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Radio World®

Buyers Guide Studio Audio Equipment See pages 29-39

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Round Two Filings Cautious

by Alan Carter

Washington DC ... Broadcasters have called on the FCC to take action to reduce AM interference but have asked the Commission to move cautiously in revising technical rules governing the band.

However, some comments filed on the second phase of the Commission's comprehensive review of AM assignment criteria, Docket 87-267, fall short of specific recommendations.

Broadcasters indicated they needed additional time to review two comprehensive listener studies the NAB included in its comments. Those filing promised more complete suggestions in reply comments due 17 August.

In its Notice of Inquiry, first issued last July, the FCC asked for comments on technical assignment principles, including protected contours, minimum usable field strength, atmospheric and man-made noise, and co-channel and adjacent channel protection ratios. Additional comments focus on antenna issues.

In the first round of comments, broadcasters urged the FCC to take a more aggressive role in controlling the AM airwaves. The NAB, among others, called on the Commission to put a freeze on granting new AM stations and major change applications for existing AMers.

NAB took the opportunity in this latest filing to complete its answer to a Commission suggestion that a 25% RSS (root-sum-squared) exclusion, rather than the current 50% exclusion, be used for calculating nighttime interference protection. NAB now agrees and urged a rule making based on findings of listener tests and other documentation.

Too much static

As in the first round of comments, the NAB again assailed the FCC, this time charging that the Commission's current technical standards "fail to depict with accuracy" the levels of interference actually experienced by AM listeners.

"Interference levels predicted by current FCC methods and protection ratios," the NAB argued, "simply do not reflect what listeners hear and in many cases, are forced to suffer."

The association also suggested that application of FCC standards to a particular AM station significantly overestimates that station's actual coverage.

The NAB "strongly" urged the Commission to establish AM interference standards and calculation methods that "more precisely characterize AM coverage and interference."

Highlights of the Summer CES—See *Earwaves*, page 4 and page 21.

To support its position, the association included findings of the two studies it commissioned: "AM Technical Assignment Criteria" by consultant Harrison Klein, and "AM Radio Interference Study" by the consulting firm of B. Angell and Associates.

The studies found deficiencies in many AM technical criteria, including inadequate protection contours, especially for adjacent channel stations.

Several broadcast groups including Greater Media and Group W concurred with the findings of the Klein and Angell studies. But others declined comment to questions raised by the FCC's notice until they had time to evaluate the studies.

Even the NAB backed away from explanation on some of its recommendations. The association said it would provide further details in reply comments.

Others like the Association of Federal Communications Consulting Engineers and the Association for Broadcast Engineering Standards also reserved comment on various issues.

Protected contours

On issues raised by the FCC, the NAB recommended that the Commission revise protection ratios, rather than revise protected contours. But as for specifics, the group declined comment until the reply comment period.

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USIA Bids Contested

by Charles Taylor

Washington DC ... A $56.6 million contract awarded by the United States Information Agency (USIA) for modernization of its Voice of America (VOA) has stalled following protests filed by a contractor whose bid was turned down on the project.

The contract, the largest ever made by USIA for a project, was awarded 31 May to a joint venture between Marconi Electronics Inc. and Cincinatti Electronics Corp., for equipment at a VOA station under construction in Morocco.

Two complaints were filed with the US General Accounting Office (GAO) last month by The Continental Electronics Division of Varian Associates Inc. in Dallas, which bid on the project along with Marconi/Cincinatti and two European companies.

The company claims, in part, that USIA improperly applied certain laws that give contract preference to American companies, and that USIA improperly evaluated Varian Continental's proposal, costing the company $2.3 million for its unsuccessful bid.

As a result of the protests, a stay has been ordered on the project, which already is months behind schedule because of a bidding process that endured for 17 months.

The contract will provide the Morocco station state-of-the-art 500 kW high-power shortwave transmitters, a high-power switch matrix, coaxial transmission lines, baluns, dummy loads and related equipment.

Continental's protests

In Varian Continental's first complaint, filed 9 June, it alleges that the USIA evaded a law requiring the organization to favor US companies in its modernization efforts.

Congressional records state that because of the "overriding national security aspects" of VOA's total $1.3 billion facilities modernization program, it is in the country's best interest to "provide a preference" for domestic contractors bidding on the projects.

"The agency and the Voice of America shall purchase American-manufactured materials to the fullest extent reasonably possible under the law in carrying out the facilities modernization program,

(continued on page 8)

World Radio History

REGULATORY NEWS

FCC Lifts Clear Channel Freeze

by Alan Carter

Washington DC ... The FCC has lifted a freeze on processing applications for AM stations on 14 foreign clear channels following its review of minority preference in the process without instituting special treatment.

The Commission in 1985 decided not to adopt eligibility criteria favoring minority and noncommercial station applicants for new channels to be created on the Canadian, Mexican and Bahamian AM clear channels. But a New York federal appellate court in 1986 overturned the decision on appeal by the National Black Media Coalition (NBMC) and its New York affiliate.

The court ordered the FCC in 1986 to issue a Further Notice of Proposed Rule Making concerning minority and noncommercial treatment. The freeze was placed on applications for new stations that would be affected.

... minority applicants would be able to take advantage of the Commission's minority preference policy if a comparative hearing is required.

No change

In a second report and order issued 8 June, on action taken 6 April, the Commission stated that comments on the second proposed rule making do not alter its conclusion that there are only limited opportunities to use foreign clear frequencies to establish new full-time stations.

"Since our studies show that the vast majority of opportunities for establishing new full-time stations already exist in areas with limited or no service, there is no compelling justification for the imposition of service based on criteria to encourage applicants to apply in these unserved areas," the FCC wrote.

The FCC said this position is supported by studies performed on a list of markets submitted by the Corporation for Public Broadcasting.

It noted there were "some exceptions," but continued that the fact does not warrant the imposition of non-technical acceptance criteria.

"If areas are characterized by few existing services where it may be practical to implement new AM service, there is no need to make special provision for proposals to provide service to such areas," the Commission argued. "Similarly, there is no reason to provide an alternative basis for filings if applicants already had qualified under the principal technical non-interference criteria."

Safeguards exist

The FCC emphasized that the action does not limit minorities and noncommercial broadcasters from applying for new stations in either the few urban areas capable of providing an available frequency or in the unserved and underserved areas.

There is no need to reserve frequency, in this situation, for minority or noncommercial voices, the Commission continued. "The available sites for these channels are in areas where there is sufficient vacant spectrum, in both the FM and television bands, to accommodate the needs of these interests," the FCC stated. "Because of the abundant availability of spectrum in most of these areas, minorities and noncommercial applicants are likely to face little competition."

The report and order also pointed out that minority applicants would be able to take advantage of the Commission's minority preference policy if a comparative hearing is required. "We believe that application of our minority comparative preference policy, as well as our other minority ownership policies, provides a strong incentive to minorities to apply for these frequencies," the Commission continued.

The appeal court ruling did not affect the section of the initial FCC decision granting nighttime operation to the daytime-only stations on foreign clear channels.

The second report and order is contained in Docket 84-281. For information, contact the international branch at the FCC, 202-254-3394.

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FCC Clips

EEO procedures

The NAB asked the FCC to clarify its new equal employment opportunity procedures concerning the collection of data on referral of job applicants.

NAB also asked the agency to suspend the use of the section of its new reporting form dealing with new employee recruitment for a period of one year.

In its filing, NAB said it doesn't oppose the collection of the information requested by the FCC, but does object "to the way in which the new requirement was introduced, the lack of clarity as to how the Commission expects the data to be collected and the type of data it expects to receive, and the lack of a phase-in period to permit licensees to come into compliance with the new requirement."

The procedure is contained in a 1988 EEO program report for license renewal applicants, which NAB said is not the same form that was proposed in its EEO rulemaking early in 1987.

Most significantly, NAB said, the agency's new form requires broadcasters to report referral data separately by race and sex. The association maintained this was not clear during the comment periods of the FCC's rule making.

For information from the NAB, contact the public affairs department at 202-429-5350.

FCC fines broadcaster for indecency

The FCC has taken a strong stand on the issue of obscenity in broadcasting by fining a Kansas City, MO, television station $2,000 for airing what the Commission viewed as indecent programming.

The FCC fined KZKC-TV $2,000 for its prime time airing of the movie "Private Lessons," which it ruled violated the restriction on the broadcast of indecent material.

Since April 1987, the Commission has enforced a stringent application of prohibition of obscene broadcasts and its limitation on indecent broadcasts, with rulings against three radio stations and one TV station.

For information from the FCC, contact the public affairs office at 202-632-5050.

Cuban broadcast list available

An updated list of Cuban broadcasting stations now is available by writing: International Transcription Services Inc., 2100 M Street, N.W., Suite 140, Washington, D.C. 20037; or calling Wilbur Thomas at 202-857-3800. There is a fee for the document.

Called the Cuban Standard Broadcast list, it shows, to the extent possible through off-the-air observations, the calculated location and operating power of each observed Cuban station.

For technical information, contact the FCC's George Dillon at 202-632-6345.

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World Radio History

ITU Meets On Expanded Band

by Charles Taylor

Rio de Janeiro Brazil ... The broadcasting industry edged closer to expanding the upper end of the AM band as allotment of an additional 100 kHz of spectrum was settled at the International Telecommunication Union conference held here in June.

Twenty-two Western Hemisphere countries met for the two-and-a-half week conference to derive a plan for use of the 10 new channels, from 1605 to 1705 kHz. Plans call for the proposal to take effect 1 July, 1990.

The move to expand the capability of AM stations is expected to provoke renewed interest in the AM band. Domestically, the FCC is considering alternatives to traditional licensing allocation to maximize such interest.

One plan under consideration is the FCC's proposal to issue nationwide licenses, where a single licensee could develop a channel nationwide.

That issue is contained in the Commission's Fourth Notice of Inquiry, in which specific rule making issues on the expanded AM band are disussed. Comments were due on the notice 11 July, with reply comments due 26 July. At press time, a request for an extension had been filed, but no ruling had been made.

The conference's primary accomplishment was the distribution of the 10 newly established channels. Under the plan developed, even-numbered channels—1620, 1640, 1660, 1680 and 1700 kHz—were alloted to the US within 330 kilometers of the borders with Canada and Mexico at 1 kW using a quarter-wave antenna. Beyond that distance, the US was alloted all 10 channels and can operate up to 10 kW.

"Essentially what came out of the conference is what we were hoping for and expecting," said Wilson LaFollette, a participant and deputy chief of the FCC's international branch.

Absence of politics

Adding to that success was the absence of politics at the conference, something that has marred past international gatherings. During the conference's first session in 1986, the Cuban delegation attacked the US because of its Radio Marti broadcasts to the country.

"All of the administrations worked very cooperatively, with all of the political issues being pushed back," LaFollette said. "It went very smoothly."

With allocations designated, American interests now will concentrate on the Fourth Notice of Inquiry to decide on the more specific details of the issue. Foremost in the notice is the national licensing issue.

The FCC, in the notice, stressed that the national broadcasting proposal "is not an either/or situation in which we are forced to choose between the traditional approach (of licensing) and a new one involving national licensing. Rather, consideration can be given to a combination of these approaches."

National licensees would be subject to the power limits adopted at the Rio conference—1 kW at the borders and 10 kW elsewhere—but within the bounds of these restrictions, licensees would be allowed to build and operate as few or as many AM operations as they wished. They could build a small number of high-powered stations, a large number of low-powered stations or a combination, at their discretion.

"The important fact is that the licensees, not the Commission, would determine what they found to be the optimum mix of number of operations and power level of those operations and interference between its own operations," the Commission said.

> ***"Essentially what came out of the conference is what we were hoping for and expecting"***

Economic incentive

"Licensees would have an economic incentive to choose that combination of operations that generated the largest advertising revenues or operations profits and hence would likely be the combination of operations that provided the most valuable set of services to consumers or listeners," it added.

The approach, while intended to encourage growth of the AM band, is far from concrete in the eyes of the FCC. The Commission encouraged comments and criticisms.

The NAB's Radio Board has already said it would oppose the plan because it signifies what it called "a departure from localism in broadcasting."

Meanwhile, the industry is crossing its fingers that the interest of broadcasters to operate within the new band and the interest of manufacturers of AM tuners will coincide. Current AM receivers broadcast only up to 1600, requiring new models to receive the expanded band.

For the broadcasters, "the Commission will have to make grants to get stations on the air," said Wally Johnson, a vice chairman of the Rio conference and president of Moffet Larson & Johnson, a Washington, DC, consulting firm. "I think a lot of existing stations will have to file and actually operate stations up there a while before they become economically viable.

If there are stations operating, however, people will buy the receivers, Johnson said. "I think there's going to be an incentive for manufacturers to actually build the receivers. It's kind of a chicken

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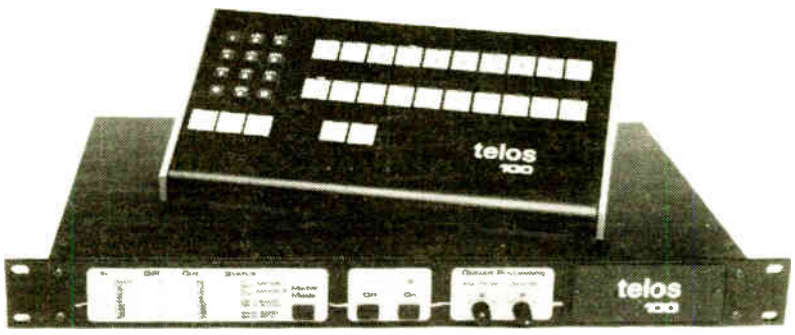

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World Radio History

Last Chance To Name That Noise

by Judith Gross

Falls Church VA ... Name that Noise ... Finally getting lots of entries for the **contest** to come up with a better name for **AM incidental modulation** in FM transmitters.

The coveted H-P calculator has arrived, and it's a beaut. It's sitting on my private shelf along with a coveted **RW** mug for the winner. Thanks to **Ted Schober** of Radiotechniques for the prize donation.

I promised you a **Blue Ribbon panel** to do the judging, and here it is: **Ogden Prestholdt**, consultant to A.D. Ring and duTreil, Lundin & Rackley, who first raised objection to the use of the word "multipath" to describe the noise we're talking about, has agreed to be a judge; also **Geoff Mendenhall** of Broadcast Electronics; **LLoyd Berg** of Gannett station WDAE in Tampa, FL and **John Kean** of the consulting firm Moffet, Larson & Johnson, who adds the footnote that he's a skeptic as to how much of a problem this AM noise thing actually is, but he's keeping an open mind for the contest.

Okay, so now, for **the last time**—get your entries in. Come up with a catchy title to describe the problem caused by AM incidental modulation. The deadline—the *final* deadline is **1 August**—and I can't take any more entries after that. Send them to me at the address below. The winner will be announced in the 1 September **RW**.

☆☆☆

I didn't get a chance to mention a few more **goodies** that were out at the **summer CES** in that toddlin' town ... folks were talking about the prospect of an **erasable CD** from Tandy. Other companies have been working on the same idea, including Thomson Audio-Video, who showed it in Paris.

"We come in peace to your planet ..."

Tandy's version, called **Thor-CD** (sounds like a name for one of Darth Vader's cohorts, doesn't it? Me, Thor, king of CDs ...) is being kept top secret but is supposed to be ready at the beginning of **1990**. Tandy is working on **recording hardware** which might sell around the $500 range, and could throw an interesting wrinkle into the DAT situation.

There was also lots of stuff for better **FM radio** reception. **Parsec of Delaware Ltd.** showed three boosted FM antennas: the FM Dish, the LS-4 and the Beam Booster. **Eclipse** introduced receivers with PLL detectors, which are supposed to **double FM receiving distance** and reduce distortion, drop-outs and picket-fencing.

And as you can see in the photo, no, that wasn't an invasion of Chicago by an alien planet. It was **Toshiba's 3-D video** system, with images that reach out and touch, as the phone company says.

Hmmmm ... 3-D TV? And we don't even have **AM stereo** settled yet!

☆☆☆

See where the **NAB Board** is raising the minimum radio **members dues** and restructuring the rate card for the other categories. They say that some categories of stations will actually be paying *less* in dues.

And they added that there won't be any more of those **trips to Hawaii** any time soon. Oh darn, and I was saving up for a surf board!

The Radio Board wants an AM person on NAB's staff to coordinate AM issues and such. Outgoing Board President Jerry Lyman says it won't be an **"AM Czar"**—but what a great idea! Any nominees for AM Czar?

There's also going to be an AM rally at Radio '88 in September.

NAB **Daytimer Committee** chairman Bud Walters also reports that less than 30% of those who are eligible for **nighttime authorization** are taking it. Many blame poor coverage on the reduced powers, but something has to be better than nothing, right?

Now the NAB wants to test a **low-profile antenna** for daytimers to help them reach their markets more effectively at night. They'll be doing it as part of their **antenna project**, you know, the one with the anti-skywave designs?

NAB has signed a lease for a site for the **Prestholdt antenna** but all but abandoned the **Biby antenna** in light of a lack of "industry support" in the wake of NEC modelling of Biby's design, which was critical about the predicted results.

An Ontario newspaper recently printed a "Man Bites Dog" type of story about Hamilton radio. The Bureau of Broadcast Measurement showed listeners aged seven and up bucking trends in the US and elsewhere and actually **switching from FM to AM**. Three Hamilton AMs gained more than 60,000 listeners per week while the FM listeners lost share.

But according to a **RADAR** report from fall of last year, **74%** of all listeners now **listen to FM**. Ten years ago the same report said 54% listened to FM and 46% listened to AM, so that's a lot of migration from AM to FM in the past ten years.

Draw your own conclusions ...

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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World Radio History

OPINION

Readers' Forum

If you have comments for *Radio World*, call us at 800-336-3045 or send a letter to Readers' Forum (Radio World, Box 1214, Falls Church VA 22041 or MCI Mailbox #302-7772). All letters received become the property of Radio World, to be used at our discretion and as space permits.

Systems nostalgia

Dear **RW:**

Amused nostalgia. That was my reaction to your 15 April special report titled "Stations Look to Systems Firms."

We practically invented that business. In the late '60s and early 70's we started building complete systems, cabinetry and consoles.

The styling approaches we started with were originated by Duke McLane in his company in California before he joined DYMA.

In the next decade we originated many new designs and expanded on the direction we had begun. A cruise through our drawing files would certainly justify our claims to parentage (or grandparentage) of today's sytems.

We also built the electronics, generally trying to follow the customers' desires regardless of how bizarre, and made some beautiful and beautifully performing equipment along with some amazing contraptions.

The untimely death of Wiley Miller, our chief cabinet maker (who was assisted by a crew of Taos Indians, believe it or not) marked the end of the cabinetry design and building phase of our company.

Even though we were a bit ahead of the market and had to go through a tremendous amount of effort in the design and approval phase, we look back on the cabinetry operations with some fondness.

I hope the new boys in the game get as much satisfaction from it as we did.

Carroll Cunningham, President
DYMA Engineering
Los Lunas, NM

Article was mistaken

Dear **RW:**

First, let me thank you for printing the article by Barry Mishkind on our AM4 stereo system. However, Barry was mistaken about our product changes. He indicated that we make incremental changes every few months. This is not the case.

The AM4 stereo system that he has was first shipped in 1983. No changes were made until 1987. These involved adding NRSC circuitry. Retrofits were made available for the earlier versions at very low cost.

Since CRL began over 10 years ago, we have had only three versions of our products. We have made minor changes from time to time, but these were sent free to our customers to upgrade earlier units. Barry happened to buy his system shortly before our new third generation systems were introduced at the NAB in 1987.

We have a full time customer service manager and we are very responsive to customer problems. We keep loaners available in case of failures.

Barry's complaint about a lack of information involved his not receiving a new brochure from the sales department to help him write his article. For this I apologize.

Bob L. Richards, Sales Manager
Circuit Research Labs
Tempe, AZ

Not all sales

Dear **RW:**

I would like to say something in response to Mr. Cummuta's *The Engineer as Salesperson* article in the 15 March issue.

I do not share his view of broadcast engineering. I agree that radio stations ultimately exist, like any other business, to make a profit, and that they do so through the sale of commercial time.

I further agree that engineers have an important role in making such sales come about. However, most of the rest of Mr. Cummuta's points are, in my opinion, defective.

When an advertiser buys radio time, he is really buying an audience. If his messages do not reach the ears of the public, he will obtain no benefit from advertising on the radio.

Therefore, I suggest that when an account executive visits a prospective client the product he is selling is an audience, not just sixty seconds of air time.

Without its listeners a radio station isn't likely to be worth very much. In fact, I would go so far as to say that it is the people with the radios around whom everything revolves, not the sales department.

Like wheat or corn crops, radio audiences do not spontaneously spring up out of nothing, but must be carefully cultivated. The farmers of the airwaves are the programming and engineering departments.

It is programming that attracts listeners, but it is engineering that assures that they can hear the programming. Engineering's essential role is the delivery of a station's air product to the public.

True "can-do" engineers do not waste time worrying about sales. They look for ways to increase the number of people listening.

For example, it may cost $5,000 to remount the antenna on the north leg of the tower rather than the west leg, but if it will get a city-grade signal to 800,000 more people, then it should be done!

It may be that something can be done to enhance the reliability of the transmitter and reduce downtime. Since people tend to tune to another station when a transmitter goes off the air, anything that reduces downtime is likely to make the audience larger.

What if, with $150 worth of parts, a station can be made just as loud as the competition but much less fatiguing to the listeners?

That's going to show up in the ratings as an increase in time spent listening (TSL). Isn't that worth something to a prospective advertiser?

Good engineers do a lot of radio listening. They may have ideas concerning programming or promotions that are worth listening to.

If a station is contemplating a remote broadcast or live concert broadcast, the CE is in the best position to know how it should be done. For these and other reasons, he should be just as much a part of a station's management team as the program director or sales manager.

Engineers are not supposed to interact with clients. That is not their job. I would suggest that is the job of an account executive.

When the remote broadcast incident Mr. Cummuta described took place, why was the engineer there? Did the announcer doing the broadcast have trouble getting the equipment to work?

Was the engineer perhaps called in at the last minute, as I was one Saturday morning, because somebody had forgotten to call the telephone company and order a line?

If I were a client, I suspect my decision to continue my relationship with a radio station would be based more on how many new customers the last remote broadcast brought through my door than on what somebody in a station T-shirt who obviously didn't know her from Adam might have said to my wife.

This brings me back to my original point: audience is the name of the game in radio. If there's nobody listening, nobody's going to buy.

"Nothing happens until somebody sells something?" Perhaps, but nobody sells anything until there is something to sell.

Robert Landry, ACE
WCRB-FM
Boston MA

Selling AM Short

The second round of filings on the FCC's review of AM technical assignment criteria have provided an anti-climatic ending to an earnest effort to revive the struggling AM service. The Commission originally extended the deadline on several issues to allow the industry to obtain important data through two comprehensive studies.

Unfortunately both the Harrison Klein review of technical issues and the B. Angell study of how much interference listeners tolerate were released awkwardly close to the deadline itself. Many of the comments filed on the second round reflect this; they decline to address the key areas of concern covered in the studies.

Instead broadcasters, consultants and even the NAB stopped short of specific proposals on ways to improve AM's technical plight, stating only that such issues would be addressed in reply comments or comments on specific rule makings proposed by the Commission.

This would be excusable if the issues included in this phase of the docket were minor. But the extension was granted precisely because the areas covered in this phase—minimum usable field strength and co- and adjacent channel protection ratios among them—are in dire need of reevaluation.

The Klein and Angell studies obtained critical information and were long overdue. Together they provide a clear picture of AM's technical status in several crucial areas, and as such they should not have been given such short shrift.

Since it was obvious from the comments filed that there was not enough time to review the studies before the deadline an extension should have been requested. Now that it's too late, the industry is left wondering where the initiative to solve AM's technical problems will originate.

Broadcasters, by their failure in this second round to state strongly and clearly the exact measures required to help AM have now left it up to the Commission to decide how to proceed.

Since the FCC's recent history is one of reacting rather than taking the initiative on the industry's concerns, broadcasters may well have passed up their "golden opportunity" to effect some real and much needed changes.

In so doing they have left AM without strong leadership and without the specific remedies that seemed so promising when the technical review was first begun.

—RW

Radio World

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World Radio History

AM Jamming Linked to TV Marti

by Alan Carter

Washington DC ... The Cuban government blasted US airwaves on 1040 and 1160 with the Caribbean Music Festival on 16-20 June, a move NAB alleged was brought on by Senate action on a television version of Radio Marti.

That interpretation, however, has been disputed by the FCC.

The Cuban broadcast started on the evening of 16 June, the same day the Senate Appropriations Committee approved $7.5 million for TV Marti. The broadcast stopped 3:15 a.m., 20 June.

While the NAB called the Cuban action retaliatory, the Commission disagreed.

"They (the Cubans) did it last year (during the festival), so we don't make the connection," said Rosemary Kimball of the FCC's Office of Congressional and Public Affairs. "The Cubans, on the radio, have not mentioned or made any political statements at all."

An NAB spokesperson was not surprised at the FCC response.

"The coincidences are that it started Thursday night, and that afternoon is when TV Marti was voted on," said NAB Media Relations VP Sue Kraus. NAB is convinced that was the Cubans' motive. "The coincidences are too strong to deny that."

At the FCC, Kimball said she did not expect the FCC to file a complaint with the US State Department about the Cuban action. However, an FCC engineer noted that the Commission generally takes such action involving Cuban interference.

The FCC only received an official complaint from WYFX-AM in Boynton Beach, FL, which is at 1040.

WYFX President Gary Lewis said the Cuban broadcast was estimated between 250,000-500,000 W but he said the station, at 1040, could not be sure because the blast penned the field strength meter.

At WHBO-AM in the Tampa, FL, suburb of Pinellas Park, the weekend Cuban interference killed the nighttime broadcast on the 1040 station.

The NAB is convinced (protesting TV Marti) was the Cubans' motive.

But President and GM Jon Pinch said the Cuban interference is nothing new, except this time it occurred when the station dropped to its nighttime operation.

For approximately a year, Pinch said, the Cubans have broadcast from 4-6 PM, but WHBO is able to overcome any interference because of its daytime operation.

KSL-AM, a 50 kW station in Salt Lake City did not have any problems in its immediate coverage area, but "further out" Cuban interference can mix with its broadcast about 50% of the time, according to GM Russell Wood.

Wood, who is on the Utah Association of Broadcasters board of directors, said the group is supporting NAB's opposition to TV Marti.

The NAB had warned Senate leaders that it expected such action by the Cubans if Congress took action on TV Marti.

"Indeed, this is likely to provoke the Cubans to retaliate with interference to US radio operations, as they did following commencement of Radio Marti," NAB President and CEO Eddie Fritts wrote in a letter to Sen. Ernest Hollings (D-SC), chairman of the appropriation subcommittee.

Fritts also raised questions about the effectiveness of TV Marti and the interference it could cause for US TV stations in Florida.

TV Marti facilities are planned to operate from the Florida Keys, using a tethered aerostat or blimp at an altitute of 10,000 to 14,000 feet. It would use a directionalized transmission antenna to broadcast VHF signals designed to reach Havana.

"Based on the limited information made available to us, the proposed TV Marti effort would be extremely vulnerable to even modest Cuban 'jamming' activites," Fritts wrote in another letter to Appropriation Committee chairman Sen. John Stennis (D-MS).

"If Cuba were to operate as few as two or three inexpensive, low power television transmitters tuned to the TV Marti frequency, the TV Marti signal would be rendered unviewable to Cuba."

For further information from NAB, contact the office of public affairs and communications, 202-429-5350.

NAB To Test New Antenna

Washington DC ... The NAB is planning to test a low-profile AM antenna designed to benefit daytimers as part of its antenna project.

Plans for conducting experiments of the new design were included in the NAB's second phase filing on the FCC's review of AM assignment criteria, Docket 87-267.

The idea for the new low-profile design is being supported by the NAB's Daytimer's Committee according to VP of Science & Technology Michael Rau.

The design is for a shorter AM antenna that would allow daytimers to make more effective use of low post-sunset and/or fulltime power authorizations, as summarized in the NAB's comments.

Also included in the filing were a summary of the NAB's plans to test the anti-skywave antenna designed by consultant Ogden Prestholdt. The NAB has filed for experimental authorization and signed a lease on the Beltsville, MD property where the antenna will be constructed.

Absent from the NAB's comments was the anti-skywave antenna designed by consultant Richard Biby. Rau explained that there is not as much support for the Biby antenna from NAB members, but said it is still being considered for testing on the Beltsville site once the tests on the Prestholdt antenna have been completed.

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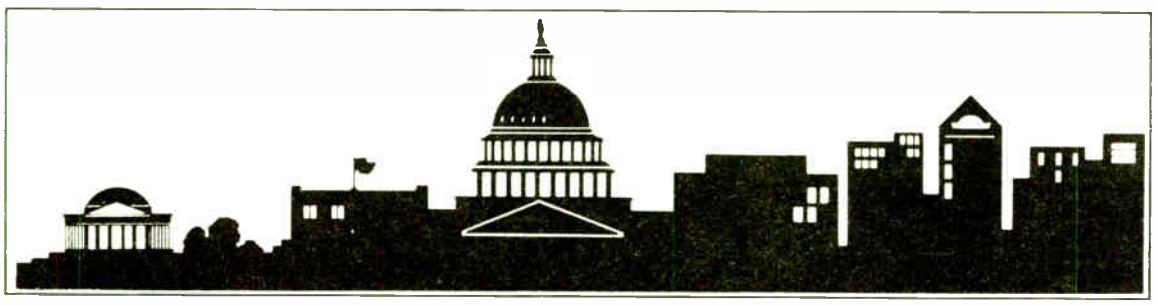

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12:00 noon - 6:00 pm
Directional Antenna Seminar

■ WEDNESDAY, SEPTEMBER 14
8:00 am - 6:30 pm
Directional Antenna Seminar

■ THURSDAY, SEPTEMBER 15
8:30 am - 4:00 pm
Digital Radio Station Seminar
5:00 - 6:15 pm
Interference: Its Causes and Cures

■ FRIDAY, SEPTEMBER 16
8:00 am - 1:00 pm
RF Radiation Regulation Compliance Seminar
2:45 - 4:00 pm
FM Improvement

■ SATURDAY, SEPTEMBER 17
9:45 - 11:00 am
AM Technical Improvement, Part I
11:15 am - 12:30 pm
AM Technical Improvement, Part II
12:45 - 2:00 pm
FM Directional Antennas
2:15 - 3:30 pm
PCs for Engineering Applications
2:15 - 3:30 pm
EBS: What's Old, What's New, What's Changing
3:45 - 5:00 pm
FCC Engineers Forum

Schedule Subject to Change

World Radio History

New Protest at USIA

(continued from page 1)
through fiscal year 1988, the Congressional Record says.

As it applies to contract bids, the law states that preference should be shown to American bidders, in essence, by increasing the offers of non-domestic companies by 10 percent. In the case of a joint venture, an American entity must own at least 51 percent of the joint venture's assets to avoid the 10 percent hike.

Varian Continental maintained that the joint venture between Marconi and Cincinatti does not qualify as an American entity under such laws, and charged that USIA should have viewed Varian Continental's offer at 10 percent less than Marconi's.

The USIA says it did not apply the laws to the joint venture because it viewed the companies awarded the contract as US-based. In a news release, the organization claimed that the contract was awarded to "an American joint venture," listing the base of Marconi Electronics in Herndon, VA, and the base of Cincinatti Electronics in Cincinatti.

While the two companies do have American headquarters in those cities, they are, in fact, both based in England. Marconi Electronics and Cincinatti Electronics are affiliates of Marconi Communications Systems Ltd. in Great Britain.

"Obviously, the agency was aware of the requirement of the law," said Philip Rogers, USIA's director of the office of contracts. "Marconi was also aware of the requirement, and they presented a proposal which is a joint venture of two American subsidiaries of Marconi of Great Britain.

"The agency's position is that that complies with the law. It is being protested, so obviously we will now have a third party forum look at it and either confirm or deny our position," Rogers said. "I think what (Varian Continental) is trying to suggest is that ownership of the American companies has to be by American citizens. I don't believe the law says that."

Officials at both Marconi and Continental declined to comment on the issue.

Incorrect evaluation?

Varian Continental also charged in its first protest that USIA used incorrect data when reviewing the company's offer, resulting in "an improper and inaccurate evaluation of (Varian Continental's) cost and technical proposals."

The accusation stems from an earlier USIA test project in which the agency purchased and installed transmitters from four firms, including Varian Continental, at the agency's Greenville, NC, facility. A primary purpose for the procurement was to evaluate prototype transmitters before determining specifications for bidders.

In March 1988, USIA sent a letter to Varian Continental, stating that the company's transmitter was performing at less than a satisfactory level. Varian Continental followed with evidence that USIA used a flawed analytic method in evaluating the Greenville data.

"Varian Continental repeatedly requested a meeting to discuss the (USIA's) conclusions . . . so that the USIA would not misuse the data for any other purpose," said Varian Continental's protest filing. "The USIA, however, refused to schedule that meeting until the USIA had completed its evaluation of proposals" for the VOA station project.

On 5 May, the parties met and as a result, USIA acknowledged that the correct performance characteristics of Varian Continental's Greenville transmitters were satisfactory, said the company's filing.

Varian Continental believes that the USIA evaluation team utilized its original, inaccurate conclusions "to downgrade Varian Continental's technical proposal and to adjust its evaluated price upward due to the erroneous data on operating and maintenance costs for the Greenville transmitter," the company said.

On 17 June, Varian Continental filed a second protest following a 10 June meeting that the company had with USIA officials. In it, the agency explained that the company's second offer had been determined ineligible for the project award because of inconsistencies in its proposed schedule for the work.

"The agency's determination was incorrect, arbitrary and capricious, and in contravention of applicable laws and regulations," stated Varian Continental in its complaint.

Also, the company said that it doesn't believe Marconi/Cincinatti has the capability to perform the work outlined in the Request for Proposals.

"Cincinatti Electronics has never manufactured equipment of this size and complexity. Marconi Electronics Inc. is a sales office with no design, test or manufacturing capability. Marconi Communications Systems Ltd. apparently is not the offeror.

"Thus, neither the individual members of the joint venture nor the joint venture as a whole has the technical knowledge and manufacturing expertise to perform the contract," Continental Varian said. "Therefore, the joint venture cannot be considered 'responsible' under the (Request for Proposals), and the agency's determination to the contrary was unreasonable and lacked a rational basis."

Marconi was not willing to comment.

Working it all out

As a result of the issues raised in its protests, Varian Continental is requesting conferences, first, to discuss the matters of complaint, and then "to decide that the agency improperly disqualified Varian Continental's proposal, and to recommend that the agency cancel the current contract and award the contract to Varian Continental."

The GAO will conduct informal conferences with Varian Continental and USIA to discuss the conflicts, and then will make a decision on the protest. That judgment is expected by late October, said Bruce Goddard, a GAO senior attorney.

The protest by Varian Continental represents yet another delay for a project already bogged by a history of delays. The original Request for Proposals was issued by USIA 29 December 1986 to provide equipment for four VOA stations, in Morocco, Thailand, Sri Lanka and Botswana.

Five companies responded with proposals, which USIA reviewed. During the summer of 1987, the organization negotiated with the companies, then asked for a best and final offer from each, which it received in August.

"Those were reviewed and we found some unresolved issues that appeared to affect the way we would have priced the proposals," said USIA's Rogers. 'There weren't any offers that were completely acceptable on their face at that point."

USIA then conducted a second round of discussions and prepared to request second best and final offers from four companies still interested in bidding. It was at this point the process got bogged down.

"The agency got drawn into the Congressional-White House discussions over budget cuts," Rogers said, "which was then followed by the stock market crash, where it became very unlikely that there would be sufficient funds to go ahead with four new radio stations."

USIA waited out Office of Management and Budget and Congressional discussions about budget expectations for

(continued on page 18)

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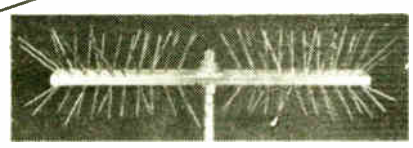

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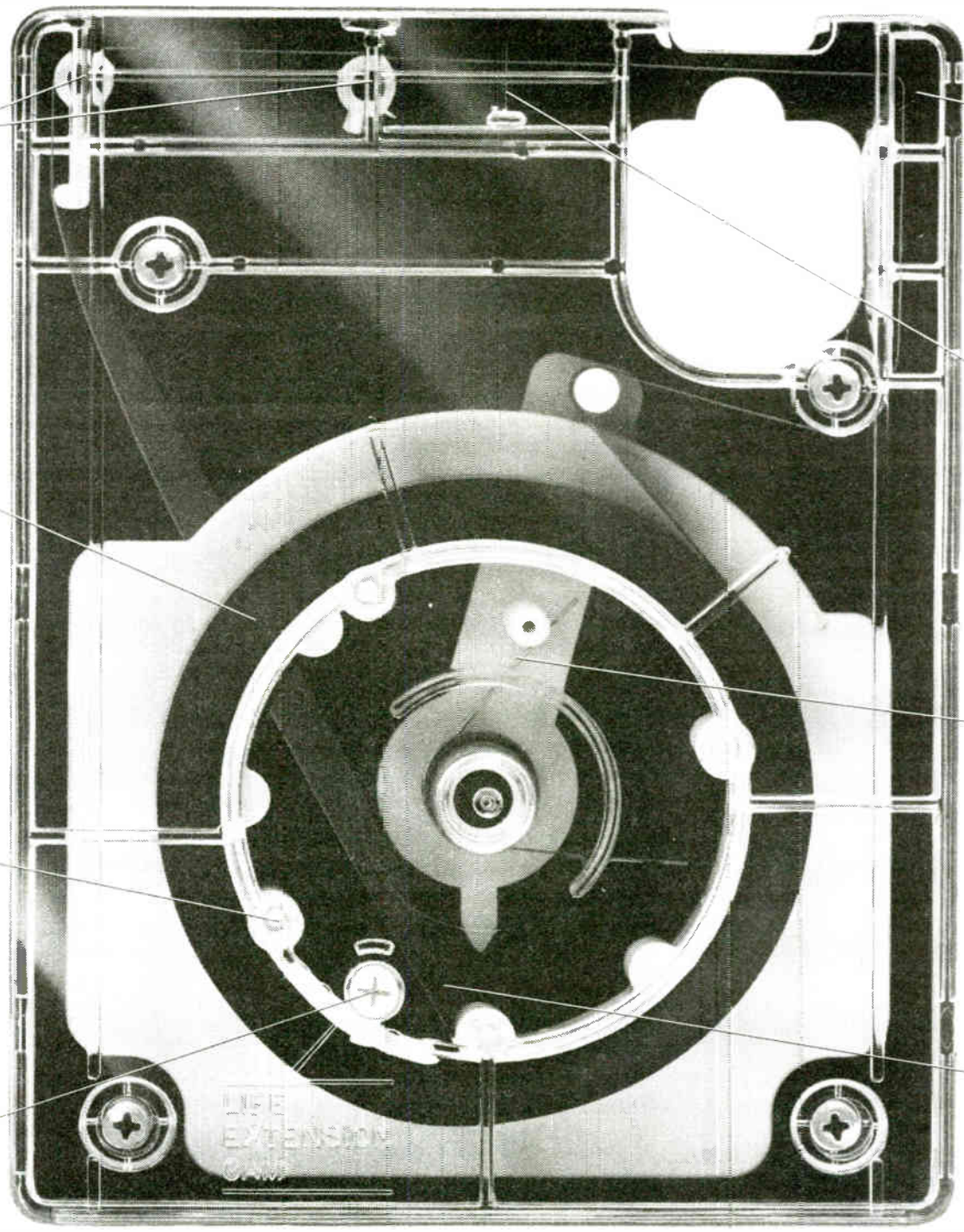

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Circle Reader Service 39 on Page 28

World Radio History

AM Tech Rules Under Scrutiny

(continued from page 1)

Based on initial analysis, however, the NAB noted there appears to be ample evidence of a need to change many of the Commission's AM technical standards. Yet the NAB also maintained, "We do not necessarily believe that protected contours should be changed simply for the sake of change."

Protected contours, the association continued, only define the limit of AM service or non-interference and must be rationally considered together with co-channel and adjacent channel interference criteria. "What is most important . . . is that a protected contour provide some reasonable guarantee that future additions of new or modified AM stations will not degrade existing AM service."

Bonneville International, operator of five AM stations, said that since protected contours are a ratio of two numbers, there are only two ways to alter such contours to the benefit of AM broadcasting: increase the power of all AM stations or reduce interference to stations at their existing facilities levels.

"Therefore, the Commission should reduce interference—or at a minimum not increase interference—to AM stations," the group argued.

Reducing protection only will result in more interference and a further degradation of the AM band, Bonneville continued.

Group W, which owns seven AM stations, also opposed any move by the Commission to reduce protected contours. The Angell study found a 26 dB signal-to-noise ratio to be the minimum acceptable level, Group W noted.

"If the area of protected contour is reduced, the number of listeners receiving this acceptable signal-to-noise ratio would be likewise reduced," the broadcast group said. "The overall result would be lower quality on the AM band, rather than the higher quality the Commission is seeking."

Greater Media, licensee of seven AMs, commented that retaining current signal strength values would insure maintenance of the service provided by wide-area facilities and prevent creation of additional interference.

The Clear Channel Broadcasting Service (CCBS) said that at a minimum, the FCC should maintain the currently protected service areas of AM stations. "It would be ironic, indeed, if the outcome of this proceeding were to set the stage for a change in standards which would facilitate the addition of more signals which would impair further the service now offered on the AM broadcast band."

Crawford Broadcasting, which owns six AM stations, argued the need to change the normally protected contour "to some reasonable level that will result in quality, noise-free service that the public has come to expect and demand."

"Implementation of 2.0 mV/m as the normally protected contour would result in power increases of sixteenfold up to a maximum of 50 kW by stations operating at power levels of less than about 3 kW, and lesser power increases by stations currently operating at power levels in excess of that value," Crawford continued.

On the other hand, Universal Broadcasting suggested that the Commission eliminate interference protection to the 0.1 mV/m contour for Class I stations, maintaining that the SNR at that contour is, in most cases, well below the desired SNR.

The broadcast group said it provided data that shows the protection of signal service for all AM stations beyond the 0.5 mV/m contour is unnecessary and undesirable, and that this gives protection to signal levels which do not achieve the minimum signal to noise levels recommended by the International Radio Consultative Committee (CCIR) or by the Commission.

Minimum Usable Field Strength

On FCC questions about minimum usable field strength, the NAB pointed to the Klein and Angell studies. It told the Commission that the first adjacent channel protection ratio of 0 dB falls "seriously short" of protecting the public from AM interference. The current co-channel protection ratio of 26 dB, however, may still be appropriate.

The Klein report noted that minimum usable field strength can vary widely depending on atmospheric and man-made noise environment and/or required system performance. No single protected contour is appropriate for all circumstances, it stated, and also suggested that differing requirements should be accommodated by the Commission's allocation scheme.

According to the Angell study the minimum acceptable D/U (desirable/undesirable) ratio for co-channel interference with musical program material was 26 dB, which supports the Commission's current policies.

However, for talk programming with either music or talk interference, 40 dB was the minimum acceptable co-channel D/U ratio.

For adjacent channel interference, the corresponding ratios were 16 dB for music, 16 dB for talk with talk interference and 20 dB for talk with music interference. The current FCC ratio for adjacent channel interference is 0 dB.

In the area of receiver characteristics effect in determining minimum usable field strength (Emin), NAB recommended that the Commission should

(continued on page 18)

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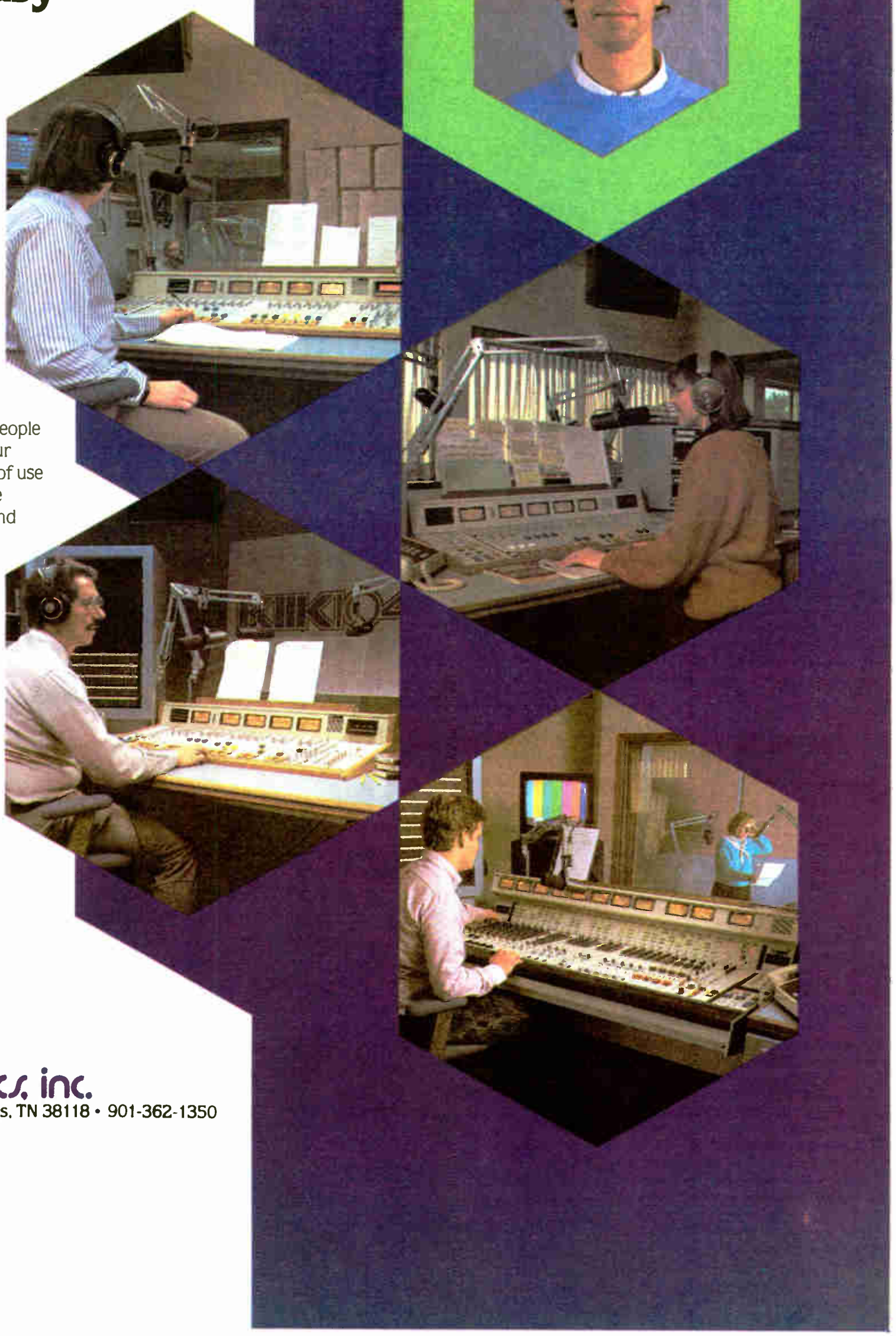

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World Radio History

NAB Votes to Raise Member Dues

by Alan Carter

Washington DC ... With more than $1 million in unbudgeted expenses this year, the NAB radio and TV boards voted at a Joint Board of Directors meeting last month here to increase dues for some members.

On the radio side, minimum dues will increase from $35 to $40 a month effective 1 July for new members and 1 April 1989 for current members.

Dues for this group have not increased since 1984. Dues in the upper categories rose in 1986, but larger market members agreed the radio membership committee should review that dues structure.

Other changes in the dues structure for radio members reduces the number of dues categories from 14 to nine. The NAB reported the changes lower some members' dues, while increasing others.

According to joint board Chairman Wallace Jorgenson, president, Jefferson-Pilot Communications, Charlotte, NC, who was re-elected to a second one-year term, changes in radio membership dues will increase dues income by an overall average of 2.5% in that category. Based on figures he provided, that will raise $91,250. Dues income this year is $3,650,000.

Jorgenson also said members discussed various financial aspects of NAB, in particular the cost of board and committee meetings.

Hints of a dues increase—and a financial evaluation—surfaced after the May executive committee meeting. Discussions then focused on unbudgeted expenditures for items including $700,000 to the Advanced Television Test Center, $150,000 for AM improvements and $300,000 for a share of a pro-radio public awareness campaign. NAB reported then it was drawing from reserves to cover expenses.

Issues raised

The Board also took a stand on several other technical issues. It opposed an FCC plan for national licensing of an entire AM channel on the expanded AM band, alleging it would be a significant departure from the concept of local broadcasting.

WPLZ President Glenn Mahone addresses NAB Radio Board meeting.

The Radio Board group also established an FM Translator Subgroup of the NAB Task Force on Radio Allocations. The subgroup will help develop NAB advocacy strategy in conjunction with the Radio Executive Committee, Radio Board and the NAB staff.

On AM improvements, the AM Improvement Committee recommended that a NAB staff person be designated as an AM coordinator to act as spokesperson on all AM radio issues.

The committee is looking for someone with a technical background.

"It's not meant to create an AM czar," said outgoing Radio Board Chairman Jerry Lyman, president RKO Radio. He also noted the idea is not meant to detract from the role of the Radio Board chairman or vice chairman.

Other recommendations from the improvement committee included a rally promoting AM at Radio '88; an AM futures retreat; use of improved AM technical standards on the expanded AM band, and a move to encourage the FCC to develop specific standards for power-line interference that would be tolerated on the AM band.

New chairman selected

In other action, the Radio Board elected L. Lowry Mays, president and CEO, Clear Channel Communications, San Antonio, TX, to a one-year term as chairman. He succeeds Jerry Lyman, whos two-year term as major market group representative expired.

Elected to a one-year term as vice chairman was George C. Hyde Jr., regional vice president/Florida, Susquehanna Stations, Miami. He succeeds Robert Fox, chairman and CEO, KVEN Broadcasting Corp., Ventura, CA, whose second, two-year term expired.

The Radio Board also held a "thorough" discussion on what NAB can do in the upcoming Congress to enact radio-only comparative renewal legislation. NAB lobbyist Jim May briefed members on a "strategic plan" he has developed to push this issue, and said he was confident it could be accomplished.

Contact NAB's public affairs department for information on the joint board meeting, 202-429-5350.

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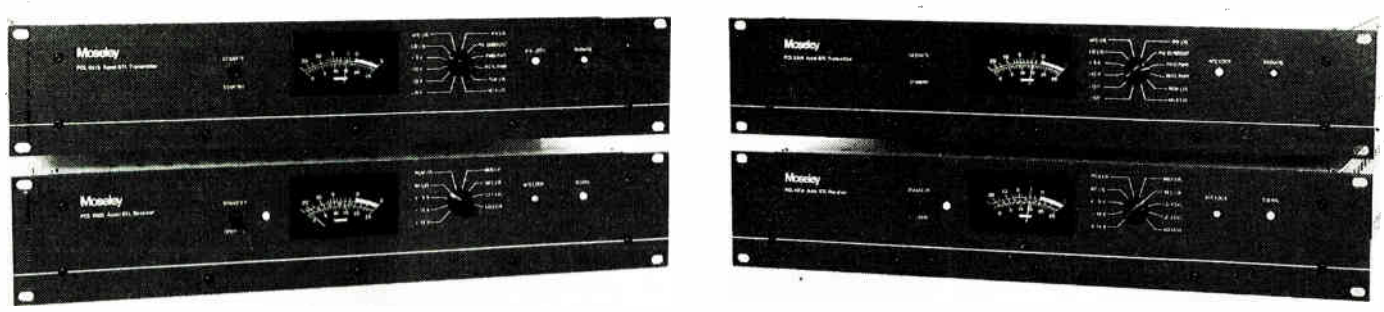

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World Radio History

The Silent Solution To Ground Loop Hum

by Bill Higgs

Louisville KY ... As we mentioned in last month's column, open-collector transistor outputs on modern equipment have both advantages and disadvantages.

The good news is that they are small and cheap. They are also silent, as opposed to relays. The bad news is that they are small, cheap (low current-handling capacity) *and* ground-referenced.

At first glance this last factor may not seem to be a significant one. After all, the electronics in the console or remote-control unit are usually acting against ground. If we look hard enough, however, we can see our old enemy, the Ground Loop.

BottomLine Broadcaster

Generic enemy

The term "ground loop" has become almost a generic for any hum problem and many difficulties are blamed on ground loops which in fact have nothing to do with them. Basically, a true ground loop is any unwanted ground path which will allow hum or interference to ride in on the audio signal.

Star grounding or common-point schemes are designed to avoid these unwanted paths, and most of us plan our grounding arrangement very carefully.

Two-inch copper strap (you *do* use strap, don't you?) is run from each piece of equipment to a common point; pins are carefully broken off from power plugs and "pig noses" installed. How, then, can a ground loop happen?

Lock carefully at Figure 1. Here we see a console remote start circuit connected to a cart machine. Our engineer has carefully grounded his equipment through a star arrangement and checked everything to make sure no ground loops were evident.

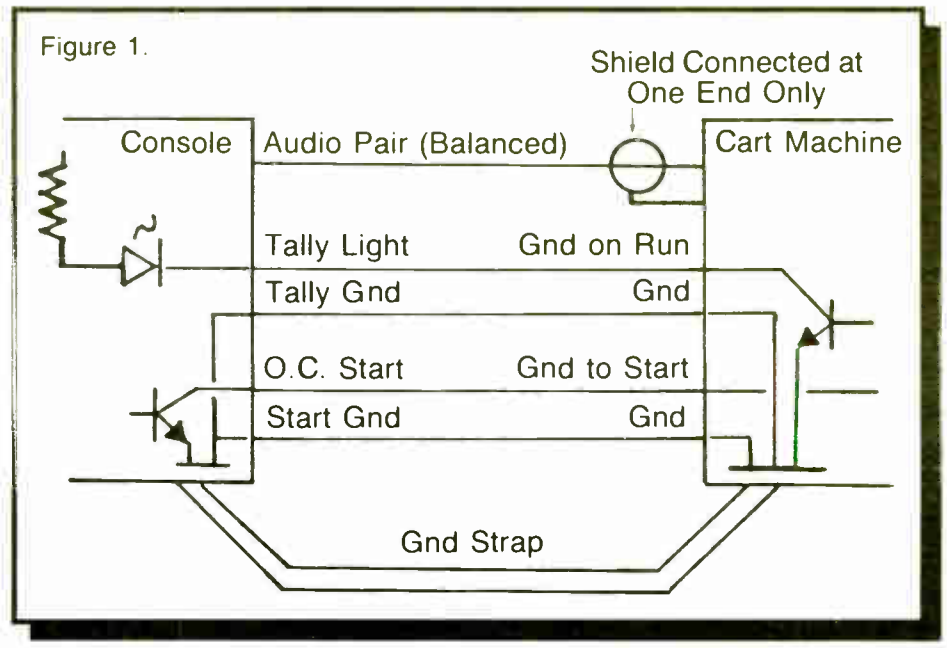
He then installed the remote start and the "run" light in the console. Not wanting his strap to be the ground return, he then installed two wires for each. Notice that there are now not one but three ground paths.

A few snags

There are two features of modern equipment that make this more of a problem than with older devices.

(continued on page 17)

Figure 1.



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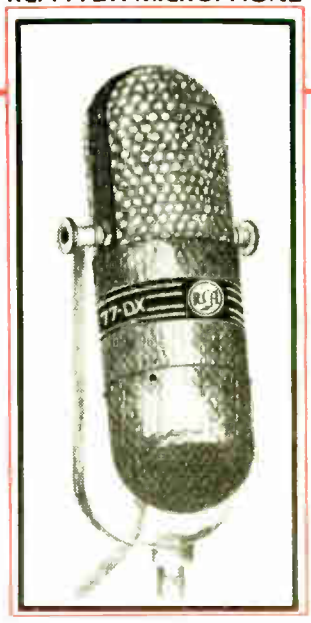

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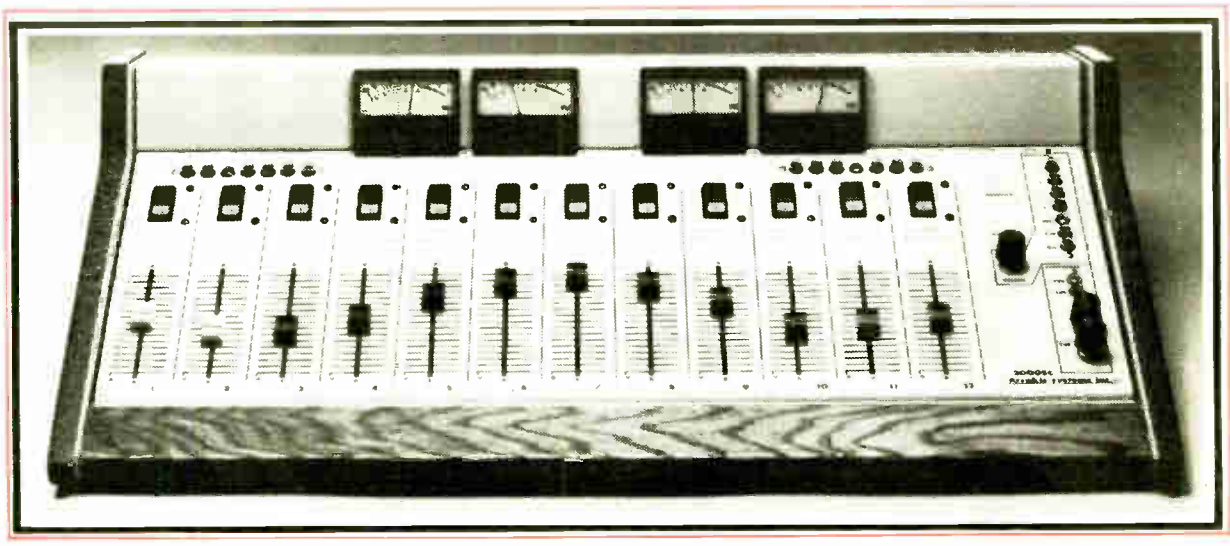

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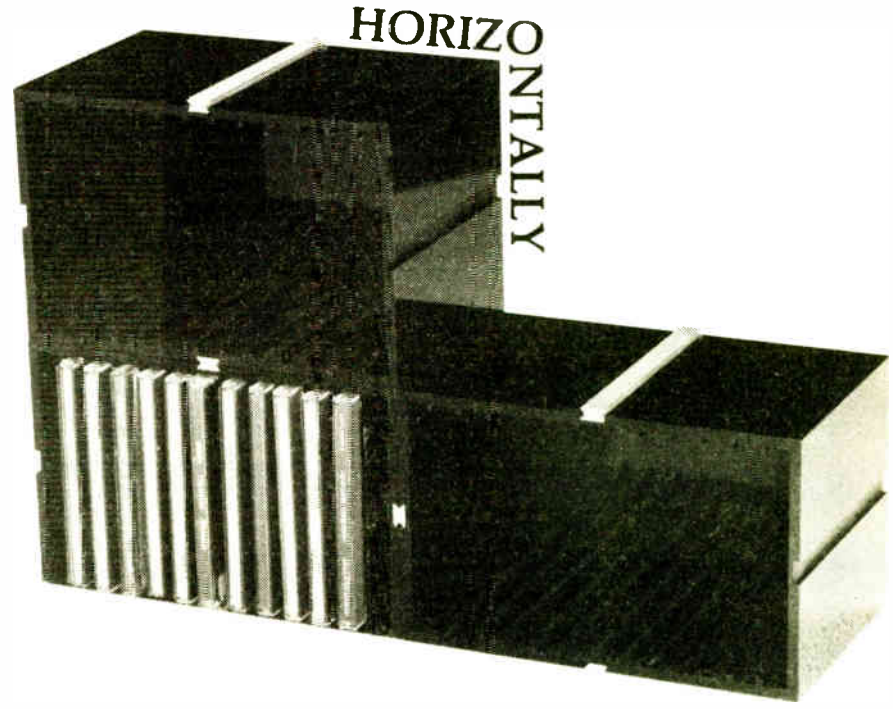

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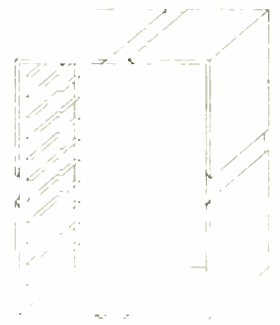
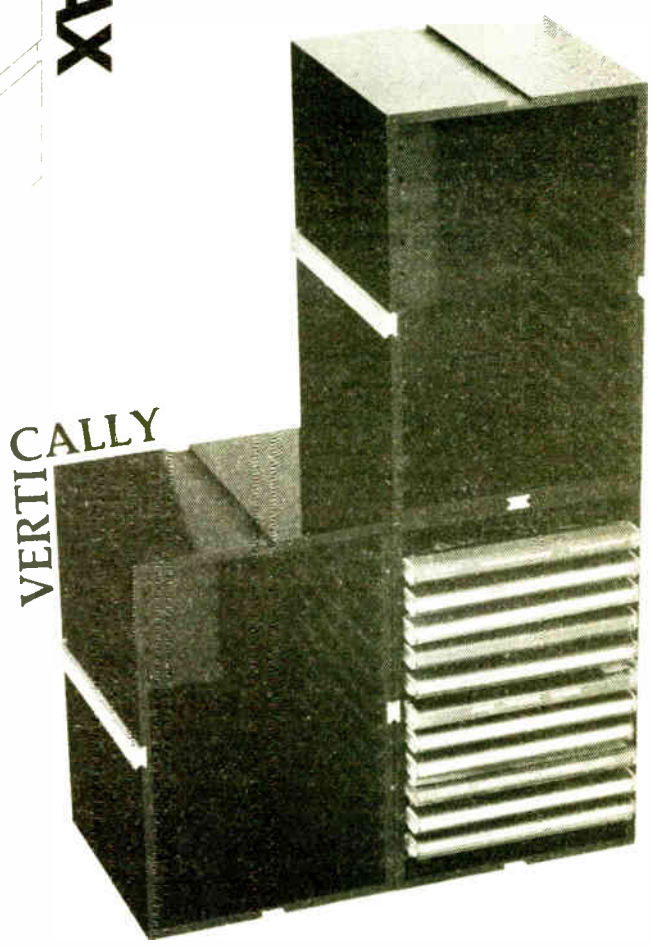


VERTICALLY



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World Radio History

How to Reprimand Employees

by John M. Cummuta

Downers Grove IL ... Do you remember the part in "The Empire Strikes Back" *Star Wars* episode where the Imperial fleet is speeding towards the planet where the good guys are hiding, and the admiral comes out of light speed too close to the rebels' detectors?

That gives the good guys a chance to put up their force fields, and it gives the admiral a good chance to apologize to Darth Vader for making a tactical booboo.

Now watch Lord Vader's management style. Let's see how he handles this opportunity to reprimand one of his employees.

"Gasp ... uugh ... grunt ... choke," the admiral pleads as he falls to the floor, hand clutching his throat.

"Apology accepted," responds Dirty Darth.

How's that for efficient management? Not only does it communicate a strong message to the rest of the staff, but it really cuts down repeat offenders.

Have you ever worked for a Darth Vader? Have you ever walked in fear, knowing that your good jobs would never be recognized, but if you made one slip it would become the basis for a public flogging?

If you felt that way when you had a "Vader" boss, think how your people feel if you've turned into one yourself. Don't get me wrong. Believe it or not, there is a certain amount of Darth's style that is positive, in a broader management context.

However, the public humiliation style of reprimanding can lead to high turnover, and it certainly deters anyone else on anything creative. This style of reprimanding molds a staff of "Yes-People" and "Play-It-Safers."

The Patton style

On the surface many think that Darth Vader and General George Patton have the same management and reprimanding style. Not really. While Darth was into public humiliation and occasional murder, Patton was the consummate firer.

Engineering-Manager

When one of his people made a mistake he fired them. Patton probably replaced more officers during World War II than any other commander in history.

If you tend to want to get rid of someone who has made one or maybe more mistakes, thinking that if you get them out of sight you've solved the problem, think again.

Making mistakes is a part of the human condition. The next person you put in that position will likely come in with their own set of shortcomings and just make their own mistakes in other areas.

You would be well to keep in mind a commandment from good management techniques: "Thou shall put thy reprimand in to a sixty-second package, and end it with a pat on the back."

In essence this is a good concept. It deals directly with the problem yet includes a positive, building element.

The main shortcoming is that, by its very nature, it tries to cram what maybe should be an all-day training process into a minute. You need to be more flexible than that and give each reprimand situation whatever time it requires.

Swimming with sharks

In his best-seller business book *Swim With the Sharks Without Getting Eaten Alive* Harvey Mackay proposes what may be the best reprimand system. His approach is to bring the offender into the office, state the problem, then hand them the paddle—letting them spank themselves.

He says something like "Joe, if you were me ... what would you do with you?"

Then he lets them begin beating their breast with confession and repentance. Mackay says that they are usually harder on themselves than he would have been.

The point is that the problem is dealt with directly, but you as the manager don't have to come off as the bad guy. Plus the employee usually feels much better when it's over. Kind of like they've confessed their sin and no longer have to bear its burden.

The key point

Whichever reprimand style you decide to use, you should keep one important point in mind. It's the theme that both the One-Minute system and Mackay's Hand-Them-the-Paddle method include.

Always separate the act from the person. In other words if they did something stupid, confront them with the stupidity of it, but don't call them stupid as a person.

This is good advice when rearing children as well. Nothing can destroy self-esteem—and therefore the ability to positively contribute to whatever you're trying to accomplish—faster than to have a significant person call someone dumb or stupid or incapable or an idiot, or whatever destructive term comes up.

It's much better to say that your opinion of them and their abilities is so "high" that you're, quite frankly, surprised at this mistake: "It's so unlike you."

See the difference in that message? Employees that walk out of a reprimand meeting like that will be committed to never letting their bosses down again because they will want to live up to his or her high opinion of them.

My suggestion is to redesign the word reprimand itself. If you look at it more like "repairmand" you might have a different attitude when you have to do it. Your chore is not to punish the offender but rather to fix the problem and assure that it doesn't happen again.

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.*

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World Radio History

DDP NEWSletter #1

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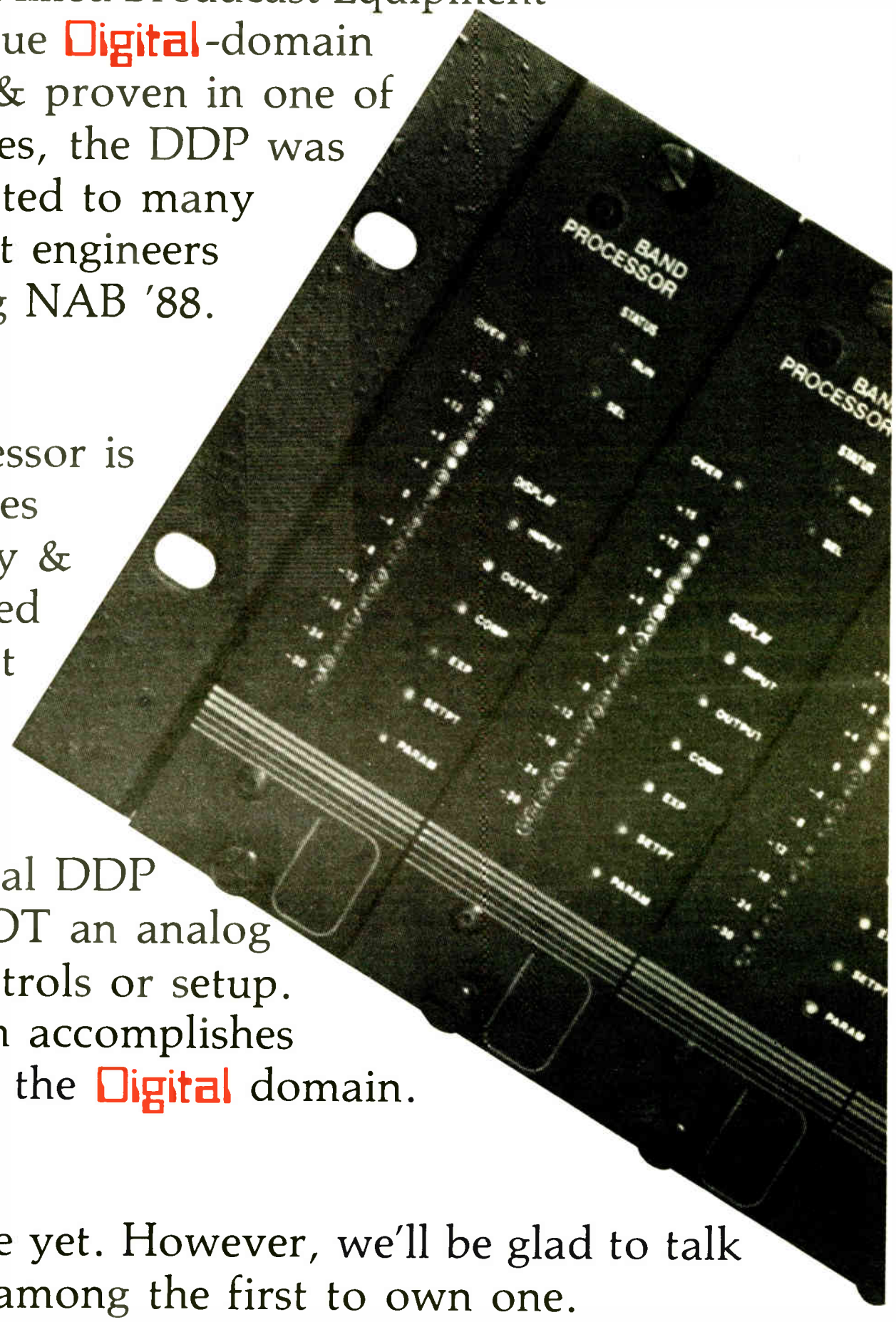

This true Digital processor is now in Beta testing sites throughout the country & is expected to be offered for sale within the next four months.

The Valley International DDP Digital processor is NOT an analog device with digital controls or setup. It IS a processor which accomplishes precision processing in the Digital domain.

The DDP is not for sale yet. However, we'll be glad to talk with you about being among the first to own one.

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World Radio History

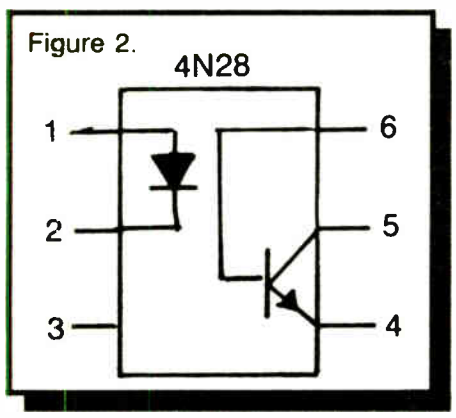
Eliminating Ground Loop Hum

(continued from page 13)

First, it is unlikely that the internal ground point for the control circuitry is the same as that for the audio circuitry. Therefore audio currents may flow through the control ground point and vice versa.

Second, most audio equipment built in the last few years uses actively balanced input and output circuitry. Unlike transformers, which truly isolate their circuits from outside influences (unless center taps are used), actively balanced circuits reference their audio above and below ground.

Figure 2.



We therefore have a problem. If ground "moves" because of control currents, our audio may be able to hear it! This shows up as clicks and pops when the source machinery starts or stops.

Additionally, any difference in AC potential between the devices will usually show up as hum. The only way to eliminate this, short of a solid silver floor, is to totally isolate control circuitry from audio circuitry.

Relays are designed to isolate and do so very well. They are also bulky, noisy, a maintenance headache and create voltage spikes when they open. Fortunately a solid state device exists that will replace relays in most studio applications.

Silent solution

Enter the optoisolator. For a dollar or less plus a resistor or two our ground loop problem can be eliminated. In addition the devices are silent and maintenance-free.

The optoisolator or optocoupler consists of an LED and a light-sensitive transistor in a lightproof case. When the LED glows it has the same effect as biasing the transistor on. Simple.

The internal construction of these six-legged critters is shown in Figure 2. Note that the base of the transistor is available at an output pin.

Although normally unused, the base can be tied through a resistor to either the emitter or collector to either increase or decrease the sensitivity of the device.

Let's redesign the control and tally circuit according to Figure 3. Note that now the control circuit's ground return is not isolated. Cboose a resistor value which will allow about 20 ma to flow through the LED (use Ohm's law here—330 Ω is about right for a 5 V circuit; 620 Ω for 12 V; 1200 Ω for a 24 V circuit). Don't forget the resistor—otherwise you'll toast the opto!

I have found that the run-of-the-mill 4N28 optoisolator is the least expensive device and is entirely adequate for most needs. If you have more complex interfacing problems, involving 5 V TTL logic input or the like, note that there are more exotic optoisolators available.

Alternatives

These include Darlington transistor output, triac output (bidirectional), analog FETs and TTL inputs and outputs. There are also dual and even quad versions of the standard optoisolator available.

Let me include a caveat here. These things are *lousy* for switching audio, lest you be tempted. Distortion and RFI are certain to follow. A better approach for this is a small reed relay or a photocell device such as those made by Vactec.

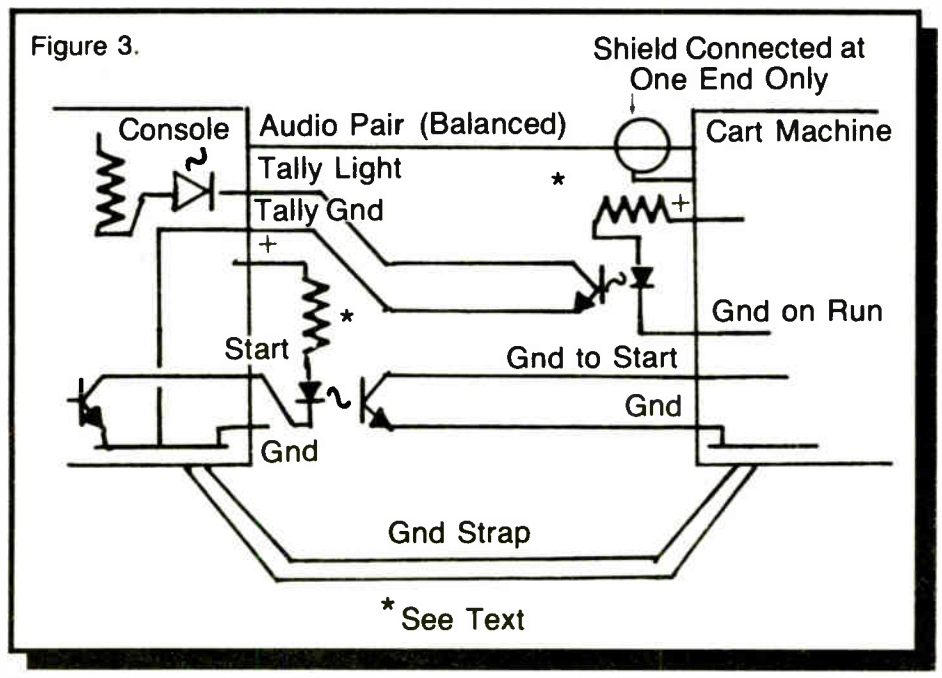
Also a quick word regarding switching AC. A few of these devices are sold as higher power solid state relays, capable of substantial switching capability. It is tempting to use these devices for AC switching applications such as the older Ampex decks.

I am rather leery of this approach. My experience with triac switching is that it produces huge amounts of square wave garbage—not unlike that which we know so well from light dimmers and speed controls. I suspect that its use in a control room would cause unnecessary grief in the form of hash on the audio.

So it would seem relays still have some redeeming social value. Use them where you have to, but some judicious use of optoisolators can solve some knotty problems in your operation, and help the all-important bottom line.

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.

Figure 3.



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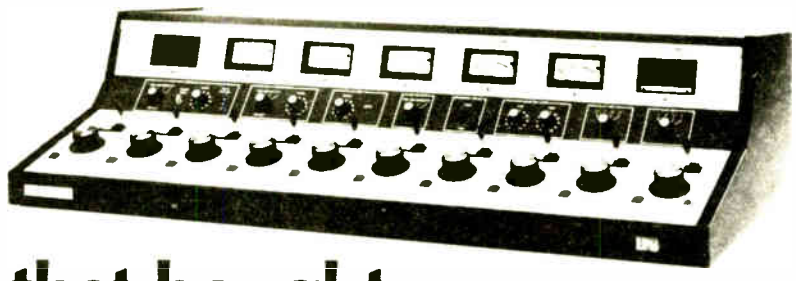

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NY AM—"Great board; our second LPB. Wouldn't buy anything else."

SC AM—"Best I've ever had. It was recommended by our consultant. Have anyone interested call us."

OH FM—"Our second LPB board, because we liked the first so well!!! Never had any problem with either."

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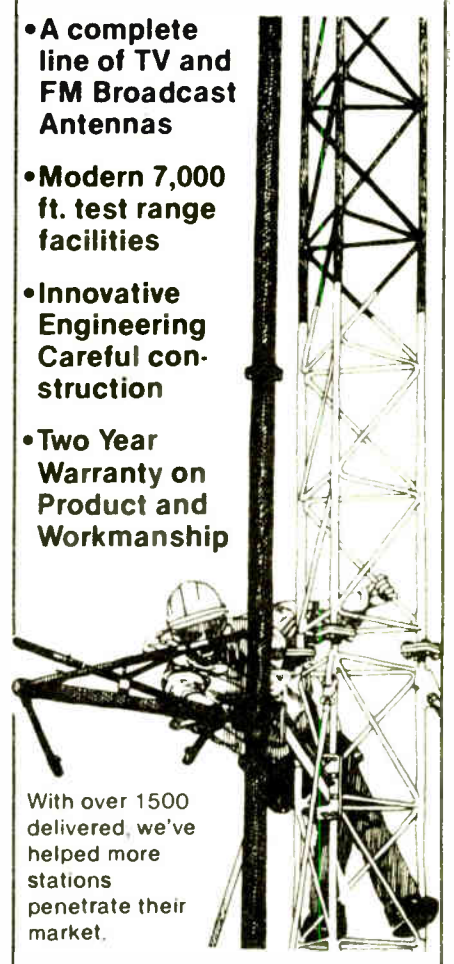

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World Radio History

Comments Request AM Relief

(continued from page 10)
use NRSC-1 audio deemphasis and a narrow bandwidth configuration.

The NAB noted that NRSC-1 brings uniformity to the equalization of AM receivers and provides a benchmark from which AM station engineers can tailor the sound of their stations.

For allocation purposes, the NAB said, a narrow bandwidth seems appropriate as a planning factor. "If wide bandwidths were used as a planning factor, the resulting allocation system would essentially ignore the millions of narrow bandwidth receivers now on the market and the fact that many wide bandwidth receivers also have narrow bandwidth positions.

"We also recognize the importance of preserving AM service in weak signal areas, regardless of whatever protection ratios the Commission adopts," the NAB added.

Group W agreed with the findings of the Klein study on minimum usable field strength, concurring that it can vary widely depending on environment and that differing requirements must be accommodated.

"These accommodations should be for inherent geographic variations of atmospheric noise," the broadcast group wrote. "Since no single protected contour would always be appropriate, the Commission should consider a protected signal-to-interference ratio method instead.

Greater Media generally agreed with NAB findings that "appear to indicate that a 40 dB signal-to-noise ratio is necessary for the provision of service that most listeners with wider bandwidth receivers would consider high quality."

Bonneville stated that it believed the FCC "must" work with the receiver industry to resolve questions concerning minimum field strength because it controls two pertinent parameters that determine what the minimum field strength must be--bandwidth and sensitivity.

Atmospheric and man-made noise

As part of the notice, the FCC proposed "noise zones" for US AM broadcasting as a way to more accurately predict service contours.

The NAB supported the concept for atmospheric noise, pointing out from the Klein report that atmospheric noise may vary by as much as 60 dB. But the association does not support noise zones with respect to man-made noise.

Greater Media also opposed man-man noise zones, noting its support for the use of the CCIR Report 332 for determining atmospheric noise levels in the US.

"Greater Media believes that variable noise level standards would be cumbersome and unnecessary," the group stated. "In most populated areas, the prime noise factor is manmade electrical noise, not atmospheric noise. Ultimately, the issue of atmospheric noise does not appear to be of great importance, to the extent that current protected signal contour values are maintained."

Expanded band

Comments on the filing also addressed the expanded AM band on 1605 to 1705 kHz. The FCC is also examining the issue in Docket 84-467 on which comments were due 11 July.

NAB noted that the criteria which results from the review of AM technical standards should be applied to the expanded band. In particular, the NAB recommended that the FCC determine technical standards based on a narrow bandwidth, claiming it would produce "a high quality AM radio service."

Bonneville said the Commission should consider using the extended band as a possible solution to some adjacent channel interference by moving "some of the problem stations."

"However, stations will be reluctant to make such a move until a larger number of AM receivers are in use that can tune to these new frequencies," Bonneville acknowledged. "Bonneville urges the Commission to ensure that AM receivers have the capability to receive all AM frequencies."

Another broadcast group referring to the expanded band was Greater Media who suggested the Commission apply enhanced protection ratios.

"This pristine band could be governed by idealized ratios to produce a significantly higher level of quality service," the group stated. "Ultimately, the experience gained from the application ... might be used to consider changes for the 540-1600 kHz band ... ."

For information on Docket 87-267, contact Wilson LaFollette at the FCC, 202-632-5414.

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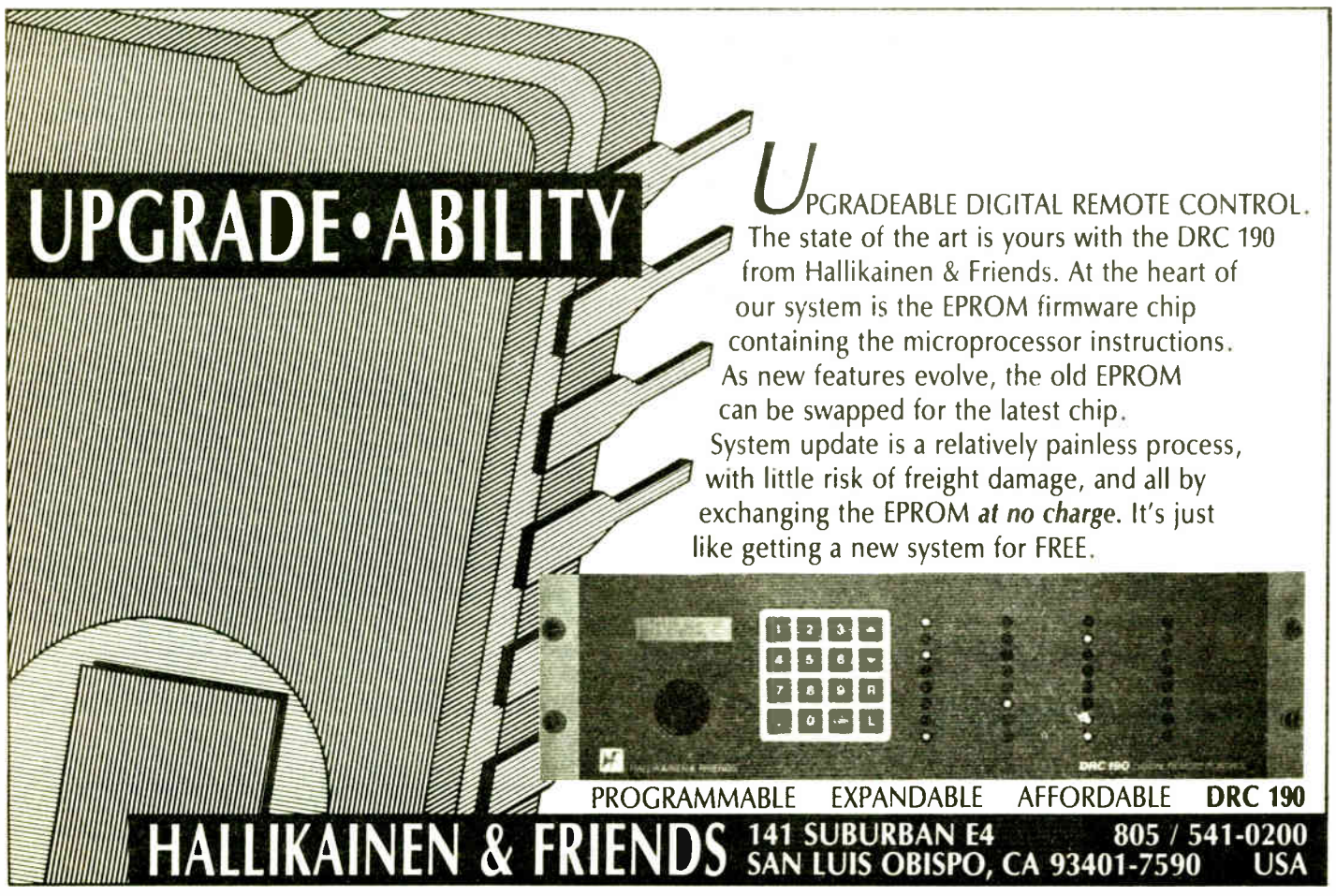

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New Protest

(continued from page 8)
the agency. The resulting budget forced USIA to rewrite the solicitation so that the base award covered transmitters for the Morocco station only, Rogers said. That was toward the end of 1987.

"The financial bottom just kind of dropped out, so we had to restructure it and that took a number of months, first to agree on what we ought to do, then to carry out our agreement. All the weeks just kind of added up and evenutally it was the end of May before we were ready to make a selection," he said.

"We are several years from having this station operational. We have another procurement which will be initiated in the near future for the antennas," said Rogers. Also, "the Corps of Engineers is anticipating making an award for the construction of the buildings by the end of September.

"So we now have a critical path that requires the marriage of all of these pieces of work sometime in the 1991 time frame," he said."

For more information, contact Dave Russell at Continental, 214-381-7161; or Philip Rogers at USIA, 202-485-6398.

World Radio History

Simplexing for Remote Control

by Thomas Vernon

Harrisburg PA ... Some of my best ideas for columns come from reader inquiries. The solutions to two recent problems on control circuits should be of broad enough scope to interest many readers.

A station has two leased lines from the studio to the transmitter site, a 15 kHz program line and the remote control line. The old 10-channel remote control is filled to capacity.

Is there a way to add just one more control/metering function without adding another line or purchasing a new remote control?

Weekly church remotes come to the station via a leased line. AM reception in the church is poor, resulting in missed cues and dead air.

Is there a simple way for the studio operator to throw a switch and activate some sort of "on air" light at the church?

The answer to both of these questions is yes. This month's column will examine simplex control circuits and their applications.

Station Sketches

. . . simplex allows remote control via a DC voltage over a balanced audio line.

Borrowing from Bell

Simplexing is an old technique that had its origins with the telephone company.

It is widely used by carrier current broadcasters to remotely control transmitters located in dormitories scattered across campus. As we shall see this technique has many other control applications as well.

In its most basic form, simplex allows remote control via a DC voltage over a balanced audio line. Figure 1 illustrates an elementary control circuit.

As long as the power supply on the control side is connected the relay at the remote end will pull in.

In some circumstances it is inconvenient to supply continuous DC down the lines. A slightly more elegant system allows simplex latching control, as shown in Figure 2.

The process

Here's how the circuit works: −24 V is momentarily applied from the power supply to the phone line through the "on" pushbutton.

Current flows through the relay coil to ground via diode D1. The relay contacts close, turning on power to the device. Once this happens, the current path reverses.

Now, +24 V flows from the device back to the control end through a current limiting resistor and the normally closed contacts of the "off" switch to ground.

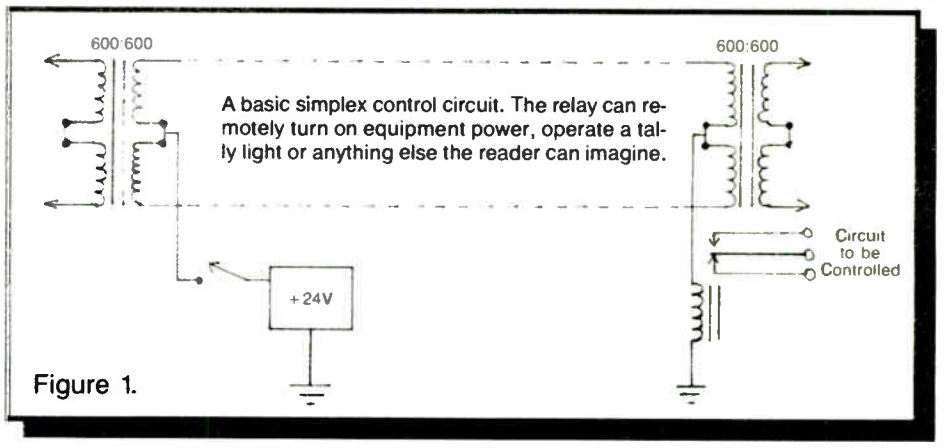
Pressing the "off" switch breaks this path and the relay contacts open, turning the device off. Note that the buttons must be held down long enough for the power supply to energize and discharge, typically two to three seconds.

Also, you can check the power supply voltage by measuring current through the off button.

Complicated uses

Perhaps your needs are a bit more complex, like maybe controlling two circuits over one line, or control and meter-

(continued on page 26)



A basic simplex control circuit. The relay can remotely turn on equipment power, operate a tally light or anything else the reader can imagine.

Figure 1.

The mic mixer you would have designed yourself–the Shure M267.

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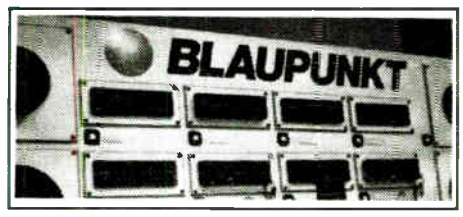
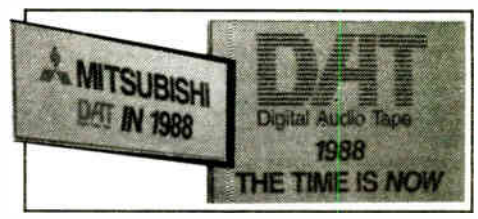
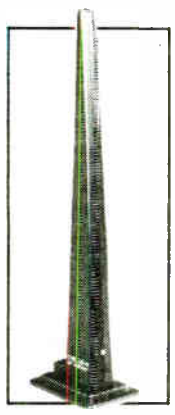
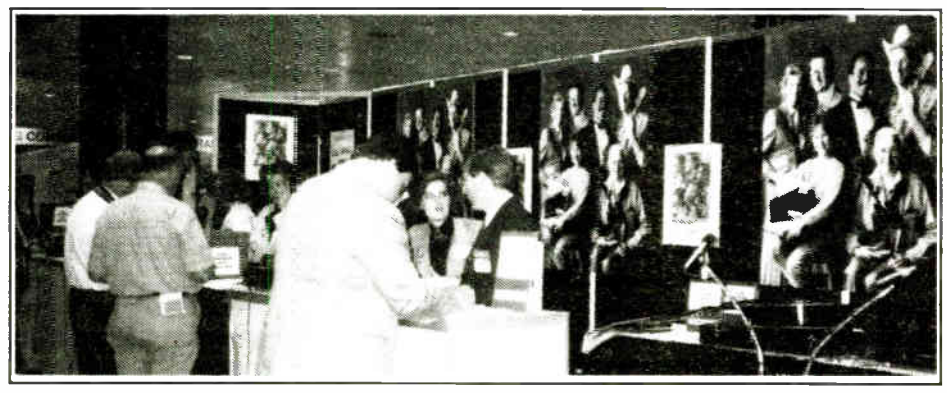


CDs, DAT, Radio Too At Summer CES

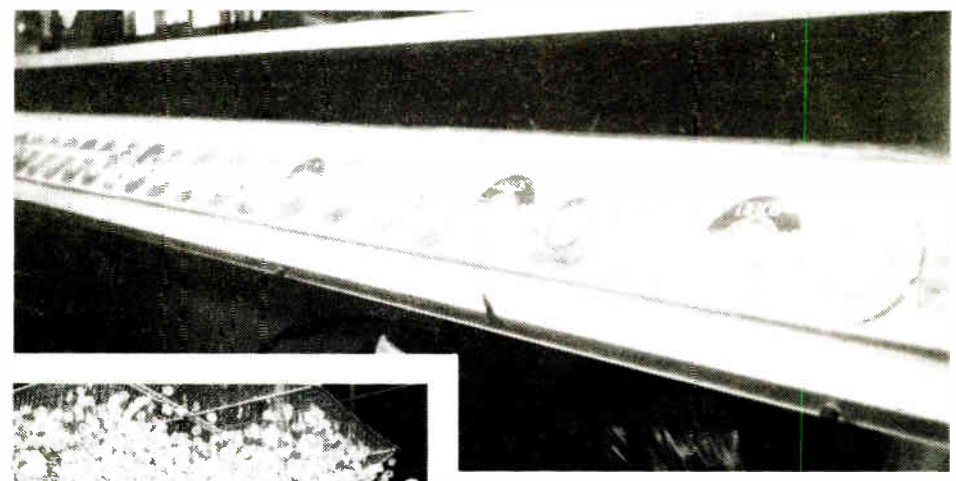


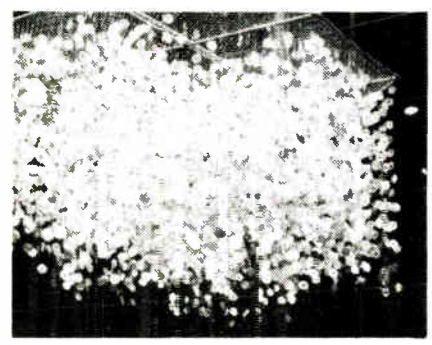




Sights and sounds from the CES include (upper left corner) Blaupunkt AM stereo car radios; (above left) Parsec's LS-4 anc FM Dish FM antennas; (below left) Motorola's C-QUAM AM stereo; (above) the Home Recording Rights Coalition encourages attendees to sign petitions against anti-copying devices for DAT; (upper right corner) Mitsubishi takes an agressive pro-DAT stand; DAT was present in prototype and player-only form.

Also on DAT (above right) Mark Finer and Len Feldman update attendees on the status of consumer DAT marketing in the US in light of the record industry's threats of lawsuits; (right) Sony unveils its new 3-inch CDs; not pictured is the company's latest portable innovation "Discman"; (below right) a CD "chandelier" decorates McCormack Place; (below, far right) more than 96,000 visitors viewed the latest in audio, video and electronic wizardry.





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World Radio History

CD Music Beds for Producers

by Tyree Ford

Baltimore MD ... Imagine that you had almost unlimited access to every CD production music library. Sounds like a Production Rat's dream come true: hours and hours of unvocalized music at your fingertips.

This has been my environment for the last few months. As I continue to immerse myself in the material of different vendors, one thought continues to surface. The subjective nature of music and preference makes communicating about it difficult.

The problem lies in the fact that music is extremely complex. The choice of instruments, the sounds they make, how they are played, the arrangements and the technical quality of the production and reproduction medium all have great bearing on how acceptable a music package may be.

What sounds contemporary to one person may sound dated to another. One factor which gives us cues about "dating" is the sound of the instruments in the arrangement, especially synthesizers, drum machines and effects boxes (wah-wah pedals, distortion boxes, etc.).

The waveforms and sounds of the earlier boxes sounded remarkable when first heard. As time passed and technology advanced, new sounds replaced old sounds. This evolution created a time base upon which any piece of music may be placed.

Striving for freshness

Even a present day composition can come off sounding like a "period piece" if the devices normally associated with an earlier period of the time base are used.

Most sensitive to the dating of sounds are the musicians and producers who create the music and the companies such as Roland, Yamaha, Ensonique and others who invent the technology. These two forces drive the market that constantly strives to sound "new and improved."

CD Number	Name	Total Time	Content	Comments
CDPL 1	Medium Tempo Contemporary	58 min.	30 60s, 30 30s, 38 Household SFX	Up tempo to medium tempo, small group to orchestra.
CDPL 2	Mellow Contemporary	59 min.	30 60s, 30 30s, 38 Auto & Plane SFX	Medium to mellow, small group to orchestra.
CDPL 3	Rock	59 min.	30 60s, 30 30s, 38 Office & People SFX	A mix of traditional, synth and sampled sounds for small combo.
CDPL 4	Country	59 min.	30 60s, 30 30s, 38 Footstep, Door and animal SFX	Small to large arrangements with banjo, pedal steel, harmonica, and dobro features.
CDPL 5	Christmas & Novelty	58 min.	18 Xmas 60s, 18 Xmas 30s, 12 Novelty 60s, 12 Novelty 30s, 38 Xmas/New Years SFX, 23 Boinks, Twangs & Borks	Mixed tempos and arrangements for Xmas. A good collection of novelty misic tracks and cartoon SFX.
CDPL 6	Specialty	59 min.	30 60s, 30 30s, 38 news/traffic /promobeds	Irish, Italian, Mexican, German, Oriental, Classical, Big Band, Bridal, Broadway, Reggae and more. All contemporary with synth accents.
CDPL 7	Medium Tempo Contemporary	57 min.	30 60s, 30 30s, 38 percussion accents	Small to medium combos with a mix of synth and real instruments. Tympani, cymbal, rim shot, gongs, bell trees etc.
CDPL 8	Up Tempo Contemporary	60 min.	30 60s, 30 30s, 38 miscellaneous SFX	Contemporary and rock guitar, bass, drum, synth, organ and sax.
CDPL 9	Christmas & Country	71 min.	15 Xmas 60s, 15 Xmas 30s, 15 Country 60s, 15 Country 30s, Weather and Playtime SFX	Synth arranged Xmas standards. A mix of traditional and Countrypolitan country beds. Thunder and wind are synth effects.
CDPL 10	Medium Tempo Contemporary	62 min.	30 60s. 30 30s, 38 War, Construction & Sports SFX.	Uptempo to medium AC and Rock beds with synth sounds.
CDPL LL-1	Laser Lightning	67 min.	30 60s with 10 more mixouts, 30 30s with 10 more mixouts, 18 Accents, Sweeps, Zaps, Bubbles, intros, etc.	A good collection of various rock arrangements and musical effects.

Producer's File

Even though you, your client and the public in general may not be as sensitive to the time base, at some point music produced with enough of these earlier boxes will "sound old."

At the bottom line, expect to pay a premium for a package of new sounds. Smart composers and producers limit the use of trendy devices in their arrangements, hoping to extend the shelf-life of their compositions.

This sometimes forces them to use more conventional instruments (and the musicians who play them) rather than computer- or sequencer-based boxes. The cost of additional musicians, in theory, will be offset by the longer shelf-life of the composition.

All of this may change as digital sampling becomes more prevalent in the marketplace. This technology allows actual sound samples of an instrument to be digitally sampled and "played back" through a synthesizer keyboard.

From "mello" to digital

The predecessor of the sampler is the Mellotron. Used to great advantage by The Moody Blues, the Mellotron used the keys of its keyboard to activate motors which pulled loops of recording tape over playback heads. On each piece of tape was recorded the sound of a string played at a specific pitch corresponding to the note on the keyboard.

The new digital sampling keyboards work the same way. The sound is not the synthesized recreation of what a string waveform should look like, but the real thing. The secret to the success of the samplers is how well the samples are taken and how they are used, but that's a completely different article.

This month Producer's File reports on The Century 21 Contemporary Music & Sound Effects collection. There are 11 CDs in this package.

The music cuts are programmed in descending order of energy or tempo. There are 60 music beds on each CD, 30 full 60s and 30 outtake 30s plus additional indexes (cueable internal timing points within each composition).

All of the cuts are arranged with at least three indexed edit points. Some of these points were improved by further fine tuning with the search dial of my Technics SL-P520 CD player.

Some of the index points occurred at awkward places in the composition. When started from these points you could definitely tell something was missing.

This package also contains over 400 sound effects, percussive and musical accent hits, sweeps, zaps, bubbles and news/traffic/promo beds. A few of the sound effect sequences like the ice-in-the-glass-pouring liquid and some of the short music phrasings are also indexed for easy editing. My favorite is the 60-second Halloween background.

Country-style and holiday

Tired of searching for those "Country Flavored" cuts on Earl Scruggs LPs? This collection has 45 different 60-second country beds, and 45 30-second outtakes.

There are also 33 different Christmas music 60s with 30-second versions. The Christmas beds use highly familiar Christmas melody signatures, but come in a wide variety of arrangements. This collection will answer the prayers of most Production Directors who get bombarded for this kind of music around Christmas.

(continued on page 28)

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World Radio History

FCC Examines License Renewals

by Charles Taylor

Washington DC ... The FCC has expanded the scope of its review into comparative renewal in an effort to curtail abuses, including allegations of competitive filings for monetary payoffs.

The Commission at a 23 June meeting issued a second Further Notice of Inquiry regarding the comparative renewal process, along with a Notice of Proposed Rule Making to eliminate the abuse for broadcast stations.

The longstanding issue, contained in Docket 81-742, aims first, through the Notice of Inquiry, to clarify the standards for determining when an incumbent licensee is entitled to a renewal expectancy and, second, to refine or modify certain other comparative factors used in comparative renewal hearings.

"The existing process is murky and inconsistent," said Commission Chairman Dennis Patrick. "We hope to develop a clearly thought out renewal process to displace the ad hoc approach currently used."

Radio stations now are required to have their licenses renewed by the FCC every seven years.

Getting at abuses

In the Notice of Proposed Rule Making, renewal process abuses are addressed. Under current regulations, challengers are allowed to file competing applications against an incumbent licensee's renewal application, necessitating a comparative hearing to determine whether grant of the incumbent's or a challenger's application would best serve the public interest.

But in a Commission meeting earlier this year, the FCC stated that petitions to deny and requests for frequency allocations sometimes are used for unethical purposes.

> ***"The existing process is murky and inconsistent."***

"We believe that parties may be filing competing applications or petitions to deny for the primary purpose of entering into settlement agreement for profit, rather than for the purposes of operating a broadcast station or informing the Commission about legitimate issues relating to an incumbent's qualifications," said Andrew Rhodes, an attorney with the FCC's Policy and Rules Division.

To deter possible abuse, the FCC is considering reimposing limits on the amount of money or other consideration that can be paid to another party by an incumbent station to withdraw a comparative application, or to forbid such payments altogether.

The FCC also said that current rules requiring the parties entering into the settlement agreement to certify that their application was not filed for the purpose of entering into a settlement, may not satisfactorily offer proof of such. The Commission requested public comment on whether current filing requirements should be made more stringent.

Remedies

One suggested variation would require fuller disclosure and a greater identification of financial contributions from those backing the application and those identified as the "real parties of interest." Comments were sought on what types of documentation might be useful as effective deterrents to abuse as well as effective alternative approaches.

On the issue of amending standards for determining when renewal expectancy is warranted for station licensees, the Commission has proposed various options since the issue first was raised in 1981. One involves setting forth standards for establishing when an incumbent's past broadcast record can be characterized as "meritorious," and thus worthy of a renewal expectancy.

The FCC also has suggested eliminating the current comparative process by having an incumbent show that it has achieved a good faith compliance with programming and community interest

(continued on page 27)

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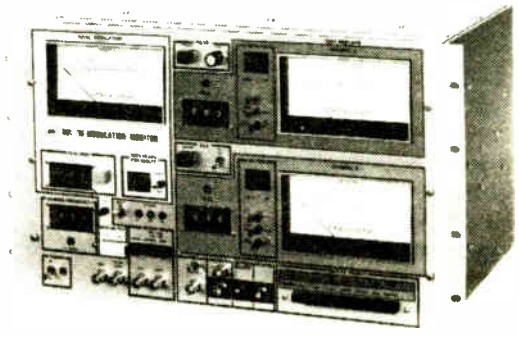

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World Radio History

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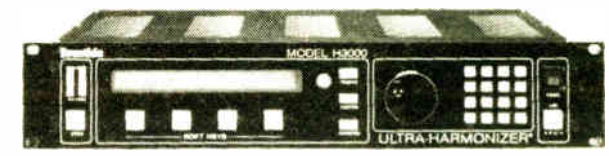

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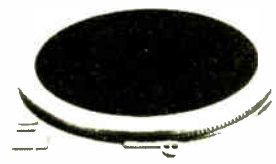

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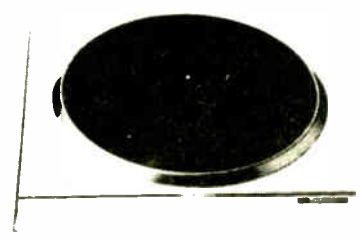

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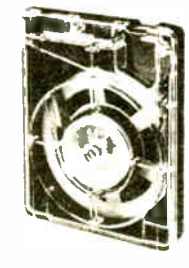

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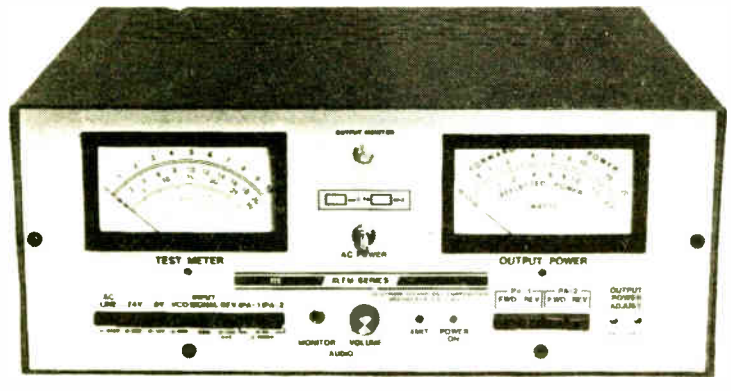

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World Radio History

Choosing Impedance Networks

by Tom Osenkowsky

Brookfield CT ... Impedance transformation can be accomplished using various types of networks. Tee and Pi networks offer the advantage of having phase shift independent of transformation ratio. An L network's phase shift is solely dependent on the ratio of resistances to be matched.

Figure 1 shows the base impedance sweep of a 102° tower with several isocouplers. A network must be chosen which will transform the carrier impedance to 50+j0 and maintain sideband symmetry.

RF Reader

In this case a Nautel 1 kW transmitter having an output network phase shift of 180° is used. Thus symmetry must occur at the transmitter antenna terminals. We will examine three network designs all having a phase shift of about −60°.

I chose this value because symmetry is best centered at this point. The component values represent real-world, standard values. In other words where a .00237μf capacitor was called for, a .002μf was used and a coil inserted in series to provide fine tuning.

Figures 2, 3 and 4 represent a Tee, Pi and tandem L network design respectively. A 15° length of transmission line is used from the ATU to the transmitter. The impedances shown include the lossless-case rotated values.

Each design has its own characteristics. The Tee design, in this case, demonstrates the best radiation symmetry even though the sideband VSWRs are not equal (at 10 kHz).

For complex cases, it is necessary to design several compensating networks to work in unison. Such designs have previously been described.

When considering the type of network to use in a DA system, pay careful attention to the overall phase shift. A series compensating network, while reducing sideband reactances, may upset the pattern bandwidth by causing radical phase departures at the sideband frequencies.

Also, up to now I have shown only the lossless cases due to the simplicity of the networks involved.

Elaborate networks need to have a detailed analysis, including voltage and current ratings for each component, and considerations given to mutual coupling between the various coils.

Careful choice of network design can yield superior results, provided all necessary variables can be accounted for.

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.*

Figure 1.

Freq	R	X
680	90	+j 151.6
670	84	+j 141.4
660	79	+j 127.4

Figure 2a. Schematic of Tee network design.

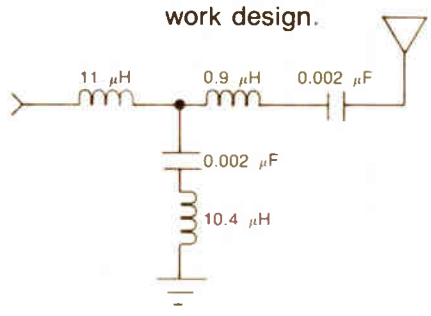


Figure 2.

Freq	R	X	Phase	VSWR	Psb	Rel FS
680	47.7	−j 5.9	−76.1°	1.14	25.8	5.08
670	50	+j 0	−75	1.00	100	10
660	47.2	+j 7.7	−71.2	1.18	25.8	5.08

Figure 3.

Freq	R	X	Phase	VSWR	Psb	Rel FS
680	49.2	-j 7.1	−76.6°	1.15	24.9	4.99
670	50	+j 0	−75	1.00	100	10
660	45.4	+j 8.2	−70.3	1.22	26.7	5.16

Figure 3a. Schematic of Pi network design.

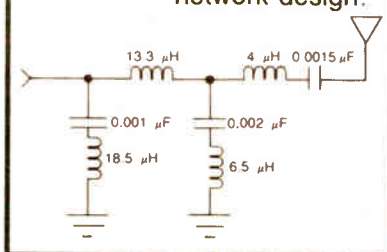
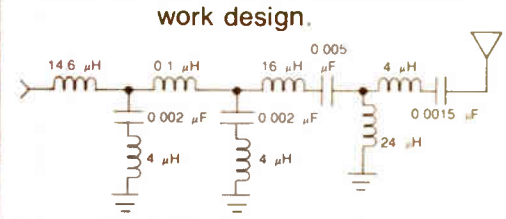


Figure 4a. Schematic of tandem L network design.

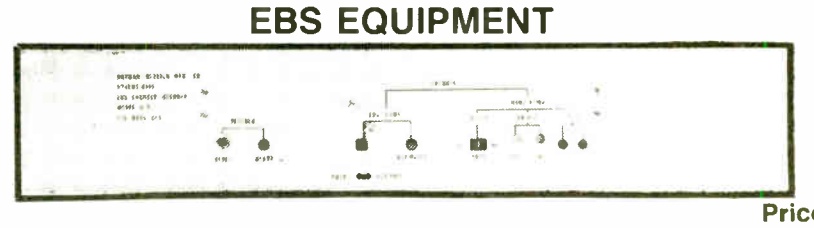


Intermediate resistance value was chosen to be 125 ohms.

Figure 4.

Freq	R	X	Phase	VSWR	Psb	Rel FS
680	45.5	-j 5.3	−79°	1.16	27.1	5.21
670	50	+j 0	−75	1.00	100	10
660	48.5	+j 8	−72	1.18	25.11	5.01

EBS EQUIPMENT



	Price
Model CEB Encoder-Decoder	$475
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Model CD Decoder Only **(REQUIRED FOR LPTV)**	$280
Receiver can be supplied to drive Decoder	$100

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World Radio History

Remote Control By Simplexing

(continued from page 19)

ing over a single line. Fear not. Figure 3 shows how this can be accomplished.

Note the need for transformers with split windings and good quality 4 μf nonpolarized capacitors.

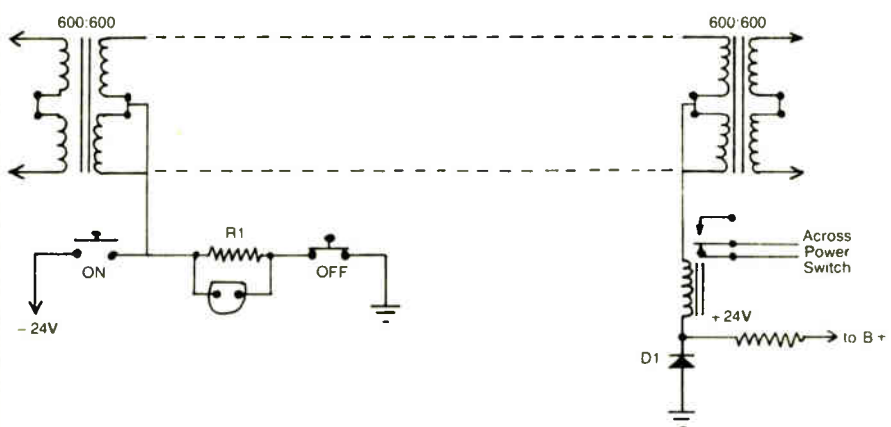
The capacitors provide a short circuit to audio, but isolate the DC from the two lines. Ohm's law and a little experimenting will tell the proper meter range and shunt resistors to use.

Carrier current broadcasters use the metering side to send back demodulated RF to insure that remote transmitters are operating properly.

The use of a simplex circuit requires DC continuity over the audio line. If you're using unequalized telco lines or your own pair, this is no problem.

Equalized lines, however, have equalizers and line amps at the telco end that will break the DC path.

Figure 2. A simplex latching circuit requires only momentary power from the control side.



If this is the case you'll have to inform telco personnel of your needs. They can usually provide a DC path around their equalizers, although an additional cost may be involved.

Low control

Control currents should be kept fairly low. A large DC imbalance on the lines is undesirable, as it can add noise and cause electrolytic corrosion of ground rods.

Sensitive relays are usually employed at the receiving end. The P&B LM 5 has always been a popular choice, and many inexpensive relays can be turned up with a normal amount of packrat activity.

More elaborate simplex control schemes are possible for the ambitious engineer. Four circuits can be controlled over one pair with the use of polarity-sensitive relays.

By using relays with different coil resistances, two or three relays can be controlled by increasing the DC control voltage.

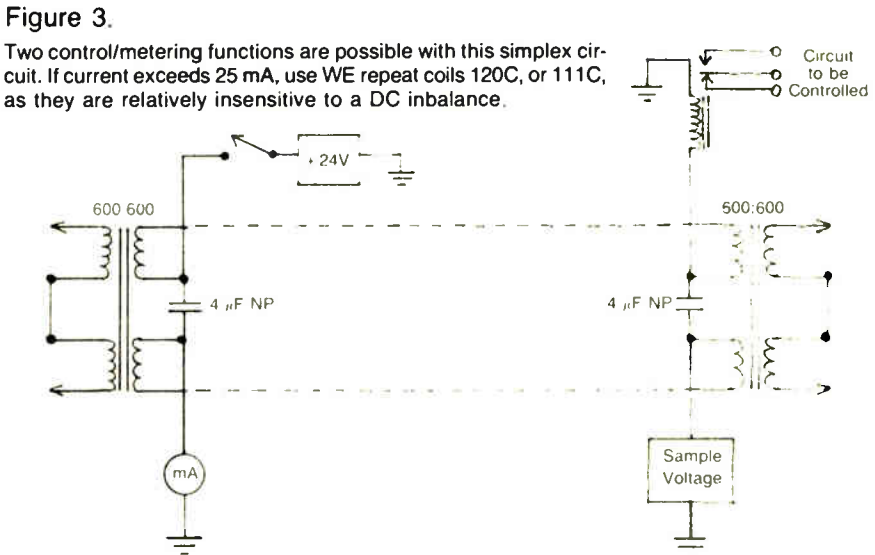
A word of caution is in order. The phone company sometimes has maximum voltage and current specifications for simplex operations over their telephone lines.

Typically these are 50 V and 350 ma. Check with them while your project is in the early stages.

Although the simplex is a very old technique, it still has many useful applications for simple control and metering over a balanced audio line.

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

Figure 3.
Two control/metering functions are possible with this simplex circuit. If current exceeds 25 mA, use WE repeat coils 120C, or 111C, as they are relatively insensitive to a DC inbalance.



Splatter matters.

Splatter is a form of radio interference that can drive listeners away from AM radio. It creates distortion in your signal, wastes transmitter power on undesired sidebands and interferes with other stations. Even with an NRSC audio filter, misadjustment of the transmitter or audio processing equipment can still produce an RF spectrum that can exceed NRSC or FCC limitations.

That's why routine monitoring of your station's RF spectrum is a must. But it doesn't mean you'll have to bust your budget on a spectrum analyzer. It just means you need the rugged SM-1 AM Splatter Monitor from Delta Electronics.

For just $2,150 you can now accurately measure your transmitter's spectral output, monitor transmitter IPM levels and make adjustments to improve clarity. An external audio input helps identify splatter sources.

The Splatter Monitor's unique offset feature tunes spectral segments for closer examination 10 kHz to 100 kHz away from the carrier. Unlike a spectrum analyzer, you can listen to the front panel speaker or your own headphones as you measure splatter levels on the front panel meter. The Splatter Monitor also has an alarm output to drive your remote control.

In this day and age where splatter matters, monitoring it doesn't have to cost you a fortune.

To find out more about the new Delta Splatter Monitor, call (703) 354-3350, or write Delta Electronics, Inc., 5730 General Washington Drive, P.O. Box 11268, Alexandria, VA 22312.

The Above Standard
Industry Standard.

DELTA ELECTRONICS

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World Radio History

Expanded AM Band Considered

(continued from page 3)
and egg thing."

LaFollette noted that he has been called by "a few" automobile manufacturers interested in including the expanded band in car radios.

"The general indication I've received is that essentially all they need to know is when the band is going to be implemented," he said. "They see no difficulty in incorporating the design changes in the receivers."

In any case, all interested parties are anxious to move the issue along. Said Johnson, "There isn't much time, only two years. I think the Commission wants to go as quickly as it can to get the final rules to implement the agreement, because everybody knows what the potential possibilities are."

FCC seeking opinions

First though, the FCC wants broadcasters to understand and comment on the details surrounding AM band expansion, many of them still somewhat hazy. The agency presented a full discussion of the issues involved in the expansion in its Fourth Notice of Inquiry, Docket 88-72.

Questions the FCC has posed regarding national licensing include its economic advantages and disadvantages, public interest gains and losses, and differences in location of stations and their power levels if nationally licensed.

The Commission asked to what extent national licensing would likely lead to station locations, power levels and interference levels that better match listeners' desires than would FCC-imposed station parameters and separation distances.

The Notice also sought to determine the pros and cons of permitting interference levels to be determined by national licensees, and the additional statutory authority necessary to implement the concept of negotiated interference rights.

The FCC also wanted comment on who should be eligible to participate in the Commission process of granting a national license and whether the FCC should accept petitions to deny from all listeners nationwide.

Moreover, who should be eligible for one of the frequencies? "There has been considerable demand for broadcast facilities in the 1605 to 1705 kHz band," the FCC wrote. "Much of this demand emanates from such groups composed of and/or representing minorities, women, public broadcasters and daytime-only licensees seeking full-time operation."

The Commission asked if the new spectrum should be available on equal terms to all categories of applicants, or if one or more channels should be reserved for certain types of applicants. Also, should application criteria be structured to favor unserved or minimally served areas?

A number of travelers information stations currently are operate at 1610 kHz. The FCC has suggested moving them to 1700 kHz, and asked for comments on such a move.

Because of the 10 kW power limit as well as the absence of skywave coverage and the limitations on groundwave signal propagation on these frequencies, the Commission stated that a clear channel approach is not feasible on the expanded band and asked if there should be only one class of station in the expanded band, and whether it should be Class III or Class IV.

New class

The FCC offered for comment as a possible alternative, the formation of a new Class V station with a minimum power of 250 W and a maximum power of 10 kW.

In view of the poorer groundwave propagation at the higher frequencies the Notice asks if there should be a minimum power of 250 W, or alternatively, should a limit higher than 250 W be established. Should such power requirements apply to all channels, the FCC asked.

In implementing the expanded band, the FCC acknowledged that it must balance the number of stations against the interference levels that will result. Is it reasonable, the agency wondered, to require a US applicant to provide more protection to an existing US station than to its 3.3 mV/m contour? And in providing for the protected nighttime contour, should the Commission divide the US into zones with varying protected contours in the different zones?

The Commission also questioned its current techniques for measuring groundwave and skywave propogation, and asked which curves would best be used in the expanded band.

In discussions concerning coverage, the FCC asked if stations in the expanded band should be required to meet a city coverage requirement, and if so, during what hours.

At the Rio meeting, the US supported the allotment of stations in preference to assigning them, however, it invited comments on the criteria of such.

Regarding applications for the band, the Commission asked if it should adopt a first-come-first served processing system, and how it might be tailored to national licensing. It also sought comments on how long the filing period should endure.

For more information, contact Wilson LaFollette at 202-254-3394; or Wally Johnson at 202-824-5660.

FCC Looks at Renewals

(continued from page 23)
standards, and that it has not seriously violated FCC rules that might otherwise demonstrate a pattern of abuse.

Alternatively, the Commission suggested granting an incumbent a renewal expectancy based singly on its exhibition of good faith compliance with various statutory and regulatory standards. Programming obligations would be examined only if doubts or questions arose.

Under this approach, said Commissioner Patricia Diaz Dennis, "the Commission will no longer assume the role of the television critic, evaluating the quality of each program. Such an approach could potentially allow us to apply a more consistent set of standards and to complete hearings more quickly, while still giving challengers their full legal rights under the Communications Act."

The FCC also sought comments on whether certain comparative criteria currently used in comparative renewal, such as diversification of ownership, should continue to be used in their present form in the renewal context. The Commission proposed retaining integration criterion without altering included enhancement policies of minorities and females.

For more information, contact the FCC's Andrew Rhodes or Tatsu Kondo at 202-632-6302.

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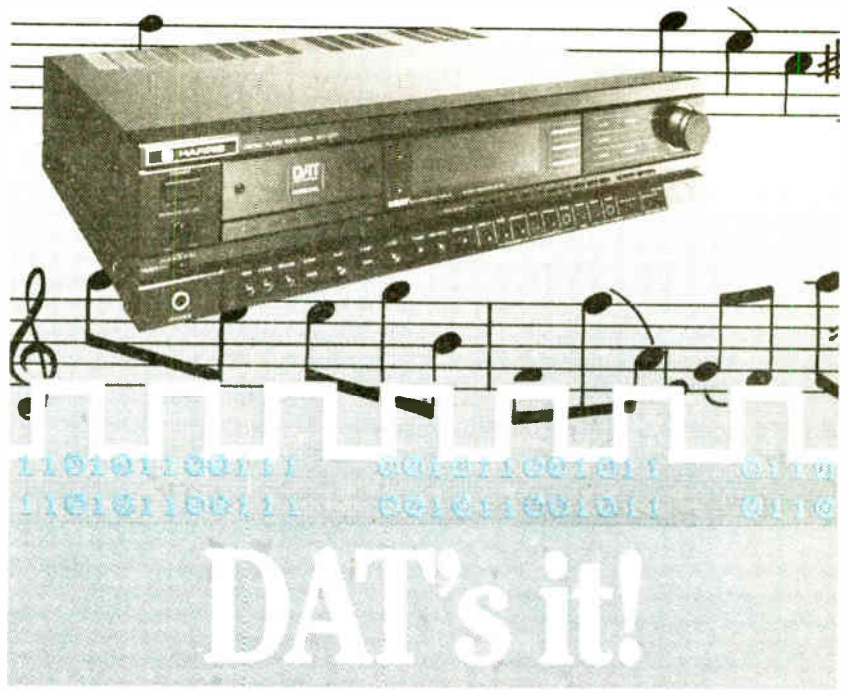

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- There's an optional hardwired remote control for added ease of operation.
- The Forward/Back Skip function permits rapid search and playback of any cut on the tape.
- The Block Skip functions let you skip whole blocks of unwanted program material.
- There's a multi-function counter, including memory, high-speed cue/review and more.

In short, DAT is it.

Whose DAT? Harris' DAT, of course. We pioneered digital technology and continue to bring you leading edge developments as part of our commitment to the broadcast industry. It's available from Harris or Allied Broadcast Equipment.

For complete specifications on our competitively-priced, broadcast quality DAT, write: Harris Radio Sales, P.O. Box 4290, Quincy, IL 62305-4290, or phone TOLL FREE: 1-800-4-HARRIS, Extension 3015.

HARRIS

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World Radio History

Broadcast Assets Reevaluated

by Charles Taylor

Washington DC ... The broadcasting industry and the US Treasury Department have agreed to work together on methods of effectively determining depreciation of radio and television station assets for tax purposes.

The Treasury Department's Office of Depreciation Analysis (ODA) has a mandate under the Tax Reform Act of 1986 to conduct studies of all tangible depreciable assets, which the department discussed with broadcasters—including radio, TV, cable, law and production concerns—at an initial meeting in March.

In a follow-up meeting in June, the two groups aired concerns and discussed potential compromises that would provide Treasury the information it needs without overburdening broadcasters.

Foremost in the discussion was how ODA can best acquire records on what happens to equipment that broadcasters dispose of, including to whom it was sold/given to and its condition. Initially, ODA proposed gathering such information through an exhaustive questionnaire, which it presented in rough scale at the March meeting.

Broadcasters, however, voiced resistance because "there's a lot of equipment in a station, and broadcasters typically don't keep their records that way. They have no real reason," according to Mark Fratrik, NAB financial and economic research director. "The level of detail they want is just very difficult for most broadcasters to supply."

One network representative estimated that the questionnaire proposed would take between 60 and 75 days to complete.

Treasury was alarmed by the estimate, responding that it did not want to encumber broadcasters.

"We started with a very complex questionnaire knowingly," said an ODA spokesman. "We've hoped to work it down into something more manageable and we're quite open to do so. It's clear that more work needs to be done, but I feel we can end with something that both we and the industry feel comfortable with."

The Treasury Department suggested a number of alternatives, including dropping some of the questions and gathering its information from outside sources.

"Some mix of field study with survey techniques might make life a little easier," said the Treasury spokesman. "There is generally information available on assets being offered for sale and we might be able to utilize some of that information."

He also suggested collecting some of the information through station visits, using the data gathered as a representative sample.

. . . the questionnaire proposed would take between 60 and 75 days to complete.

The spokesman stressed that the Department of Treasury intends to work closely with broadcasters. "There is no specific timetable. If they need more time, then we'll take more time."

The groups also discussed the inclusion of cable companies and independent producers in the study, since those groups use some of the same equipment as radio and television stations.

"Producers use a lot of the same equipment that stations do and local cable systems use some of the same production equipment as broadcasters," NAB's Fratrik said. "We had the argument that there should be a level playing field for all firms using the same types of equipment."

The Treasury Dept. is discussing the issue with the cable and production industries before it reaches any conclusions.

While ODA did not commit to any estimate on when the questionnaire might be ready for broadcasters, it was estimated at the March meeting that it would take about a year.

For more information, contact Lowell Dworin at ODA, 202-566-8563; and Mark Fratrik at the NAB, 202-429-5377.

CD Music Libraries For Production

(continued from page 22)

There are 12 Novelty 60s with 30-second versions. These are all pieces with a sense of humor. My favorite is the "a capella" barber shop quartet which "oooos" a great arrangement.

The Specialty Tracks CD offers 30 international, occasional, jazz, gospel, classical, broadway and other 60-second tracks.

This is a collection you won't use often, but can't do without.

As with all of the music tracks, there are 30-second versions with additional index cue points. This is a collection you won't use often, but can't do without.

Musically this is a well-rounded package with a good balance of rock, country, mainstream and even a few "new age" sounding arrangements.

Because I also produce music for commercials and artists, I have certain preferences for instrument sounds. One of the few problems I have with the Century 21 package is the cymbal sounds.

I prefer my cymbals to go "Sssss," some of theirs go "Shhhh." Some of their snare drum samples don't have the sound I would pick. This is a personal thing for me; let your own ears be your guide.

Created for spot

EQ and production-wise the Century 21 collection is not as open sounding on the high end as the DeWolfe or Network libraries, so a little judicious EQ may be necessary.

Unlike some other libraries, this package has been created specifically for spot production. Not only are the beds of the appropriate length, they also sound "commercial."

This doesn't mean they can't be used for A/V work. It does mean that if the A/V segment you're working on is more than 60-seconds you'll have to do some editing.

The table will show you more of the specifics of each disk. Note that Century 21 has two additional six CD production libraries—Laser Lightning and Generation III—and a new double CD sound effects package.

Rates for radio stations are based on market size and range from $100/month to $300/month. After the third year, you can buy out the library for an additional yearly payment.

Production houses may purchase the discs of their choice for $20 each and pay $35 for non-broadcast use and $50 for annual broadcast use. For more information call Dave Scott at Century 21 Programming in Dallas at (800) 527-5959.

Ty Ford, audio production consultant and voice talent can be reached at (301) 889-6201 or by MCI mail #347-6635.

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007	027	047	067	087
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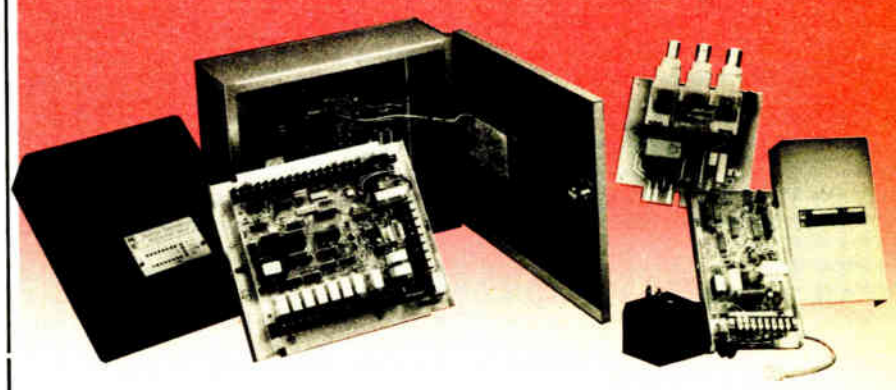

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World Radio History

BUYERS GUIDE

Studio Audio Equipment

AKG "Effect-ive" at WBCN

by Marty Acuff, CE
WBCN-FM

User Report

Boston MA ... WBCN is engaged in rebuilding its facilities with the goal of added practicality. In our main production studio AKG's ADR 68K digital audio processor fits very well into that objective.

There are a number of digital effects boxes on the scene with a variety of features and price tags. In mid-priced digital processors the ADR 68K is a prime value.

The ADR 68K is a versatile reverb and special effects processor with excellent sonics, ease of use and flexibility as an all-around audio processor.

The device comes in two parts: the main processing assembly and the remote unit. The main processor is rack mounted (EIA, two units or 3.5") and needn't be mounted near the operator. This is an important space-saving feature for close-quartered studios.

With the exception of the primary power switch all functions are controlled on the remote unit: a keyboard and display package (measuring 11"×9"×2.5") convenient for tabletop use.

XLR input and output connectors

All audio connections are made to the main processor. The ADR has XLR-style Hi-Z balanced inputs (transformerless) used as stereo or dual mono, depending on the application. Input sensitivities can be changed from the factory set +8 dBm via jumpers.

The four output connections are also XLR type: Main Left and Right, and Aux Left and Right. The outputs are active balanced +17 dBV maximum.

The pin connections conform to European standards (pin #2 is high, pin #3 is low and pin #1 grounded). Also included are MIDI in, out and thru connections.

The "mainframe" and remote connect with 6-pin DINs and the factory supplied 50' cable. Lengths of up to 100' are possible. The remote unit has four ¼" tip-ring-sleeve standard jacks on the rear panel used for triggering from foot switches, synths, etc.

AKG's design philosophy of making a completely software-based processor is perceptive. Since the processing isn't dependent on hardware, upgrades are much simpler and cheaper; the ADR will stay current through updates instead of becoming obsolete.

No simulated stereo

The ADR 68K is also *true stereo.* Most low-cost digital effects processors are mono input/simulated stereo output. Some of those try to fool us into thinking that they're full stereo inputs by having left and right input connectors. These low cost processors act on the L+R internally summed audio. Beware!

Marty Acuff, CE, WBCN radio, poses with AKG's ADR 68K

Photo by Mim Michelow

The ADR at WBCN has enough internal memory to allow audio samples of about 8 seconds, expandable to 32 second samples.

The back-lighted four row LCD display is easy to read. Each program usually has several pages of parameters that are easily scrolled with the cursor buttons. The program menus naturally direct new users to desired effects, while quick direct access to programs is also available.

The manual is thorough in its discussions. Brief theory sections on reverb and sampling are provided to aid the new user. MIDI basics are also covered; most broadcasters aren't up on MIDI ... yet.

The manual also covers field service such as installing software upgrades, power supply problems and troubleshooting hints. A condensed theory of operation is also provided.

As for repairs, the best thing I can say about this product is I don't know, it hasn't broken.

The ADR is exceptionally powerful in its capabilities. There are 11 main categories, or banks, of functions: Plate, Chamber, Room and Hall reverbs; Splits, Sampler, Reverse Reverb, multi-effects, stereo processing (of mono sources), Chorusing and DDL (digital delay lines).

Factory presets sufficient

Many production people will find the factory presets sufficient for their needs. The internal and cartridge presets are available for storing user defined parameters. (The cartridge is removable for use in other ADR 68Ks or additional cartridges can be assigned to each production person.)

A total of 50 registers are available in internal and 50 in the cartridge presets.

Defining presets is quite easy. Each bank (with the exception of Sample) has a number of parameters that allows the user to shape the sounds to his or her own liking.

The parameters are usually controlled with a linear fader-like slider or button. With up to 48-user programmable parameters in each reverb or effect, the ADR 68K has vast potential for the creation of custom effects.

But not everyone has time to program his or her own effects. For this reason, AKG has provided over 100 factory preset sounds. Many of these presets are available with just one or two keystrokes.

AKG provides a huge variety of sounds, from warm and natural reverberating spaces to crazy pitch-changing echo effects. The factory presets are logically arranged so that you do not have to spend a lot of time hunting around to locate a desired effect

Reverb variety

The ADR 68K includes six different kinds of reverb, each simulating a particular sound situation. The parameters control the apparent size of the room, the decay time and even simulate the type of materials that make up the walls!

(continued on page 31)

BUYERS GUIDE INDEX

User Reports:

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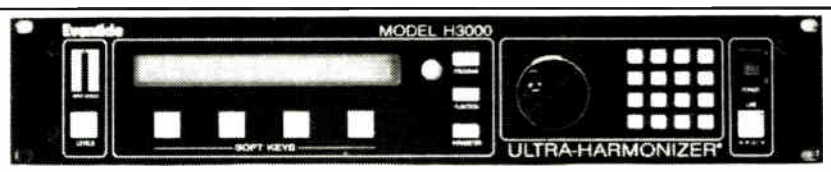
BUYERS GUIDE

Eventide Wins Production Points

by Bill Karambelas, Co-owner
Chicago Broadcast Services



The Eventide H3000 Ultra-Harmonizer

Palatine IL ... The Eventide H3000 Ultra-Harmonizer is the newest entry in the battle of effects processors. But don't let the name fool you!

Eventide, a company with a reputation for its high quality pitch shifters, has just taken a giant leap forward. Not only has the company vastly improved the abilities of this box as a Harmonizer, but it also comes loaded with some dynamic effects.

When we began shopping for an effects processor, we had a pretty good idea of what we were looking for. Like everyone else, we need to stay on the cutting edge of the latest wave of digital mania.

We wanted a strong reverb program, a good delay and a pitch shifter to help cram those spots that accidentally run 65 seconds down to 60. We also wanted a box that would give us those wild "Max Headroom" type of effects that have become so popular.

When we got our first glimpe of the H3000 at last November's SBE convention, our search came to an end.

The unit arrived in mid-March and the fun began. I say began because here it is July and I'm still constantly discovering new variations of the factory algorithms.

The H3000 software has 11 algorithms and 58 factory presets derived from the algorithms. It should be noted that the factory has left open ROM slots for future expansion.

Before examining the algorithms in further detail, let's first cover the front and rear panel controls and connections.

Input levels are programmable and are monitored by means of a bar graph display. An alpha-numeric display provides program and parameter information.

User Report

A combination of seven other push buttons allows you to select parameters which can be edited by a numeric keypad or by a rotating knob.

Total relay bypass is also available at the push of a button. Inputs and outputs are balanced differential and terminate to XLRs.

Complete MIDI control of all parameters and program selection is available. Eventide specs the H3000 as full 16-bit resolution at 44.1 kHz sampling rate with a frequnecy response of 5 Hz to 20 kHz, ±1 dB.

Now on to the algorithms. The first, called Diatonic Shift, is a very useful program for musicians.

It allows you to pick the key in which you wish to play and will automatically analyze the pitch you input, correct it as necessary and play it in tune with that key. Don't let anyone call you tone deaf again!

The second and third algorithms are very similar. Layered Shift uses a mono input to create two separate pitch-shifted outputs. The range of the shifts are two octaves down and an octave up. Mix the shifts with the original signal and you get a three-part harmony.

Dual Shift is a dual mono pitch shift that turns the H3000 into two separate Harmonizers.

Stereo Shift is designed to change left and right pitch in unison, while maintaining stereo imaging and mono compatibility.

The last algorithm in the pitch shift family is called Reverse Shift. This one takes adjustable length splices of the input material, reverses them, changes the pitch and has adjustable feedback to create some very bizarre effects.

Swept Combs gives you six high quality delay lines with up to ¼ second delay, modulation control and feedback. This program is great for flanging effects.

Swept Reverb is similar to the aforementioned program, with the addition of a reverb network. It fathers the preset

(continued on next page)

Introducing the new Orban Programmable Mic Processor

- 3-band parametric equalizer with "constant-Q" design and full notch filtering capability
- Smooth, transparent compressor with adjustable release time
- Noise gate (attenuates control room noise by up to 25dB) and compressor gate (prevents noise rush-ups during pauses)
- De-esser controls excessive sibilance

Fully processing power.

- 99 memory registers store complete control setups for instantaneous recall
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- 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.

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World Radio History

BUYERS GUIDE

AKG's Versatile Audio Processor

(continued from page 29)

We can create the illusion of anything from a small room to a canyon. Spacey effects can be created with Reverse Reverb, making audio sound like it's being played backwards when it's actually going forward (for that "Jimi Hendrix" sound.)

For the "Phil Collins' Drums" effect, gated reverb is available, which "chops off" part of the reverb tail.

The Split is a special bank of two completely independent mono in/stereo out effects at once. The split effects may be used either independently (a separate effect for different voices) or chained together to create rich, complex reverb sounds.

Two examples of this are the Plate/Hall split reverb program and the dual DDL. All internal signal paths are digital, so effects can be cascaded in the digital domain with no loss of signal quality. It's like two reverbs in one box.

A range of effects

The ADR 68K doesn't stop with reverb, but features a wide range of effects. The dual DDL bank can be configured as two completely independent delays, parallel delays (for phasing, flanging or doubling effects) or chained delays.

The Poly-Chorus bank produces chorusing, pitch-shifting, automatic panning and other effects.

The stereo processor bank has several techniques to choose from for creating a stereo image from mono source material. All of the techniques provide mono compatibility when summed back into mono.

Multi-Effects allows the user to combine many of the effects into one process, as though you had a pair of DDLs, a gate, a two-band shelving EQ, a stereo chorus, a reverb and stereo multi-tap all patched together.

This multi-effects bank is so powerful that it leaves the cheaper effects processors far behind.

Powerful sampling capability

The sampling power is truly where the ADR shows its stuff. WBCN's production staff uses sampled audio as the tag for conventional carted dubs to save time.

Sample recording may be triggered by the onset of the sound, or manually. Editing is as simple as moving a single fader.

Playback may be triggered manually, by an audio trigger (with less than 2 ms trigger delay), by a footswitch or by any MIDI keyboard.

Up to four different samples may be playing at the same time, each with a different sound and edit points. The ADR 68K also does stereo sampling. And if that's not enough the two-second samples can be used in most of the other reverb and effect modes.

AKG's ADR 68K covers most of the bases for broadcast production. At WBCN, I find that we've barely scratched the surface of it's capabilities. What's most important, though, is how the ADR 68K has enhanced our station's sound.

Editor's note: Marty Acuff has 10 years of experience in broadcast engineering and is a certified member of the SBE. He may be reached at 617-266-1111.

For more information on the ADR 68K, contact Richard Ravich at AKG: 203-348-2121.

Harmonizer

(continued from previous page)

which Eventide calls the "Death Flange"—a very unique effect.

The Reverb Factory algorithm is just that, a very powerful reverb network with six delay lines and individual EQ on each delay line. And Ultra-Tap provides a dense field of 12 delays, adjustable in length with pan and level controls.

Of the last two programs, Long Digiplex is a basic delay line with adjustable feedback, providing up to 1.4 seconds of delay, while Dual Digiplex is a stereo version with half the available delay time.

Even with all these features, operation is very straightforward. The manual is well-written and even provides sample logs for documenting your own custom presets. Speaking of presets, there is room for over 99 of your own.

As you can see, the Eventide H3000 Ultra-Harmonizer is more than just another Harmonizer.

Editor's note: After spending several years with WLS-FM in Chicago, the author formed Chicago Broadcast Services Co. with partner Ed Murphy. CBSC produces radio commercials, station ID and promo packages and syndicated programming. He may be reached at P.O. Box 162, Palatine, IL 60078.

For more information on the H3000 Harmonizer, contact Gil Griffith at Eventide: 201-641-1200.

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The Hybrid Coupler is a low cost telephone coupler that provides both "Send" and "Caller" capabilities. This unit turns the two wire telephone circuit into a four wire system. It's a perfect match for the EFT-100 or any time you need a connection to a telephone line.

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BUYERS GUIDE

(l-r) KIIS's Paul Donahue and Mark Driscoll, with Oz Productions' Jonas Olmsted manning the station's Synclavier.

Enter: Digital Work Stations

by Marlene Lane

Falls Church VA ... In the fiercely competitive major markets a few radio stations are jumping feet first into what they believe will be the production medium of the future: the digital audio work station.

The recent deal between the Gannett Broadcast Group and New England Digital signals that the time is ripe for radio to take a serious look at this leading edge digital technology for production.

Gannett-owned KIIS in Los Angeles is a beta test site for NED's full blown, $350,000 Synclavier digital sampling keyboard, optical disk and Direct-to-Disk storage systems.

Its success there has prompted Gannett to purchase NED's 8-track Direct-to-Disk system for WGCI in Chicago. More systems may be on the way.

"We are buying (the NED system at KIIS), we bought the system at WGCI, and we're probably going to buy more systems," says Gannett Director of Engineering Paul Donahue.

"At this point, we're not sure which elements of the full blown system at KIIS are going to be germane to NED's final (radio) version," he adds, "but we'll probably end up expanding the smaller version at WGCI."

Gannett may network the systems together to share the creative capabilities of the Synclavier and take advantage of the digital storage and editing capabilities of the Direct-to-Disk systems.

The Synclavier has 60 timbres, or banks of sound that come standard. These banks are not synthesized, but are actual sounds. Thus, a grand piano on the Synclavier is comprised of the digitally recorded sounds of an actual grand piano.

The nuances of the sound may also be expressed using the Synclavier keyboard. The harder you hit the key, the harder the attack of the piano note.

Industry Roundup

Sounds not standard on the Synclavier can be digitized into the system. Up to 304 sounds can be accessed from a single keyboard setting.

The system incorporates a proprietary 200-track Memory Recorder, which functions both as a sequencer for audio and MIDI events and as a software-based edit decision list for triggering live recordings.

The Memory Recorder does not store or play back digital audio data itself, but records cue information and edit decisions fed to it by the piano-like keyboard, a sound effects triggering interface or from other software interfaces on the computer terminal.

The cue events then trigger audio segments which are held in solid state RAM in the Synclavier (or Winchester disks in the case of the Direct-to-Disk system).

"The Synclavier will do for creating and editing program material, commercials and promotions what the word processor does for someone who is writing," says Mike Callaghan, CE for KIIS.

"We can move snippets of material anywhere, change the pitch, put waveforms in and take them out stretched in time and frequency and even correct mispronounciations in voice tracks," says Callaghan.

NED's entrance into the radio market was, in the words of company marketing director Mark Terry, almost a fluke.

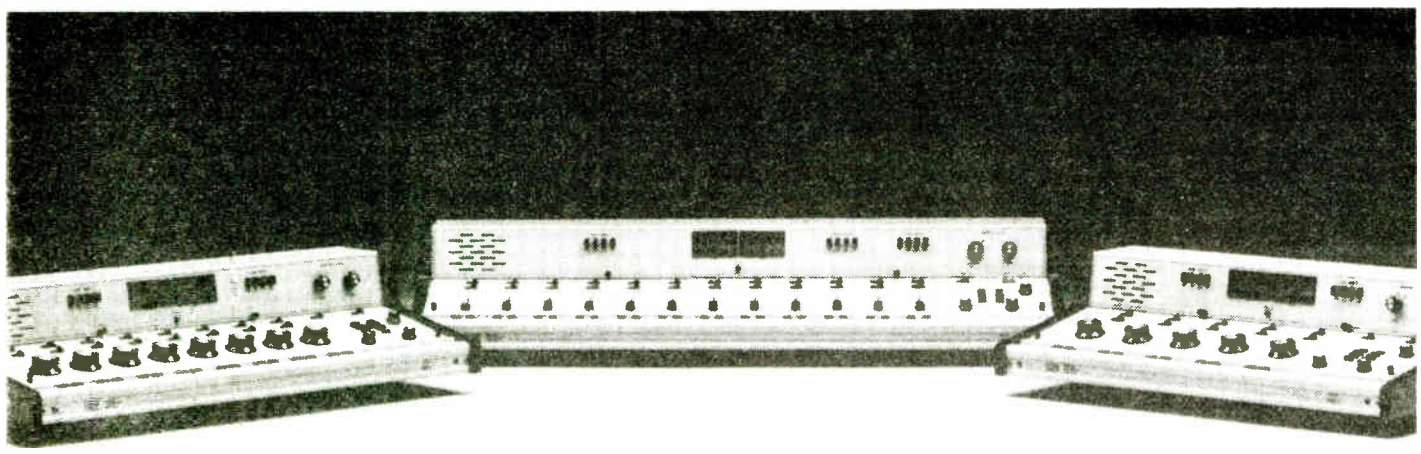
"We exhibited at NAB two years ago because we knew there would be a lot of video people there," Terry explains, "but then the radio people saw us and a lot of interest was generated."

Donahue was one of those who expressed interest.

"We got excited about the fact that we could get rid of our razor blades and leader tapes and all that nonsense that takes a lot of time," says Donahue.

NED is now aggressively pursuing the radio market, thanks in part to the encouragement of 19-year radio veteran Jonas Olmsted.

(continued on page 34)



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BUYERS GUIDE

787A Keeps Mic Levels in Check

by Ken Tankel, CE
WIOQ-FM

Philadelphia PA ... The difficulty of achieving a good live sound from studio microphones has been recognized for a long time. Air chain processing for music leaves something to be desired when it comes to live voice.

As a result, many engineers are presently using a compressor/limiter on the studio microphone. The problem with this approach is that this processor must be set for the level of the average voice.

A voice much softer than average will barely be affected, while the loudest voice will be heavily compressed. It is possible, of course, to use compression so extreme that it becomes an effect in itself, imparting to live voice a punch, presence and larger-than-life feel.

This will eliminate the inconsistencies of more moderate processing but introduces pumping, breathing and even distortion.

I think everyone would agree that asking every jock on your station to accurately reset a number of processor controls every time he or she starts an air shift is not a practical solution to this problem.

When I saw the prototype of the Orban 787A, nearly a year and a half ago, I ordered one on the spot.

The 787A incorporates a three-band, fully parametric equalizer, a gated compressor, a noise gate and a de-esser in a single package under microprocessor control.

Push button adjustment

The conventional controls of other processors (either rotary or linear pots) have been replaced by digitally controlled attenuators.

This allows all adjustments to come under microprocessor control. Adjusting this processor is done via front panel push buttons.

User Report

The compressor is the only stage that is always in the signal path. All other functions can be individually bypassed for each setup. Ninety-nine presets can be stored as numbers between one and 99.

The zero position has a permanent setup with the compressor threshold set so high it essentially will not operate. All other functions are set to off.

At any time, you can lock out all the front panel controls except the recall function. Jocks only have to enter the number of their preset. The lockout prevents any other changes.

Noteworthy options

There are several other features worth mentioning.

There is an optional RS-232 interface, making the unit ideal for use with computerized formats. A MIDI interface makes it a very powerful production tool.

Orban's Model 787A microphone processor

A simple remote control for recalling presets allows you to mount the unit anywhere.

And, finally, the microprocessor can actually control two audio sections. A slave audio can be set up to operate as half a stereo pair or as a totally independent unit.

The manual, although preliminary, does not leave out any essential information. The 787A was put in use, without problems, very quickly.

It was first connected off-line in the air studio. This gave me some time to listen to the unit and familiarize myself with the controls.

The control scheme and the use of push buttons and a display took some getting used to, but it didn't take long before I could make adjustments quickly and easily.

Next, to avoid any surprises on the air (either to our listeners or our announcers) we set the unit up in a production room and spent about 10 minutes with our announcers to get a basic processing setup for each of them.

On-air fine tuning

The unit was then put on the air. Fine tuning and equalization was done with the unit on the air so that the effect of the main processing chain would be taken into account.

We have 12 announcers on the air. A

(continued on page 39)

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.

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BUYERS GUIDE

Radio Eyes Digital Work Stations

(continued from page 32)

Olmsted, who is president of Oz Productions in Colorado, wrote the initial broadcast marketing plan for NED. He cites his influence, as well as the absence of competition and the enthusiasm of engineers like Donahue as the factors which finally convinced NED to commit to the radio market.

Olmsted is now NED's project manager for broadcast applications.

NED is working with Gannett to develop a system with features most suited to radio that will carry a lower price tag.

"We're working on a system for radio that will cost $50,000 or less," says Terry.

Although $50,000 may still sound steep to many stations, Terry and Olmsted justify that it is worthwhile.

"The technology will be around for the next 10 or 20 years," says Olmsted.

But NED is not the only player in the market. E-MU Systems is actively marketing its Emulator Three keyboard along with the Dyaxis production system (see page 35 in this issue) through Bradley Broadcast and other distributors. They are currently looking for a radio station beta site.

The Emulator Three, or EIII, is capable of many of the same functions as the NED system, says E-MU president John Bezjian, but at a lower cost.

"About $13,000 will buy you a basic system," says Bezjian.

Of course, there are tradeoffs.

The core unit of the system is, like NED's, a keyboard device which samples true 16-bit digital audio into the RAM memory. But unlike the NED with its editing capabilities, the hard disk system is used only as a storage medium.

The Synclavier can sample at up to a 100 kHz input sampling rate; the EIII samples at 44.1 kHz. The NED system contains about twice as much RAM.

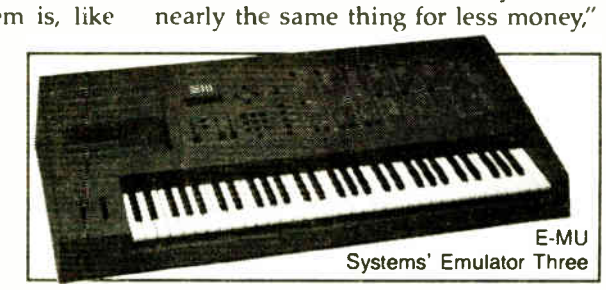
"Our system is the low end of the high end," says Bezjian.

Bezjian says that what really allows E-MU to compete at a high quality level for lower cost is its third party relationships.

"The WORM (write once-read many times disk) drive we're coming out with is being developed out of house, and we have people developing Macintosh software for sound editing on the Emulator Three as a separate company," says Bezjian, "so we don't have to tie up our R&D resources."

Bezjian believes the medium market stations will turn to the Emulator Three.

"Smaller stations are going to look at Gannett using the Synclavier and then look at the EIII and realize they can do nearly the same thing for less money," says Bezjian.



E-MU Systems' Emulator Three

Bezjian says E-MU also is developing an alternative to the keyboard which is now used for triggering effects.

"A keyboard is good for sound effects because you can map 60 or 70 of them in one location, but we are looking at alternatives—maybe pads—because we know many people have an aversion to piano keyboards," said Bezjian.

Neil Glassman, sales manager at Bradley Broadcast, says broadcaster response to the Emulator Three has been very good.

"I think it's recognized that these types of devices are not just the future, but the 'right now' of sophisticated production facilities and broadcasters know that they're going to be getting into it," says Glassman.

But he warns that broadcasters will have to learn a new vocabulary in order to make these devices work effectively and profitably in their facilities.

Other companies are also marketing their digital storage and editing systems (which may not have keyboards or sound banks, but may have MIDI interfacing capabilities) to radio broadcasters—CompuSonics, AMS and Lexicon to name a few.

All these companies say they are intent on working with the radio community. Most, including New England Digital and E-MU, plan to attend NAB's Radio '88 show in September.

"We're full force into radio and very excited about it," says Terry, who added that NED's alignment with Columbine Systems and Radio Control Systems (RCS) was meant to further the company's commitment to radio.

In radio's constant search for the competitive edge stations might find it worth their time to start exploring these digital systems now, scrutinizing their promises of increased creativity, productivity and quality. And at least to one major broadcast group, the performance already appears to be worth the added investment.

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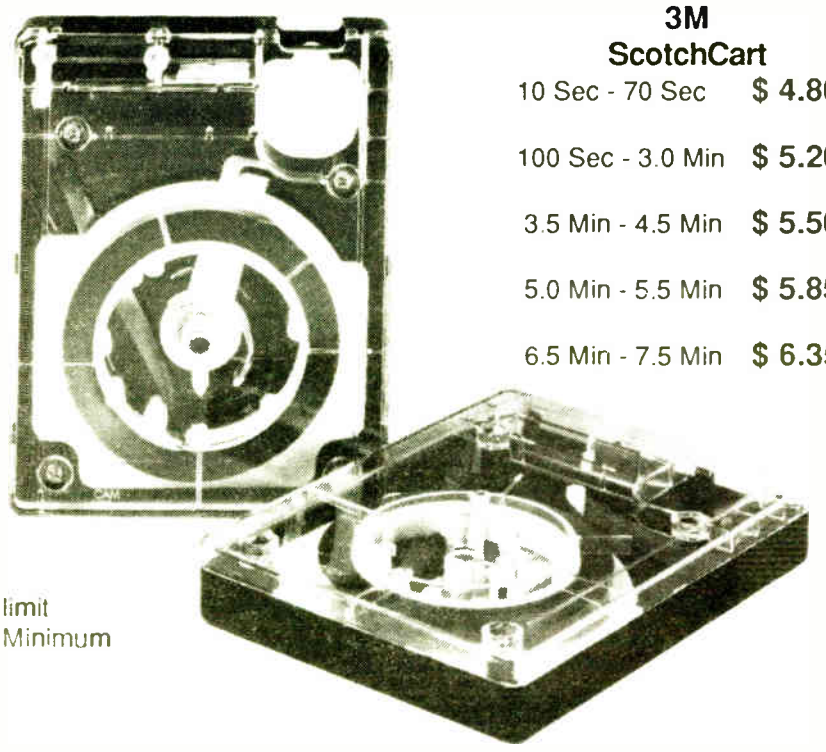

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TUNED IN

New Directions ... Field testing by **Broadcast Electronics** on a new system to provide a **synchronous FM booster** to help stations fill in holes in their coverage area caused by terrain blockage has just been successfully completed. The company was urged by several stations to develop a system since the FCC decided to allow frequency booster powers up to 20% of the main transmitter power.

The basis of the system, according to design engineer Ed Anthony, lies in the transmission of a reference frequency from the main transmitter site to a remote "booster" site. The frequency tone from the main exciter is filtered before being relayed to the booster. The reference signal is filtered again at the booster site to remove hum and extraneous noise.

The booster is being marketed as an **option to BE's FX-30 exciter.**

People ... You may have already heard the big news—**Thomas Yingst,** former president and GM of Continental Electronics, has been appointed VP **and GM of the Harris Broadcast Division.**

Yingst spent 13 years at Varian/Continental, serving as operations manager, GM/San Carlos plant, and manager, EIMAC Operations. He holds a BSEE degree from the American Institute of Technology and an MS in Physics from Franklin and Marshall College ...

On another front, **Titus Technological Labs** is doing so well that principal **Larry Titus** is leaving his position as CE of Chase Broadcasting to work with his company **full time.** TTL manufacturers the MLW-1, an automatic audio correction and routing device for radio, as well as audio products for television.

In Toronto, **McCurdy Radio Industries Ltd. just gained a new marketing manager** with a background in electrical engineering. **Omar Fattah** will be responsible for international sales, new market development and coordination of McCurdy's dealer network.

New Locations ... Because of the increased interest in **AMS and Calrec** products in the US, AMS is opening a **distribution and support office** here for the companies' entire range of products ... .

In charge of AMS Industries will be **Nigel Branwell,** who has been handling Calrec sales for six years and has been a dealer for AMS audio processors for three. No word yet on where that office will be located.

Of Special Note ... Massachusetts-based **dbx Professional Products** recently announced new **software enhancements and a major price reduction** for its RTA-1 Professional Real-Time Analysis System ...

Software enhancements include enhanced room-response curve capabilities, improved microphone calibration capabilities and customized printouts. Current owners of the RTA-1 will be able to upgrade by retrofit ... dbx has lowered the price from $6,950 to $4,500.

As you may have heard, dbx was recently acquired by **Carillon Technologies,** the same folks in San Bruno, CA who purchased **Finial.**

If you have industry/equipment news to report, send it to **Radio World Buyers Guide,** *PO Box 1214, Falls Church, VA 22041.*

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BUYERS GUIDE

IMS Gets the Blade Out of Edits

Rob Meuser, Pres
Int'l Bdcst Support Services

Hamilton Ontario ... Dyaxis from IMS (Integrated Media Systems) of San Carlos, CA, is one of the new breed of all digital production systems now available for less than the price of a good eight-track machine.

Price in the world of digital audio is established by two primary factors: the cost of hardware development and manufacturing and the cost of storage, both disk and RAM.

Today disk storage is tumbling in cost and increasing in reliability. And while RAM is still costly, it appears to be on a downward price trend.

IMS has tackled part of the price problem by using readily available hardware where possible. The Dyaxis hardware is in the form of a Macintosh computer (of any flavor).

The entire Dyaxis system is comprised of an A/D, D/A converter box, the disk drives and the Mac.

The high quality converter unit accepts balanced inputs at normal studio levels and outputs the finished product in the same form. Additionally this unit can be equipped with MIDI, EBU/EBS interfaces and SMPTE time code.

The converter interfaces to the Macintosh via a serial port for control and via the SCSI bus for the actual digital audio patch. The disk drives, mounted in a separate unit, attach by SCSI.

Smarts for Dyaxis come from the software in the Mac. Mac Mix is normally supplied with the system.

With Mac Mix, you can perform editing that will instantly convince you never to return to the razor blade. Recording and multitrack mixing is also available. Up to 100 mono or 50 stereo tracks are possible.

Editing in a window

The relationship of mixing and editing changes with such digital systems. For one, editing is done graphically in a window which displays a replica of the sound files' amplitude and can show anything from a few milliseconds to several minutes.

Each edit can be done in one window, and then copied to another. Therefore, one base file can be split into many windows, each with its own special edits.

Since these edits are really only jump instructions in the computer's memory, they can be changed over and over in order to achieve the exact cuts you want.

In the end, the base sound file is still unaltered and ready for more abuse.

Using multiple windows, complex edits will actually be performed as mixes. Because we have an abundance of tracks as well as the ability to re-mix without degradation, such an approach opens new possibilities for radio production.

After the edit windows are placed into the mix window, you can move the individual segments around in order to perfect your timing.

If you re-edit an edit window, that change is reflected in the mix. The operations in Mac Mix are different than the traditional analog methods, but they stand well on their own.

Technology Update

If you are very persistent, you could employ Dyaxis to be the ultimate digital signal processor. The envelope function permits point-by-point alteration of the amplitude window of your sound files.

You could use your knowledge of what that sound actually contains and alter it accordingly—no more messy time constants!

Software enhancements

In addition to Mac Mix, other software such as Cue Sheet and Alchemy broaden the capabilities of Dyaxis.

Cue Sheet allows Dyaxis sound files to be placed in an event window and cued in exactly according to either time code or MIDI commands. Alchemy allows for digital filtering, resampling, reversal, reverb, envelope modification and more.

Dyaxis is an economic way to begin building your digital production room. The system is available for $9,000 to $12,000 with reasonable amounts of disk storage. All you need to add is a Macintosh.

In actual operation, Dyaxis defies technical nit-picking. The measurements are typical of a 16-bit digital system, i.e., near the floor of your test equipment. At 48 kHz sampling, audio response is past 20 kHz.

Operationally Dyaxis is a new experience. Some operators love it, others are shy of a new technology and take more time to become comfortable with it.

At one station consulted by IBSS, the staff put all music editing and special production on Dyaxis within one week.

Editor's note: Rob Meuser is a frequent contributor to **RW.** *He may be reached at 416-526-8200, or via MCI Mail at 325-3672.*

For more information on the Dyaxis, contact Jerry Kirby at IMS: 415-592-8055. Dyaxis is marketed in Canada by Digital Audio Technologies (DAT) of Hamilton, Ontario.

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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World Radio History

BUYERS GUIDE

Sonex Offers Sound of Silence

by Spence Burton, Tech Mgr
Alpha Audio

Richmond VA ... When it comes to the on-air sound of a radio station the acoustic environment of the control room is just as important as the subsequent signal path.

Many a chief engineer has worked long and hard to optimize the broadcast signal only to find that each improvement makes poor control room acoustics more apparent.

In some cases stations may have to broadcast from a temporary location with acoustics similar to a closet, or worse, a bathroom. Other times, you are simply looking for a technique that will give your station's on-air sound the extra polish that will set it apart.

Improved sound at the source (the announcer's microphone) depends entirely on optimization of the ambient sound environment for speech intelligibility.

The problem of enhancing speech intelligibility has been extensively researched.

Key parameters are SNR, reverberation time, distance from the source, source misalignments, reflections under 1' of path length difference, and reflections that are late in time (100+ ms) and higher in level than energy near them.

Except for source distance and source misalignment, each of the above parameters will be affected to varying degrees by the acoustic treatment of the control room walls.

Note that three of the remaining parameters deal with reflection and reverberation. The same absorbent materials that control these characteristics will improve the SNR by reducing the overall sound level in the room.

Technology Update

Alpha Audio Acoustics offers Sonex as a solution to broadcast acoustics problems. This foam material converts sound to kinetic energy using both absorption and dissipation.

The patented Sonex surface contour is based on the acoustically optimal anechoic-wedge shape. It is light, easily cut and attached to the wall, comes in a variety of colors and meets applicable building and fire codes.

As an absorber, Sonex exhibits the required broadband characteristics. You can even "tune" Sonex to achieve maximum absorption at your trouble frequencies by selecting from various thicknesses offered.

Research has shown that the 2 kHz frequency area is critical to speech intelligibility. This point is often missed when calculating NRC (noise reduction coefficient) performance, which is an average figure.

As a general approach to control room treatment a modified version of the live-end/dead-end concept has been found to be successful.

The room is divided into a hard-surfaced, reverberant "live-end" and a soft-surfaced, absorbent "dead-end" using Sonex to line the walls.

The announcer sits in the live end of the room (or at the boundary) facing the control room glass. The microphone faces the Sonex-covered end so that little room reflection is picked up.

This approach gives the announcer pleasant reverberation off the live end of the room, yet the effect on the broadcast sound is negligible due to mic placement. At the same time the absorbent, Sonex-lined dead-end of the room maximizes speech intelligibility.

With some fine-tuning, Sonex can help you to achieve the combination that will result in a noticeable difference in the sound heard by your station's audience.

By the way, if you ever do have to do that remote in a closet, bring Sonex along. It's very portable.

Editor's note: For more information on Sonex, contact Nick Colleran at Alpha Audio: 804-358-3852.

WPHR Gives High Marks to JBL

by Dick Satterwaite, CE
WPHR-FM

Cleveland OH ... How many decisions does an average broadcaster engineer make in a work day? Now imagine that same engineer designing and building an air studio. What's the decision count now? The number is mind-boggling.

I have always thought that laying out a studio starts with the intended purpose. From there you decide on equipment, progress to physical positioning and eventually to the interfacing of the equipment within the studio.

Decisions on individual items are based on many factors: availability of existing equipment, price, function, dependability, practicality, appearance and operator acceptance.

So when WPHR decided to design and build a new air studio, we first put together a list of the equipment we wanted, and then called Dave Kirsten of Broadcasters General Store for his suggestions.

User Report

Open to suggestions

We put together a package that was, for the most part, pre-selected. Dave was very helpful in areas where I had no preconceived opinions and was open to some experimentation.

One of these areas was in monitor speakers.

Dave suggested we use JBL speakers. After hearing the dimensions of the room and our intended use, he further suggested the Model 4408.

Our application is an air studio in a relatively small room. WPHR is a CHR format. Its slogan is "Power 108." I sometimes think that it stands for the dB level required of the studio sound system to satisfy the rock-jocks; anything below the threshold of pain is not acceptable.

So we selected JBL speakers which had the power handling capacity to satisfy the announcers and the frequency response to please everyone.

No blown speakers

The close field dispersion of the JBL model 4408 is perfect for our room and application. The power rating frees me from worrying about blown speakers and the fidelity tells me that we are hearing a faithful reproduction of both our console and air monitor audio.

High quality components used in the manufacture of the speakers, along with the JBL warranty, assures us years of trouble-free operation. The low cost amazed everyone.

As a broadcast engineer, speaker design is not a primary interest. I leave that to the sound system people and the recording studio engineers. My concern is what works for broadcasting studios.

The JBL Model 4408 fit in that slot.

Now it's decision time again. How many do you buy? We bought six, two for now and four to be used in the next phase of our expansion.

Editor's note: Dick Satterwaite has been an engineer since 1956, and has worked for WPHR since 1973. He has built and/or completely remodeled 12 studios, and designs and builds all his own studio cabinets.

For more information, contact Bill Threlkeld at JBL: 818-893-8411.

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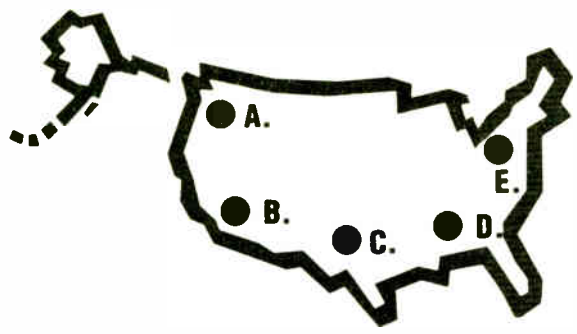

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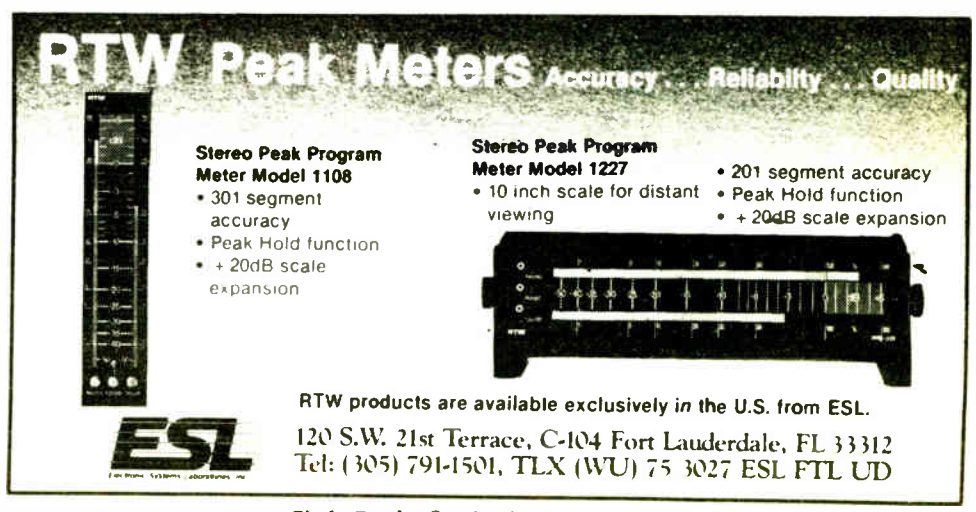

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BUYERS GUIDE

Micro FX: Big Sound, Small Size

by E.F. "Doc" Michaels
Audio Consultant

Joelton TN ... Valley International, those Tennessee folks famous for VCAs, the now-ubiquitous Model 400 Microphone Processor and most recently the DDP (Digital Dynamics Processor), have pulled another rabbit out of their collective hat.

The Valley Micro FX line of signal processors marks a departure from the ongoing rush toward more complicated audio gear and high-tech solutions to common production problems—which are both accompanied by ever-expanding price tags.

The new line includes a "booster" box, attenuator, noise gate, compressor, de-esser and one-way noise reduction box.

The booster box connects −10 dB hi-fi gear and −20 dB instrument and synthesizer feeds to +4 dB or +8 dB balanced lines; the attenuator performs exactly the opposite function without unbalancing the +4 or +8 line.

The noise gate is useful both in recording and for special effects. The noise reduction box is a good-sounding gadget that has lots of uses.

The entire product line comes packaged in identical black, anodized, extruded aluminum housings designed to withstand anything short of a direct lightning strike or close-range multiple hits from large-bore weapons.

Interlocking units

As an added attraction, these sturdy little boxes interlock, and three of them fit side by side in a 19" wide rack pan which occupies only 1 ¾" of vertical space.

This feature provides flexibility similar to modular processors but without the overhead of a powered rack enclosure.

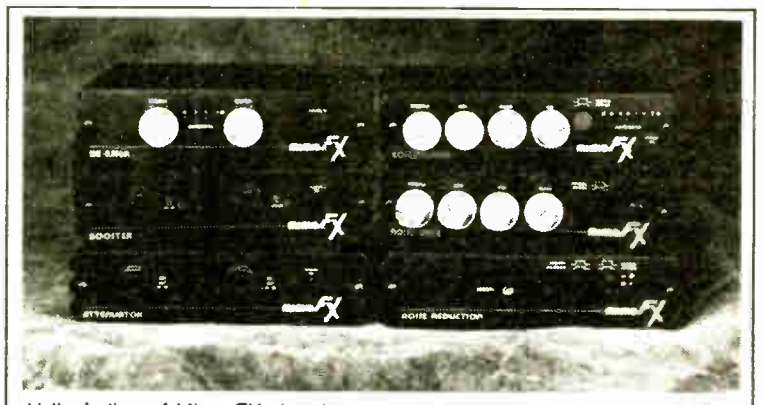
Hook up is handled through ¼" three-conductor (stereo headphone-type) jacks, with XLRs and phono jacks where appropriate.

User Report

The only down side to this packaging format is the use of an external plug-in transformer, complete with trailing cord and calculator-style plug.

As we all know, installation of equipment using these things calls for appropriate Anglo-Saxon utterances, but the RF decoupling is quite adequate, and it's (ahem) a small price to pay in order to pay such a small price!

Of particular interest to broadcasters are the compressor, de-esser, and noise reduction units.



Valley's line of Micro FX signal processors.

Just like the pros

In use, these boxes respond pretty much the same as their big brothers in the Valley pro audio line.

That's no surprise since the internal circuitry, including the Valley VCA, is identical to that used in the regular Valley processors. As a result, you can be sure these boxes do nothing to your audio except what you want done to it.

The compressor delivers smooth dynamic control of most types of musical material and voice. It sounds great on mixes.

When used judiciously, the compressor imparts plenty of loudness to the processed signal without causing it to sound strained and squashed.

Since the compressor is capable of adding gain to low-level signals (as are all *true* compressors), Valley has included an interactive expander—a kind of soft noise gate—to reduce the noise level when no signal is present.

Although no direct control of the expander is possible, it works well for the great majority of uses.

A word of caution is in order at this point: the Micro FX compressor design creates a unique transfer curve which causes progressively less gain reduction as the input signal rises above the threshold.

Compressor, not limiter

Combined with the linear integration detection used internally, this scheme makes the compressor impart plenty of

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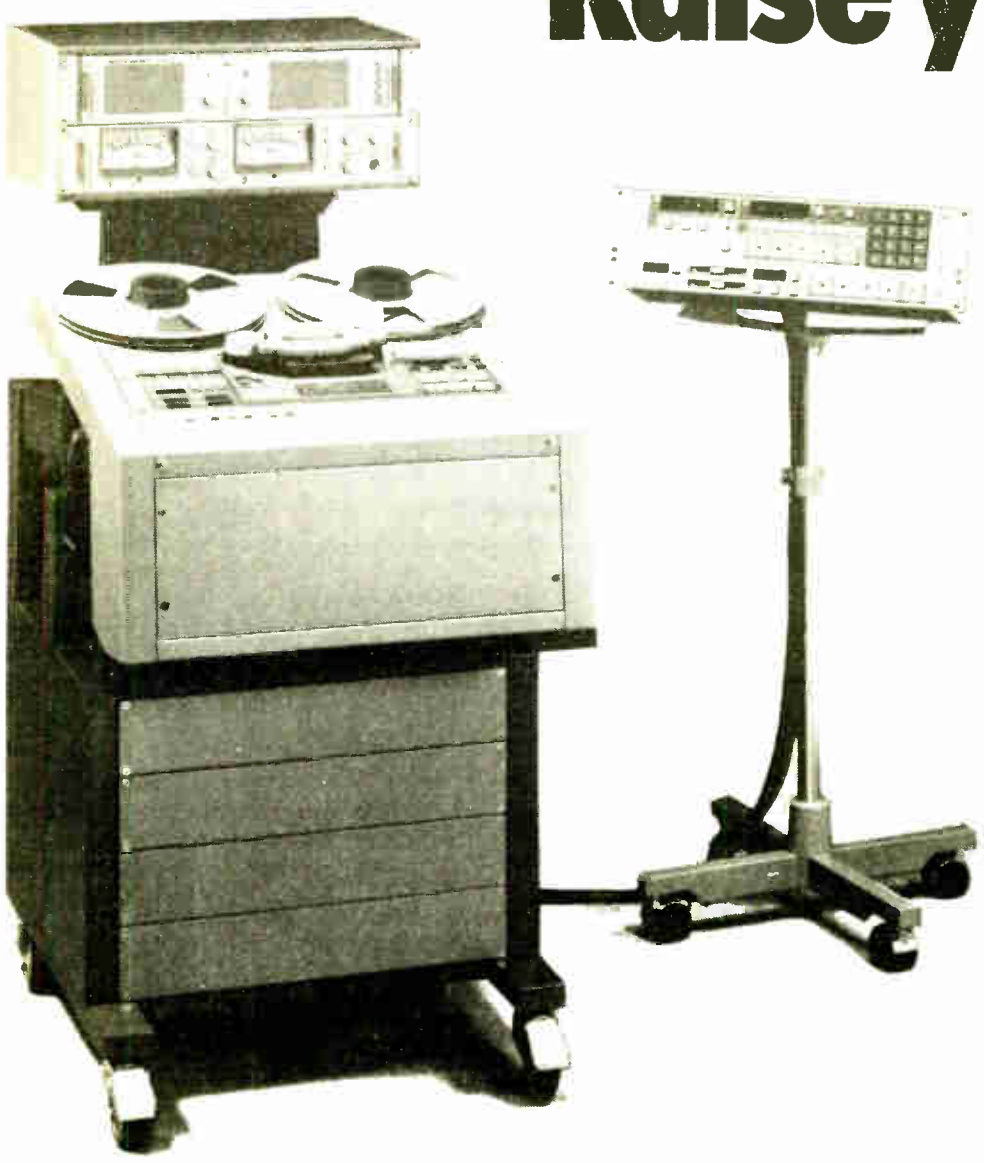
Raise your standards.



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.

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TASCAM

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BUYERS GUIDE

Micro FX Units Deliver Big Sound

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vocal punch and gives it a warm, musical sound when used on mixes or instruments. But this box will not limit the signal, so don't expect it to.

The de-esser is a simple, side-chain-equalized unit which works very well on spoken word. The de-essing action is smooth and free of the high frequency loss caused by "dipper" type units having filters in the audio signal path.

The two controls labelled Sensitivity and Frequency are at first a little confusing, since they, like all other Micro FX controls, lack any markings.

After using the device, one soon begins to think of them as "how much" and "when," and the operation becomes really simple.

As with any de-esser, with the notable exception of Valley's DSP (Dynamic Sibilance Processor) unit, a little goes a long way, so use it judiciously.

This brings us to the noise reduction unit. This little box is unique because it does a lot of noise reduction, although it is quite subtle.

Also, it doesn't mess around with the high frequency content at low listening levels as does the current crop of sliding-filter devices.

Although originally intended to suppress tape hiss, this box has proved excellent for "disappearing" room noise, crowd noises and the odd muttered imprecation from microphone feeds. It also does a passable job on disk surface noise and turntable rumble—without the "hang time" of a gate and with exceptional clarity.

After an hour with this box in the signal chain you will begin to wonder whether it is working. One touch of the bypass switch will convince you.

Overall, the performance of the Micro FX gear is quite good.

Not for the timid

Inclusion of side chain inputs on the compressor and noise gate raises the possibility of some neat effects, such as vocal stressing and gated reverb, but these are not for the timid soul who is afraid to experiment.

Any of the processors can be linked with another of its type for stereo processing.

Initially, the absence of markings around the front panel controls causes some confusion, but use of the gear is simple and intuitive.

It is actually easier to relate to "more or less" than to numbers. In actual operation one adjusts a processor for the audible effect, not by following a cookbook with numbers.

As with any de-esser . . . a little goes a long way, so use it judiciously.

The really nice thing about this product line is the "performance-per-buck ratio." At $149 apiece you can have several of these boxes without going too deeply into your pockets.

The quality is typical of the Valley product line. As for the trade-offs which permit the low cost, well . . . you might do better . . . but only at four times the price.

Editor's note: E.F. "Doc" Michaels is a noted raconteur and self-professed good ol' boy from Joelton, Tenn. When he gets around to it, he's a pretty fair audio consultant, too. Sorry, neither his "pick 'em up" nor his bass boat has a cellular phone.

For more information on the Micro FX processors, contact Norman Baker at Valley International: 615-383-4737.

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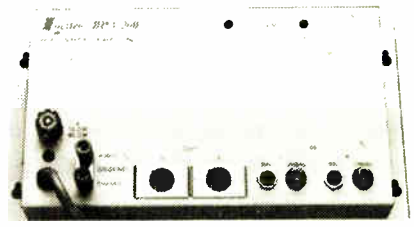

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World Radio History

BUYERS GUIDE

Orban Makes Mic Control Easy

(continued from page 33)

9 dB range of input adjustment was required to achieve a uniform 10 dB compression for everyone.

The ability to program the compressor threshold and obtain a consistent amount of compression for each of our jocks made the 787A worth having, even as a standalone compressor. The additional features make it outstanding.

The gate threshold is set so that when our mic channel is turned on and the monitors are muted, the compressor gate returns the compressor to 10 dB of gain reduction automatically.

The voice level comes on right where it belongs, with no audible side effects. The noise gate also activates, at the same level, and is set for 6 dB of gain reduction.

I found that 6 dB is the maximum depth that would recover quickly enough not to be audible when the input level comes up fast.

Greater noise gate depth settings are probably possible, depending on interaction with the settings of other controls.

The 6 dB figure is sufficient to noticeably reduce room noise when the mic channel is switched on. The de-esser (which sounds better to me than the stand alone Orban unit) was simply set by ear.

Equalizer settings were difficult to make with the unit live on the air. Our solution was to make an off-air tape of the live breaks of each jock. This was then played back and equalized using a production studio Orban parametric equalizer.

This yielded the EQ curve that would achieve the best vocal sound, taking into account the main processing chain. The curve was then set on the 787A equalizer.

It is important to note that the compressor threshold control is also the input level control to the other audio sections. Therefore, changing the threshold after setting up other processor levels requires that you go back and adjust the operating points of the gates and de-esser accordingly.

Even stations running extreme amounts of compression can benefit from (the 787A).

This is not made clear in the manual. Also, both gates operate at the same user selectable level, although they can be set in or out of the circuit individually.

One further note—changing between some settings causes the audio output of the 787A to mute. I found this very annoying, but it can be defeated. The defeat instructions are buried in the EQ section of the manual.

Although it was frustrating to wait so long for delivery, this product was worth the wait. Our live sound is noticeably improved.

The EQ has allowed me to take advantage of a mic with a characteristically great low end and compensate for its lack of brilliance.

Most of our jocks immediately noticed and like the difference.

There have been no problems with recall of the presets. The 787A is ideal for achieving a consistent, natural, quiet and distortion-free sound for every jock.

Even stations running extreme amounts of compression can benefit from the EQ, gating and de-essing, although not from the finer points of compression control, which led me to buy it!

I think this is an innovative product that deserves some attention.

Editor's note: Ken Tankel has done acoustical design and construction as well as broadcast studio design for the past 10 years. He may be reached at 215-667-8100.

For more information on the 787A, contact Howard Mullinack at Orban: 415-957-1067.

Radio World

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JANUARY
Test & Monitoring Equipment

FEBRUARY
Automation Equipment

MARCH
Microphones, Turntables & CDs

APRIL
AM Transmitters & Exciters

MAY
Antennas, Towers & Cables

JUNE
Program Audio Processing

JULY
Studio Audio Equipment

AUGUST
Consoles

SEPTEMBER
Reel-to-Reel Recorders

OCTOBER
STL, Remote & Telco

NOVEMBER
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DECEMBER
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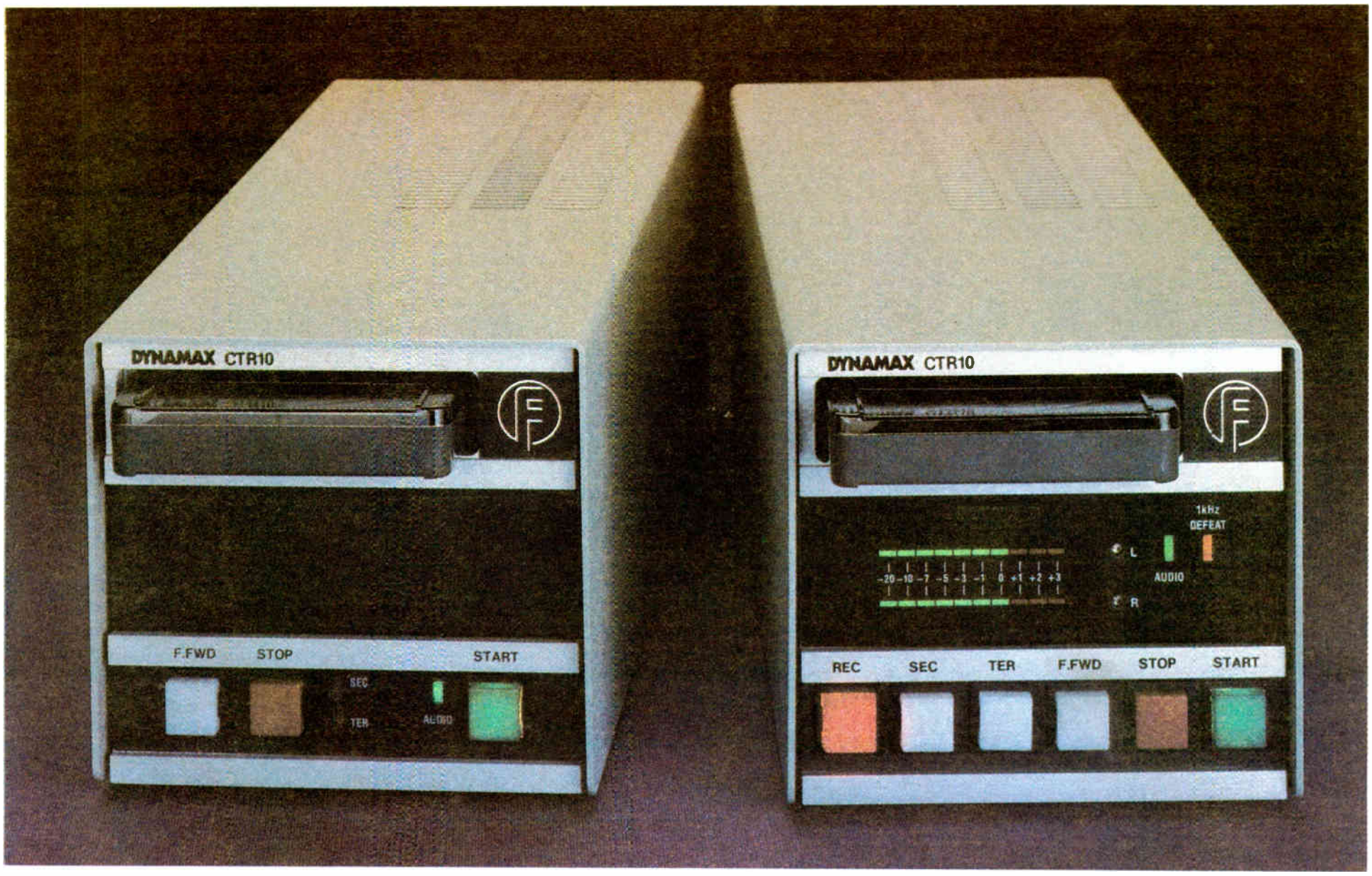

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