is part of the NAB disc reproducing standards.

We do not have an RFI problem at WKSZ, so I have no personal experience with the PA-1's RF rejection capability. But reports from other stations indicate that the PA-1 may work where other preamps do not.

The RF filtering is achieved with hand-wound toroidal chokes and silver mica capacitors. Assuming you do not need the RF protection, you can easily remove these components if you wish to see if any sonic degradation results from the LC circuitry.

I tried this on one of our preamps a few years ago and thought it did improve the "transparency" of better records, but I could be fooling myself. The difference wasn't great enough to convince me to

modify the other preamps.

Testing phono preamps is not as simple as measuring, say, a tape recorder. Test records reveal much more about the cartridge than about the preamp.

Bench testing with an oscillator does not prove that the preamp will work properly with a cartridge.

However, crosstalk can be measured, and the PA-1 is excellent with over 80 dB of isolation between channels. It might be much more than 80 dB, but that's the best I could determine with the test equipment I had.

This means that the PA-1 could be used as two separate monaural preamps where stereo is not required.

It may be unglamorous, but the Radio Systems PA-1 works reliably and well. Records will be around for quite awhile longer and good equipment to reproduce them is still required.

*Editor's note: Doug Fearn is a frequent contributor to RW.*

*For more information on the PA-1 contact Dan Braverman at Radio Systems: 215-356-4700. The author may be reached at 215-565-8900.*

## A727 CD Cues to Music

(continued from page 29)

RCA jacks, fixed level and variable level using front panel controls. Unbalanced mono is also available.

Remote control can be configured two ways. You can use ground switching for all play functions, or you can use European-style "fader start."

When you apply 5 to 24 VDC (any polarity) to the fader start terminals, the machine will start the selection and disable front panel play functions. You can't even turn the machine off while in this mode. This definitely eliminates on-air mistakes.

The self-illuminating display shows all modes of operation. You can monitor elapsed/remaining time of the track or disc.

Options available are transformerless output amplifiers (which you specify upon order with no extra charge) and a lighted remote control panel.

The circuit boards are rock-solid. All ICs are socketed. The manual contains all schematics and component layout pictures.

Should a machine ever fail, back-up support from Studer and its dealers is readily available. Sub-assemblies can be quickly swapped out so you can keep the machines in service where they belong.

In addition, customers can retrofit their equipment with any future soft-

ware improvements Studer may make. This means that it is possible to keep older equipment in step with the latest technology.

When I was preparing for this article, I asked the guys here at KNIX for their opinions. Virtually every DJ said the A727s were "great," "easy to use," and "(give me) no problems at all."

I asked our production director what he liked most and least about the A727. He said, "everything and nothing." Our program director especially likes the "review" feature.

The machines have been in service at KNIX for six months in control and production studios. We now air 75% of our music through two A727 CD players, 24 hours a day. To date we haven't had a single problem.

Possibly the display could be a little brighter, and I'm sure some stations would like to have a vari-speed option, but we have had a hard time coming up with negatives about this machine.

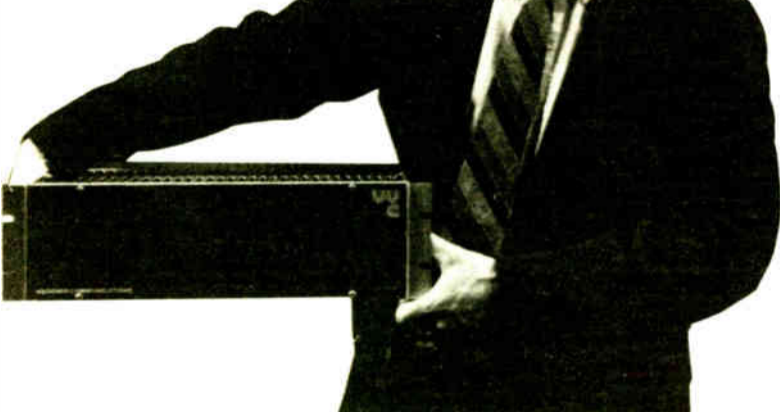
The Studer A727 is a true broadcast professional.

*Editor's note: Mike Malo began his broadcast career in San Francisco 10 years ago, and has built two California stations.*

*For more information about the A727 contact Charles Conte at Studer: 615-254-5651. The author may be reached at 602-966-6236.*

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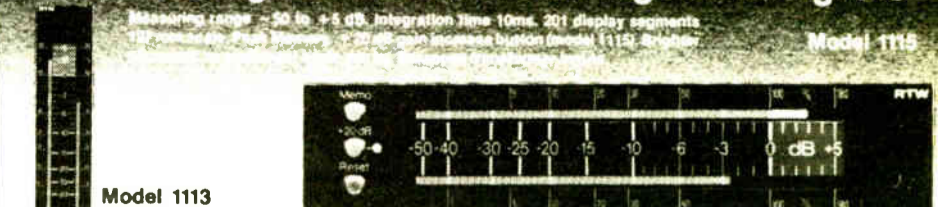
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**BUYERS GUIDE**

**High Quality Mics in Demand**

(continued from page 29)

crossing toward the sound source. Cardioid mics should be spaced at 131.5° angles; hypercardioids should be spaced at 110° angles for optimum stereo, according to NPR training coordinator Skip Pizzi.

There is a great deal of controversy as to which method provides the best quality stereo. Each has its advantages and disadvantages.

"With the M-S, you have the advantage of being able to broaden or narrow the stereo perspective with controls," says Greg Silsby, Audio-Technica's marketing manager for professional products.

"And because you can record its output in such a way that you're recording the mid and side signals instead of left and right stereo, you can go back in post production, rerecord it and change the perspective," he adds.

Pizzi believes the M-S method "highly outperforms" X-Y.

"Using X-Y, the center of the image is always 45° or more off-axis from either of the two mics, and there is a loss of presence from the center which is typically the most important part of the sound," says Pizzi. "And X-Y gives you a flat sound."

But the M-S method, Pizzi explains, has a mic to capture the center image,

and allows greater control of the width image.

Although the X-Y configuration allows for no such control or the luxury of added spatial enhancement in post production, it does offer simplicity in setup and a lower price tag.

"If you're just doing 'get it and get out of there' types of production, then it's much easier to work with because there aren't a lot of controls on it, if any, for people to play with out in the field," says John Phelan, marketing manager for professional products at Shure.

At the center of the M-S/X-Y controversy, however, is whether either approach is mono compatible.

"A key part of why no one has standardized on one or the other is because some people claim M-S is mono compatible and some claim X-Y is," says Schwartz. "Even the question of mono compatibility is hard to define," he adds.

Electro-Voice has not yet entered the stereo microphone marketplace, but is currently working on the development of a product that "better meets the needs of broadcast," according to Schwartz.

Audio-Technica and Beyer believe M-S mics are mono compatible.

"(The M-S mics) have that advantage because all the information that is arriving is arriving at the same time because the capsules are so close together,"

says Silsby.

Vito Colonna, production manager for classical station WNCN in New York, says he uses Beyer's M130 and 160 mics (designed to be used together for M-S recording) because of the mono compatibility provided by the system.

"A lot of our audience listens in mono. (These mics) assure us that we're in phase—we don't have to worry about mono compatibility," says Colonna.

Shure Brothers contends there is a mono compatibility problem in each method, although the problem is more exaggerated in the X-Y technique.

"The problem is more noticeable (in X-Y) because you're just blending the two signals together, so you're going to get some sort of phase cancellation whose frequency is going to be dependent on the physical spacing of the two cartridges in the mic," says Phelan.

Despite the perceived mono compatibility problem, Shure is developing both M-S and X-Y stereo mics, and says no standards need to be set.

"We're not here to tell people what to do; we're here to design and build products that let them do things the way they want to do them," says Phelan.

**Industry Tidbits**

New Directions ... Representatives from the Australian Southern Broadcast-

ing Systems Ltd. company, which makes a digital audio mass storage system for broadcasters (called DAMS) among other products, are currently touring stations in the US. It is installing a 500 minute stereo DAMS system at CHAM, according to its US representative Hugh Heinsohn (301-859-3028).

New Locations ... Construction on Gentner Electronics Corporation's new 20,000 square foot manufacturing facility has begun. The building will be located in West Valley City, UT.

People ... CRL's marketing director Ray Updike recently left the firm to start his own (non-broadcast related) business in upstate New York ... Thomas Mintner, former Studer/Revox vice president and general manager, and formerly in charge of Studer direct sales, has resigned.

On the "new hires" list is Thomas Ransom who is now Harris' radio district sales manager for the Pacific Northwest. Ransom was formerly IGM's director of marketing and sales ... CCA Electronics has hired Bernard Moskow as VP of Finance and Administration ...

Teac/Tascam is looking for a new advertising manager. If you're interested, contact Andrea Berry at 213-726-0303.

If you have industry/equipment news to report, send it to Radio World Buyers Guide, PO Box 1214, Falls Church VA 22041.

**Raise your standards.**



To understand the superiority of the Tascam ATR-60/2N, begin with the heads: no other 2-track production recorder has heads that can provide sync response fully equal to repro response—an advantage that allows you to save time by making critical audio decisions without rewinding.

Next, look at its direct-drive reel motors, its PLL servo capstan, and its 3-motor servo controlled tape handling system—all factors that lead to the ultimate in fast, accurate, and stress-free tape handling.

Finally, consider that the ATR-60/2N gives you all this and more, hour after hour, year after year.

Then call or write today about the Tascam ATR-60/2N. And take your broadcasting to a higher level.

**TASCAM**

## BUYERS GUIDE

# AT836 Mic Comes Out on Top

by Rod Rogers, CE  
KSKG-FM

Salina KS ... After upgrading our air chain three years ago the need for a change in studio microphones became obvious. In the search for replacements, I discovered the Audio-Technica AT836. Little did I know about the popularity it was soon to enjoy!

I considered the "standard" mics for this application, but was tired of the proverbial "Music/Voice" switches, broken plastic parts and having mics that, while excellent for other applications, were never intended for close-up work.

I also had the handicap of a small market budget.

Due to the standardization problems with mic specs, I decided to evaluate strictly by ear to see for myself what sounded good.

Our local distributor loaned me several armfuls of mics for evaluation, including some of the "standards." I went into the production room with my private stock of tape and compared mics for several hours.

In test after test, the Audio-Technica AT836 kept coming out on top. It had an open, natural sound and didn't get too muddy when worked close or off axis.

It sounded best from about 5' back, on axis, but it never sounded bad no mat-

ter how I worked it. I was a little reluctant to believe that this very economical mic was winning!

Then I realized that there were no "Puberty Switches" on it (M/V), no plastic to break, and it had good internal suspension for hand-held use.

### User Report

It wasn't a condenser model, so I avoided the powering hassles. And it had a price tag of around \$130!

The PD and several jocks agreed that it was the best sounding mic.

I sold both of our \$400 "standards" on

the used market, bought three AT836s, and netted a profit! Needless to say, the GM was also pleased with this new mic.

Being a contract engineer for several other stations, I had them compare the AT836 against their mics. I never got one back!

The AT836 is a simple, cardioid dynamic mic. Output is 250 ohms, balanced, and contains no transformer. It has a very rugged metal housing and the metal screen is not easily bashed in.

I think the secret of this mic is its slight low-end rolloff and very gentle proximity effect. It keeps low frequency noise under control, but has a clean, flat sound when used close up.

The drawbacks of the AT836 are

mainly psychological. If you like a large, fat mic, a nerf ball for a wind sock, or a lot of switches to play with, keep looking.

If, however, you want a very clean, natural sound at less than half the price, I seriously recommend the AT836.

There are better mics in the world, and you can spend a fortune if your budget allows. But for the majority of us, especially in smaller markets, good sound and good value are still big priorities.

*Editor's note: Rod Rogers also does contract work for stations, commercial sound systems and industrial manufacturing equipment. He confesses he is a "hopeless audiophile" who can't stand bad sound.*

*For more information on the AT836, contact Greg Silsby at Audio-Technica: 216-686-2600. The author may be reached at 913-825-4631.*

# LogiConverter Ends CE Woes

by Hank Landsberg, Pres  
Henry Engineering

Sierra Madre CA ... One problem often encountered when installing a cart machine, cassette deck or CD player is that the remote control circuitry of the machine is not compatible with that of the audio console.

Two of the most popular reel-to-reel decks use 24 V logic, which is incompat-

ible with TTL or CMOS; one machine requires 24 V sourcing rather than the more common ground switching.

### Technology Update

Very few cart machines will interface directly with TTL (5 V) or CMOS (12 V) logic, since most machines require a logic "Lo" to start, but the console provides a "Hi" when the channel is on.

Another common headache is figuring out a way to stop a cassette or reel-to-reel deck or CD player.

Henry Engineering's LogiConverter is a remote control interface unit that creates compatible, isolated control circuits between your console and all outboard studio equipment.

It has three basic functions: (a) it isolates the control circuitry, (b) it converts the control signals to those most appropriate for the device being controlled, and (c) it provides a "stop" output where none was available from the console.

Each of the four channels has an opto-isolated input and relay-isolated output. The input signal can be either a voltage or a circuit closure from a transistor or relay.

Since the input is the LED section of an opto-isolator, the input voltage is not critical. Any input from 5 V (TTL) to 12 V (CMOS) or higher can be used.

The input signal can be either momentary or maintained. LogiConverter's circuitry can generate a momentary or maintained output signal from either input. There are 24 combinations possible.

The four LogiConverter channels can operate independently for start-only use, or in pairs for start-stop applications. An internal eight-pole DIP switch can be set by the user to program the unit for the various operating modes.

For example, you can have a maintained input generate a start-pulse output. This would be used to start a cart machine from a logic "Hi." Or you could program the unit to generate a start pulse from a logic "Hi," then a stop pulse when the input went "Lo."

This would be applicable when interfacing a reel-to-reel deck that needed momentary closures for start and stop.

All of LogiConverter's outputs are via SPDT relays. Both the NO and NC poles are available, so equipment that requires an NC contact for the stop function can be accommodated.

The relays are rated up to 120 V/0.5 A, so even older equipment using relay logic can be controlled directly. LogiConverter is self-powered from 120 VAC; no external power supply is required.

The unit is small and lightweight, and can be "velcro-mounted" just about anywhere.

*Editor's note: For more information contact the author at 818-355-3656.*

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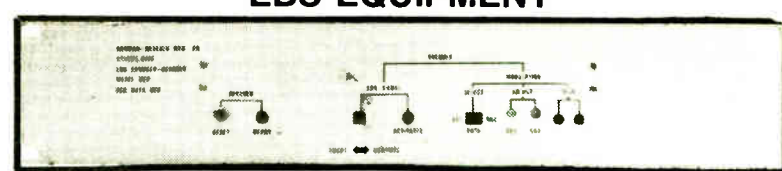
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**BUYERS GUIDE**

# Cleaning Up With Monks' RCM

by Jon Monks, Director  
Keith Monks Ltd.

Aldershot, Hampshire, England ... With other music reproducing media such as CD, cassette and now DAT starting to dominate the hearts (and wallets) of nearly everybody these days, you might think that the humble LP record has become a thing of the past.

And yet, to the vinyl detractors at least, a paradox has emerged. Even the biggest labels have limited production resources.

The message is clear: a lot of music is fast becoming irreplaceable. The need to maintain valuable record collections has switched from being merely desirable to imperative. Safe and thorough record cleaning has become more important.

The RCM (Record Cleaning Machine) is a scientifically correct way to ensure proper cleaning of records. In terms of the design concept-to-performance ratio, it remains unique.

Proprietary record care accessories have been available for almost as long as the record itself. However, these cleaning methods are no match for those sneaky bits and pieces which settle snugly into the depths of a record groove.

The pressure of a stylus travelling

along the groove inevitably embeds these particles into the surface of the record itself, causing irrevocable damage.

With most wet record cleaners the problems don't end there. Some alcohol-based liquids used in conjunction with

## Technology Update

a cloth or brush can dislodge a large proportion of dust deposits.

The problem is removing the liquid again afterwards; this is something the brush or cloth cannot completely accomplish. So the remaining fluid evaporates, the dirt simultaneously congeals together and suddenly mini-particles have become mega-boulders!

It's different with the RCM. First the liquid is applied.

On switch-on a gearboxed direct-drive turntable motor starts up, propelling the platter around at high speed (around 72 rpm in 110 VAC models) to minimize evaporation and speed up cleaning time.

Liquid application is made by depressing the plunger on the front panel, which is linked via tubing to the cleaning fluid container and to a brush assembly on the deck.

The brush block assembly holds a spe-

cial antistatic nylon brush which can be brought to rest on the record using a two-way universal pivot. Tiny holes in the brush block secrete the liquid onto the bristles and the brush then sets about distributing the fluid across the surface of the disc.

After 30 seconds this part of the process is complete, with the record side fully immersed and the dislodged dirt in suspension. The brush is then swung clear of the record.

Flipping another switch causes a powerful vacuum pump to leap into action. Tubing links the pump to the factory-balanced arm assembly via the waste fluid container, where the vacuum

is created and maintained.

Incorporated at the head of the arm is a miniature PTFE nozzle, from which a nylon guider thread passes out and back down the arm to the waste container.

This thread supports the nozzle above the record surface not only to protect the disc from scratches but also to maintain the correct gap between nozzle and record for optimum suction.

The arm is drawn over the revolving turntable and placed on the label at the center of the disc. A 1 rpm torque motor then steadily moves the "pick-up" arm outward across the record.

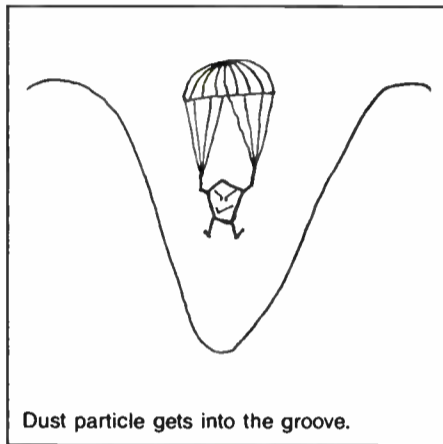
The vacuum action removes all traces of liquid and particles and deposits them in the waste jar.

Optional fittings accommodate any size of record, including seven inchers. The CR503 is recommended for low (one to two hours) daily usage for small stations.

Where record use varies greatly from day to day, stations choose the MK II Pro-RCM, or the MK III Twin Pro Deck for the extra busy station.

Deteriorating vinyl wonderlands with the high-tech grim reaper reaching up to snatch them away forever will become a thing of the past with the Keith Monks RCM.

*Editor's note: For more information contact your regional Allied Broadcast Equipment representative, or visit Keith and Jon Monks in Las Vegas at NAB Booth 557.*



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And when it comes to handling, the 122MKII is the complete professional tool, with cue and review functions (manual cue), balanced XLR +4dBm inputs and outputs, and rack-mountability.

Call or write for more information about the 122MKII. Get it now, and use it for decades.

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