

Hill Holds Radio Hearings

by Alan Carter and John Gatski

Washington DC The story of a Connecticut man whose 1969 Chrysler has better AM reception than his 1988 Mercury gets to the basics of the plight radio broadcasters are trying to make lawmakers understand as they seek legislative relief.

FCC Mass Media Bureau Chief Roy Stewart related the story in testimony 26 October before the House Telecommunications and Finance Subcommittee. The group is considering proposed radio legislation addressing technical aspects of radio design and the radio renewal process.

"Although this is just an anecdote, I believe it illustrates a point that has been

raised many times," Stewart said. "Many AM radios do not have the quality they once had and they are certainly not competitive with the quality of FM radios."

Technical aspect promising

Committee members appeared more receptive to the Broadcast Radio Quality Improvements Act of 1989 (HR 2714) than the Radio Renewal Act of 1989 (HR 1136).

Rep. Al Swift (D-WA) said he had about five or six radios and the AM reception was not what it should be.

The technical bill includes provisions which would require that receivers sold in the US with FM also receive AM and that those with FM stereo also have AM stereo. It would also require the FCC to

adopt rules reducing interference on AM and FM, restrict the use of FM translators and use part of the expanded AM band to allow AM daytimers to go nighttime.

KANE-AM President and GM Art Suberbielle, a member of the NAB's AM Improvement Committee said he was pleased with response to the technical bill, for which he testified. "I didn't get any negative response," he said, admitting the renewal bill was not as well

received.

"Very simply, we asked Congress to assist the FCC in changing those technical standards that are absolutely essential to facilitating the technical competitiveness of AM broadcasting," Suberbielle told the committee. "The Commission's technical standards must reflect the technology of the '80s and leave the technology of the '40s behind."

The audio quality listeners expect "is (continued on page 10)

Citations Dropped In Fatal Tower Crash

Kansas City MO The Occupational Health and Safety Administration (OSHA) has dropped citations against Structural Systems Technology Inc., which constructed a broadcast tower that collapsed in Colony, MO, 2 June 1988, killing three workers.

According to OSHA's Assistant Regional Administrator Janice Barrier, the citations against the McLean, VA-based company were withdrawn because of a lack of industry-accepted standards on tower construction and maintenance.

"We had some conflicting evidence by our experts," that resulted in inconclu-

sive findings, Barrier said.

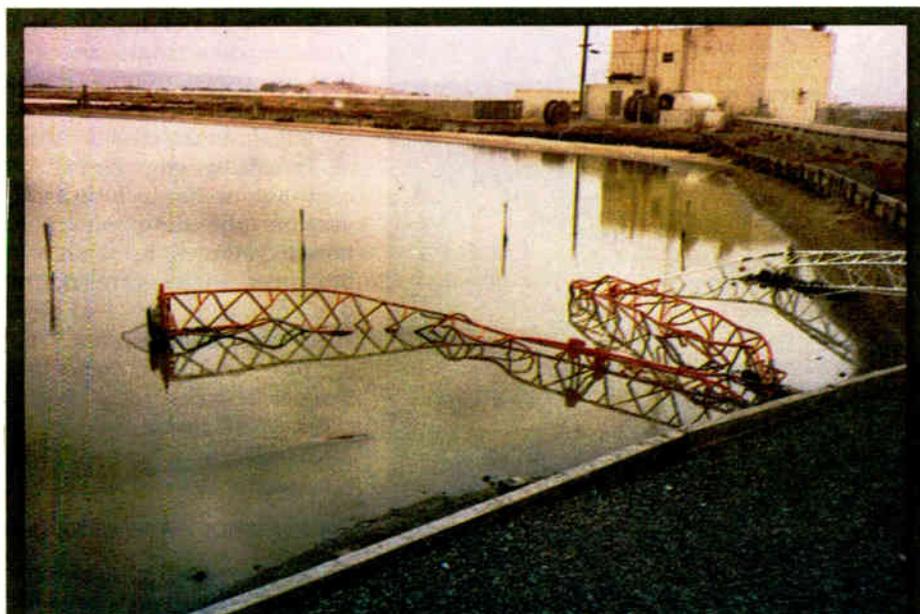
Structural Systems Technology President J. Cabot Gowdy was pleased with OSHA's findings.

"We feel this vindicates the accusation of wrong-doing on our part," he said.

Gowdy said there are civil suits against the company stemming from the incident, but he declined to elaborate because they are still pending.

The tower was used by KTVO-TV and KRXL-FM.

For information, contact OSHA's attorneys at 816-374-6441 or J. Cabot Gowdy at 703-448-0979.



KGO's crumpled tower showed that it fared worse than KABL.

KABL Stays On Air Despite Earthquake

by John Gatski

San Francisco CA KABL-FM/AM Engineering Manager Dennis Gooch always keeps a sleeping bag, change of clothes and rain suit in his Chevy Blazer—just in case.

During the first three days following the devastating earthquake that shook Northern California 17 October, at least two of those items came in handy.

Gooch and Assistant Engineer Phil Hartman virtually camped at the studio/AM transmitter site to ensure the beautiful music station's signal remained on the air during the aftermath of the second worst earthquake to strike the US.

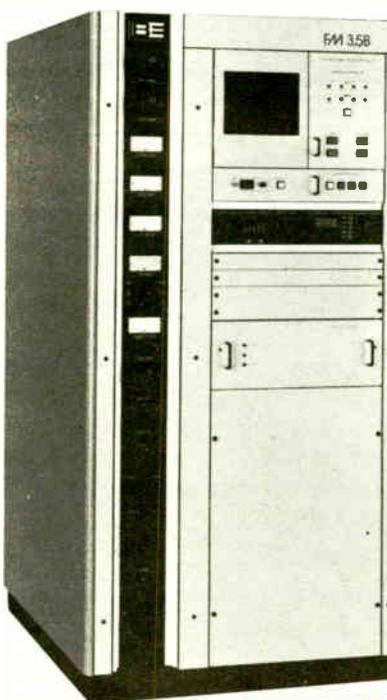
The AM studio/transmitter is located near the Oakland side of the San Francisco-Oakland Bay Bridge toll booth. It also is close to the double-decker Interstate 880, a major Northern California highway that had a section collapse during the earthquake.

KABL's three 250' AM directional towers are located with the studio and are anchored in the San Francisco Bay.

Station slightly damaged

According to Gooch, KABL's AM and FM signals were never off the air for more than a few minutes during the initial hours after the disaster and only for (continued on page 14)

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NEWS BRIEFS

Look at Radio Spectrum

Washington DC The NAB reiterated its position to the FCC that the agency should undertake a review of radio spectrum, allocations and technical interference policies.

The statement came from NAB President and CEO Eddie Fritts in a letter to Chairman Alfred Sikes in support of a petition from the Association of Maximum Service Telecasters (MST) to examine TV spectrum.

Fritts reminded Sikes that the petition expands on a previous letter to the Commission in August 1988 from NAB, MST, NPR, ITS, CPB and ABES on interference and other technical degradation of over-the-air broadcast services—both radio and TV.

A Pirate Reborn

Paris FRANCE According to reports from Reuters News Service, Radio Caroline, Britain's oldest pirate radio station, has re-

sumed broadcasting.

Radio Caroline was silenced in August by Dutch and British authorities after complaints of a jammed emergency radio frequency.

According to the France Radio Club, Radio Caroline is broadcasting from the Ross Revenge, a ship in the North Sea. Radio Caroline was founded in 1964 by Ronan O'Rahilly.

Format Protest in LA

Los Angeles CA West Coast news sources have reported that a group calling itself the Committee for Classical Music has petitioned the FCC over the loss of classical music station KFAC.

The former KFAC, now known

as KKBT-FM, changed hands in September leaving Los Angeles with no commercial classical music station. Public radio stations KUSC and KKGO-FM have added classical music to their programming, but lack the signal strength of Evergreen Communications' station.

The petitioning group, headed by Harvey Fry and Ellen Stern Harris, accused Evergreen Communications of a "lack of candor" in public comments regarding a format change prior to acquiring the station. The petition further added that the license transfer "would surely have been protested vigorously" had the public been aware of the planned changes.

S&T Staff Addition

Washington DC F. David Harris was named director of special products for the NAB's Science and Technology Department.

Prior to the NAB appointment, Harris was head of the Electrical Engineering Technology Department at Purdue University. From 1976 to 1986 he was associate professor of engineering technology at the University of Hartford's Ward Technical College.

Formerly, Harris was a consultant to the telecommunications industry, GM of a company producing specialized electronic equipment, staff engineer for both the National Aeronautics and Space Administration and Blonder-Tongue Laboratories, and technician for the US Navy.

Engineering Achievement Award

Washington DC The NAB is accepting nominations for its Engineering Achievement Award to be presented at the Tuesday engineering luncheon at the NAB convention, 31 March-3 April in Atlanta.

In order to be considered by the Engineering Conference Committee, nominations must be received by 1 December.

Qualified candidates will "have made a single contribution or contributions over a period of time which measurably advanced the state of the art of broadcast engineering. A contribution may include an invention, the development of new techniques, leadership in broadcast engineering, or the dissemination of technical knowledge and literature," according to the association's Science & Technology Dept.

For details and a nomination form, call NAB Science & Technology at 202-429-5346.

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NAB Plans New Show Schedules

by Alan Carter

Los Angeles CA The NAB is expected to announce that it will change the days of the annual convention to avoid weekend days when the show is in Las Vegas.

The word came from NAB Exhibits and Associate Membership VP Rick Dobson at an exhibitors advisory committee meeting here during the Society of Motion Pictures and Television Engineers conference. The announcement should be made before the 1990 show opens 31 March in Atlanta.

The change comes after the NAB suffered through a room shortage crisis for the 1989 show in Las Vegas, when hotels would not honor NAB's request for 16,000 rooms. They guaranteed only about 12,000 for the organization.

"We are really shell-shocked from 1989," Dobson said. He called the situation "devastating. It was a very embarrassing situation."

Not a repeat

While attendees obtained rooms in '89, many had to work outside the convention bureau.

The shift in days to avoid a weekend would only be for Las Vegas, Dobson noted. The show returns to Vegas in 1991 and 1992 after moving to Atlanta in 1990.

The show goes back to Atlanta in 1993.

In addition to changing the days of the show, NAB is considering limiting the number of rooms an exhibitor could reserve based on square footage for the booth. The idea is to keep exhibitors from tying up rooms for employees other than personnel who work the booths. Dobson said that is under consideration by the NAB housing department.

Dobson commented that NAB expects Las Vegas hotels to have a change of heart in the next several years, as a significant number of new hotel rooms will be built and the convention center expansion will be completed.

On to Atlanta

As exhibitors plan to open the 1990 show 31 March in Atlanta, Dobson said there are no problems other than "normal concerns" surrounding a new facility. This will be NAB's first venture into Atlanta.

Among issues Dobson referred to was extended exhibit hours on Saturday and Sunday to 7 PM to accommodate an expected increase in one-day traffic. He said Atlanta is easily accessible by air.

Attendance is expected to increase by 10 percent from 1989, or by about 5000. NAB had an unexpected attendance this year of some 50,000.

On the rooming situation in Atlanta,

Dobson said NAB has obtained more rooms than it did in Las Vegas. Atlanta is courting conventions such as NAB and is very accommodating, he added.

Parking woes

The biggest problem to face in Atlanta is a lack of parking at the World Congress Center, where the exhibits will be located.

Dobson suggested that exhibitors not

The shift in days to avoid a weekend would only be for Las Vegas . . .

plan to drive to the convention center because there will not be enough parking spaces.

He said companies may want to set up private shuttle services, or specify hotels in the outlying Atlanta suburbs that are on the subway system, which comes to the convention center.

Dobson also noted that traffic will be heavy in Atlanta during the city's daily rush hours.

However, he said Atlanta will be "much better" than Dallas, where the 1986 and 1987 shows were.

NAB has contracted on all parking spaces at the convention center and will establish a pass program for exhibitors. Cost for the parking passes would be based on what the contract costs NAB. "We are not going to mark up the cost on this," he said.

Exhibit space is sold out, with about 150 companies on a waiting list. All will not get space, he said, but he suspected a majority could be accommodated.

To help get as many companies with new products in future shows as possible, NAB is looking into "a new product exhibit area" for companies that have never exhibited at an NAB. To get in this area, a new company would have to have at least one new product to exhibit.

Dobson said it would be 1992, when Las Vegas and Atlanta convention site expansions are completed, before NAB would be able to accommodate all companies that want to exhibit at a show.

For information on exhibits from NAB, contact the exhibits department at 202-429-5335.

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Cruisin' and Groovin' to the AM

by Judith Gross

Falls Church VA I have a confession to make. I listen to AM radio. Honest. I'm not ashamed to admit this.

I listen in my car, and **only to AM**. Not being discriminatory here. AM is all I can get. OK, so it's a ten year old car. OK, so it's a Chevette. I got it for the proverbial song (*Not Verdi's "Aida" more like "Row, Row, Row Your Boat"*).

Anyway, I thought about replacing the AM-only cheapie radio with a **super sound system**, you know, CD, AM stereo and all. But lately I've been listening to the AM music stations and I gotta say it's (as Spock would say) **fascinating**.

Yes, Virginia, there are still enough AM music stations to provide the requisite variety. In the vicinity of the nation's Capital I got a classical simulcast, a **country simulcast** and a **heart and soul blues station**, among several other notables I want to spend some more time with.

You'll **never guess** what I noticed about these stations. I think yer gonna like this. I noticed, flipping around the dial and all, that the stations which have gone stereo **sound better**. No kidding.

Now the radio **isn't stereo** (in a '79? get real!). And its **bandwidth** is rather limited. But the AM stereo stations sound better.

I don't know if it's the fact that they're making better use of their **occupied bandwidth** or if they had to clean up the overall audio chain when they went stereo or what. I just know **what I hear**. You can say it's subjective, call me crazy or what. But I know what I hear.

☆☆☆

Now about this **bandwidth** thing. Denon came out with a prototype of its



NRSC radio and I heard it at the last NRSC meeting. The specs say it goes out to—hold onto your hat—8.5 kHz. I gotta admit, I was impressed by the sound.

But we're still sensing a **reluctance** (and that's a kind way of saying it) on



Okay, Doug—tell Bill how you got the cork back out . . .

the part of receiver manufacturers to rush in and live up to their half of the bargain by making **higher fidelity AM radios**.

May I remind you that AM stations had the legitimate right to broadcast to 15 kHz but voluntarily (until it becomes mandatory next year) agreed to limit themselves to 10 kHz with the NRSC standard?

Hey guys, the broadcasters pushed for this one. Self-regulation and all that. So now it's **your turn**.

The resistance to **wider bandwidth** AM radios centers around the argument that there's too much interference, especially at night, and that listeners will **complain** to the vendors of said radios in droves.

Now excuse me, but that's a tad hard to swallow. Have we really seen thousands of new car buyers, home radio buyers, et al marching back to their **Crazy Eddies** and **Maniac Mikes** en masse to return, or even complain about their AM reception?

No, you say, they speak with their **push-buttons**, zapping off AM and turning to FM. But can you honestly say that it's only due to interference? Maybe it's because of the **narrow bandwidth**.

So who is it, exactly, that's doing **all the complaining**? And is it just a coincidence that narrowing the bandwidth of AM radios was also a **cost-cutting** method?

And what will it take to get the companies who make the radios to actually **participate** in all these discussions? Are they waiting for **Congress** to go ahead and mandate AM stereo? Golly gee, doncha want to look like heroes instead of spoilers?

☆☆☆

Tascam found a nice way to help me end my whirlwind tour of the **AES show** up in Noo Yawk. It was only pouring rain for three days so I was not in a hurry to up and leave the cozy, warm Hilton.

Seems Tascam was celebrating the introduction of its **24-track digital machine** and was pouring a few glasses of red wine for a select group gathered at the back of its booth. **Bill Mohrhoff** did the honors with a wine supplied by **Don Mark**, of Marketraton not too far from here in Maryland.

Now I know there's good wine country up there, because I've been to a few local vineyards myself. But Don had come up with an **absolutely out of this**

world bordeaux. I mean, you don't expect good vintages from a trade-show booth reception, know what I mean?

Anyway, a bunch of folks (including yours truly) **signed the cork** and then Bill was asked to push the cork into the bottle, which he and his strong thumbs succeeded in doing. This got his pals in the booth razzing him, saying how they had really wanted to **save the cork** with all the John Hancocks on it and such and Bill was more than a little bit miffed.

But while he diverted his attention to chat with your ole pal, JG, voila—the cork magically appeared in the hands of **Doug Cook**, VP of Audiotechniques. Bill couldn't believe it, and neither could I, so I snapped this pix of his incredulous look.

OK, **Doug baby**, how'd ya do it, huh? I really want to know. I won't tell anyone, promise. Just a few thousand readers . . .

☆☆☆

As for the rest of the AES, seems the war of the **digital audio workstations** is fully deployed. One long range target is radio production. First **AKG** and now **Symetrix** are both aiming some nifty real-time production systems at the broadcast market.

You might even see more products with costs in line for some of the big and medium market stations before too long.

Ran into **Les Tyler**, formerly of **dbx**. He's still in old New England and he and **Gary Hebert** told me about their new company: **That Corp.** (at least it's not all lower case!) formed to handle **dbx OEM** products.

In case you're confused, the situation with **dbx** goes like this: **Carillon Technologies** (the laser turntable folks, remember?), which had bought **dbx**, sold the pro part to **AKG**, which is moving all production and marketing of **dbx** products to **Orban**, which **AKG** also bought.

Carillon kept the consumer division of **dbx**, and Les and Gary are handling the OEM **dbx** products from the new company in Natick, MA.

Got that straight? There'll be a quiz next week . . .

It came in a **little red box**, with a cat decal, a silvery ribbon and pretty pastel sketches. I thought "Chocolate!" but it was something even better.

It was a box of the latest cassettes of *The News from Lake Wobegon*, the long-running feature from **Minnesota Public Radio's** now-defunct (except in reruns) *Prairie Home Companion*.

It was better than sweets because the tape runs over four hours, while everybody knows chocolate is gone in mere minutes (around here, anyway).

Anyway, **Garrison Keillor** is starting a new radio show this month. It's called *The American Radio Company of the Air*, and it will originate from the Brooklyn Academy of Music, not far from where I used to live.

Wonder if he'll continue the **storytelling** tradition he started up in St. Paul. Hmmm. News from Lake Canarsie?

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 1989 edition Radio World mug.*

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READERS FORUM

Send comments to: Readers' Forum, Radio World, Box 1214, Falls Church VA 22041 or MCI Mailbox #302-7776; or call 800-336-3045.

Preventive maintenance

Dear RW:

I enjoyed reading Mr. Hallikainen's article (11 October issue) on a station operator's failure to know the efficiency factor of the FM transmitter (among other things).

I was employed by WIL and WIL-FM, a regional 4-tower DA-2 and 100 kW FM with stereo and SCA from 1955 until 1984 and was CE for more than 25 years.

From about 1979 until 1984 I also worked with Ralph J. Bitzer, a first-rate consulting engineer here in St. Louis, writing the computer programs and doing all of his directional antenna design and FM allocation work on my computer system. This unfortunately ended with Ralph's untimely death in 1984.

During my tenure at WIL we always had about eight fulltime engineers with First Class Radiotelephone Licenses. These men *did not* double as announcers!

As CE I wrote an operations manual covering all phases of technical operation and stressing the primary importance of transmitter operation above other duties.

Copies of the manual were given to all personnel and to temporary vacation and sickleave personnel. Charts were posted at all control points and at each ATU (What the heck is an ATU, the present-day ops may ask).

The charts gave full information on maximum and minimum allowable base currents and sampling ratios, plate currents, etc and described exactly how to

make all calculations.

During that time we did not receive a single citation during an FCC inspection and always received a rating of "Excellent" on the inspector's report.

When "deregulation" appeared on the horizon, I saw the handwriting on the wall and took early retirement at age 59. I have never regretted doing so for one instant!

All of my predictions regarding the consequences of deregulation and the demise of the First Class ops are proving to be well-founded.

I also believe that the first class preventative maintenance programs that we followed, with two men at the transmitter each Monday morning for maintenance and field intensity measurements, are a thing of the past.

The present day practice at most stations appears to be "if it will get on the air, don't touch it!"

Melvon G. Hart, WORV
Des Peres, MO

Safety first!

Dear RW:

In the 23 August issue of *Radio World* the front page shows Tom Becker being very careless.

I am an owner/operator of a tower maintenance and erecting company. In 10 years of field work we have a very good safety record, something I work hard to maintain.

I am concerned that those that have seen this photo will try to follow Mr. Becker's footsteps.

Specifically, Mr. Becker is not using any safety gear; tennis shoes are not safe for climbing and his insurance would probably not cover him if he fell.

As many of your articles have addressed the fact that the pool of good engineers is shrinking, let us not encourage some to work unsafely, be it in the shack or on the tower.

Richard H. Wood, President
Skyline Communications Ltd.
Cottage Grove, WI

School for radio

Dear RW:

I enjoyed the "Seeking a Radio Curriculum" article by Ty Ford (27 September issue). There has been until now very little information available to those interested in a broadcasting career.

With so many choices to make, it can be very difficult to decide what the best choices really are. I thought your readers would like to know about another alternative, not mentioned in your article.

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The efforts of the National Radio Systems Committee on behalf of AM technical improvement are currently at a crossroad.

The long work of the committee, which has resulted in a new standard for AM which will become mandatory next year, has begun showing signs of running out of steam.

The NRSC was reactivated a few years ago after a dormant period for the purpose of tackling AM's technical ills and its work crystallized around the pre/deemphasis standard and second adjacency relief.

But ever since its two sponsoring organizations—NAB and EIA—succeeded in getting a mandatory standard enacted, its meetings have lacked the focus which has marked its work since the reactivation.

Time To Rethink the NRSC

For AM, talk of a certification mark has not drawn the participation from receiver manufacturers that the original standards work did. As for FM, areas such as FMX have been declared off limits to avoid the potential for conflicts of interests.

Meanwhile, a working group on multipath studies has had the project shifted away from the group and onto the shoulders of an individual station. This has raised more questions than the committee is prepared to undertake at this time.

And a working group on composite bandwidth has ventured into competitive areas which have caused one manufacturer to investigate legal action.

Without a clear goal, the committee's recent meetings have failed to move toward any future achievements which could equal that of its AM standard.

It's time for both the EIA and NAB to re-examine the NRSC's work and see if an active committee is still required. It may be in the best interests of the industry to deactivate the NRSC again until a new, more focused scope of work emerges and let any remaining work fall to the resources of the NAB and EIA individually.

—RW

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Next Issue RW
Dec. 13, 1989

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I hope this information is helpful to your readers. I feel we have quite an effective program and can help anyone interested in a broadcasting career.

James B. Singer, Admin. Dir.
Broadcast Center
St. Louis, MO

Editor's note: Those interested in contacting the Broadcast Center can do so by writing them at: 7720 Forsyth Blvd., St. Louis, MO 63105 or by calling 314-862-8181.

Money and radio

Dear RW:

I enjoyed reading the latest account of the demise of KFAC (25 October issue). But I'm depressed by the sudden realization by the station staff that radio is a business fueled by money.

Regardless of the size of a radio market, some owner of a station is going to bed each night with a debt for which he or she—and not the staff—is responsible.

While I have been among entire radio staffs "blown out" by ratings or whim, I'm not sure I understand what the alternative was to KFAC's format shift.

Yes, announcers should have fun, the

public should be served *and* operators should be allowed to make money. I gather from your article that it should have been KFAC's fate to stick with its format and, though artistically successful, go belly-up under a staggering debt load years down the road.

The owner takes the bath, fine, but at least staff will be able to hold their heads high knowing they were able to take the station into Chapter 11 without missing one beat of elitism.

The suggestion seems to be also that if I own a radio station (which I do not) and someone offers me a zillion dollars for it, I should turn it down or risk being ashamed of having made a (here it comes) *profit* in reward for *my* taking the financial risk, *my* accepting the responsibility for every facet of the operation.

And who gets to determine when the amount of money that I've made is beyond acceptable social limits? The announcing staff? Give me a break.

Reading the article, you'd think radio just became a business and that the reason most owners are in the broadcast industry to make money is a trend that's developed after deregulation.

The KFAC staff—and its listeners—have learned a lesson that all radio people eventually learn. I have experienced the pain they now feel but I'm smarter because of it.

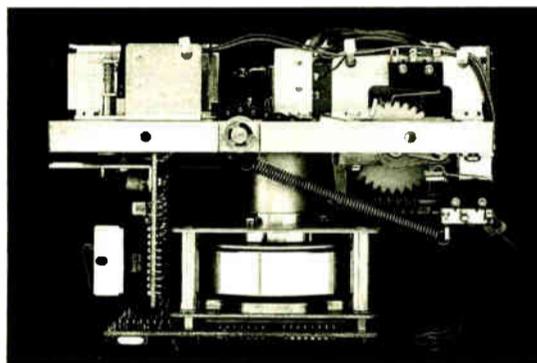
I work harder than I used to at my radio niche. I realize the people "in the trenches" and those in "upper management" need not be regarded as one side having the values and the other side the money.

I realize the station is someone else's investment and by working harder to make this investment more profitable today than yesterday, my listeners *may* be better served, I *may* have more listeners and my chances of being another radio victim *may* be lessened.

Bob Collins, VP Programming
WSBS/WBBS
Great Barrington, MA

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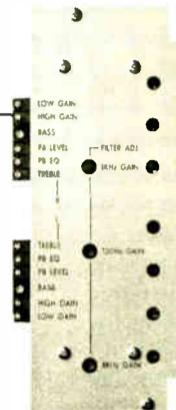
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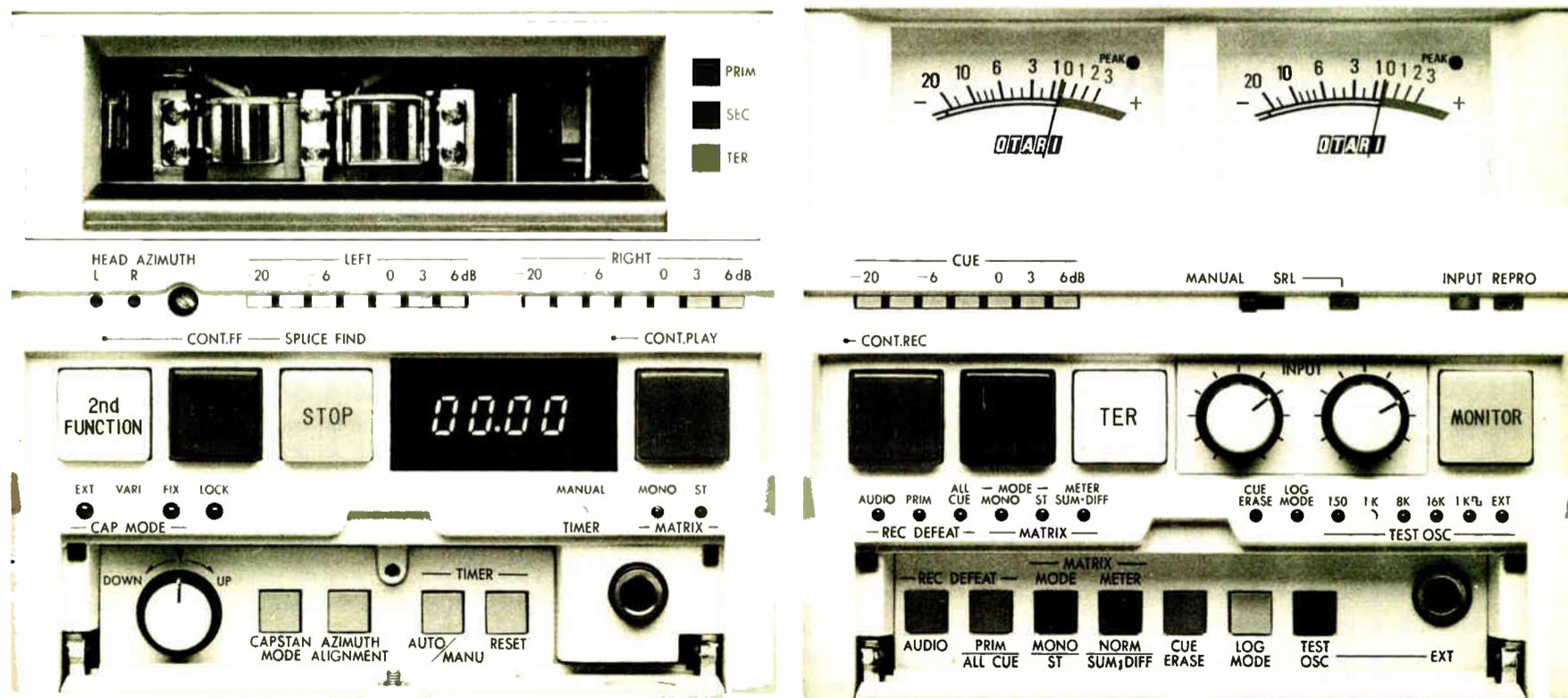


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FCC, FAA Consider Peace Talks

by John Gatski

Washington DC Based on a recent meeting with the FCC, broadcasters are hopeful the Commission will work quickly to end a conflict with the Federal Aviation Administration (FAA) over its role in denying permission to construct broadcast towers.

The FAA is under fire from the NAB, other broadcast groups and individual broadcasters, including C3s and Class A's authorized for upgrades, because of a number of recent denials to stations applying for new CPs or those that want to make improvements.

Representatives of the NAB, Association of Federal Communications Consulting Engineers (AFCCE), Association of Broadcast Engineering Standards (ABES) and Federal Communications Bar Association (FCBA) met with FCC Mass Media Bureau staff members 20 October to discuss the urgency of resolving the dispute.

Because stations can be denied permission to broadcast from desired locations or an opportunity to upgrade, the NAB and other groups plan to continue pushing the issue before the Commission.

One group, known as BEAR (Broadcasters for Equal Air Rights), plans to file a petition at the FCC to seek remedy of the problem.

According to Ralph Justus, NAB director, engineering regulatory and international affairs, the 20 October meeting was scheduled to point out the urgency that has resulted from the FAA's denial of CPs for new or improved towers.

Denial of CPs

"The FCC is very aware that hundreds of applications are being denied," Justus said. "Basically, we need to resolve this quickly. The public is being deprived of FM service because of this."

AFCCE FCC Liaison Committee member Don Everist said the brief meeting

with the FCC hopefully will prompt the Commission to work with the FAA.

"From an information standpoint, I think the meeting was a success," he said.

Both the FCC and the FAA are willing to discuss the issue according to both agencies.

Recently appointed FCC Mass Media Bureau Chief Roy Stewart, termed the meeting "informational" because he has not had time to study the issue.

"I don't think any final decisions were made at all," he said. "But I do think we are going to try and work with the FAA."

Inter-agency solution

Stewart said he would like to see the dispute worked out on a "staff-to-staff" level.

The conflict has been termed an inter-agency turf war because of the two differing approaches used in approving broadcasting towers—the FCC with its authority over spectrum and the FAA's regulatory power via the aircraft safety issue.

The FAA originally was empowered with the authority to object to a tower if its presence could endanger air traffic. That power since has grown to include a station's potential signal interference with aircraft communications and control systems.

FAA Spectrum Engineering Manager Jerry Markey said the agency has been cast as the "heavy" in the so-called dispute, but he said he is willing to work with the FCC.

He said the FAA is enforcing its rules as it always has, but there are more stations and higher powers that require closer scrutiny—and some stations will be denied new or upgraded facilities at chosen locations.

Cooperation stressed

He said the FAA is willing to consider any remedies except changing the signal strength (-86 dB) requirement needed to accommodate aircraft and control

towers' radio coverage.

Markey said the FAA also will not change the prescribed navigational service area of airports, which are critical to protect air traffic under a variety of conditions.

"An airport cannot be moved. It's easier to move an FM station than a airport," Markey said.

He said the agency is willing to discuss ways to better inform stations about early evaluation of potential tower sites.

Stations spend thousands of dollars on the FCC process and development costs only to find it doesn't meet FAA guidelines, according to Markey.

Both the FCC and the FAA are willing to discuss the issue . . .

Markey said a station could ask the FAA before it chooses a site whether the signal could interfere with air-to-ground communications or the tower is a hazard to aircraft.

The stations would not have to waste money on site development and the FCC license process for that location if they know beforehand, he added.

Computer-based predictions

The FAA/FCC conflict deepened in 1988 when the FAA implemented a computer modeling program designed to more accurately predict interference potential of broadcast stations.

The NAB said the computer prediction results are flawed and place an unnecessary expense on broadcasters who have to choose another site if the FAA bases its denial on the results.

Justus said any interference to the aircraft (108-137) MHz frequencies from broadcasters is usually the result of intermodulation distortion, which is caused by general aviation using poorer

quality radios.

He said major aviation, such as passenger jet service, uses higher quality radio receivers which are not prone to interference by broadcasters.

So far, the agency refuses to mandate changes in quality for general aviation radios that would require only inexpensive modification, Justus said.

In addressing the radio filter problem, Markey said there are no retrofitable filters that are reliable enough to hold up under severe temperature conditions and vibration associated with air travel.

The long-term solution, however, will begin in 1995 when new regulations will require better quality aviation radios for international flights, he said.

For more information about the FAA/FCC dispute, contact Roy Stewart at the FCC, 202-632-6460, or Jerry Markey at the FAA, 202-267-9710.

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Shively Combiner Up in Chicago

Nine Windy City FMs Find a New Home Atop John Hancock Center

by John Gatski

Chicago IL A new \$1.5 million Shively FM combiner is operating here in the John Hancock Center with users expecting improved sound quality and a reduction in such signal problems as multipath.

The combiner went on line 22 October and the unit has performed flawlessly, according to Charles Lomas, president, Communications Site Management, which manages the combiner and other broadcast equipment in the Hancock building.

Beyond expectations

"It's far beyond our expectations," Lomas said. The combiner performs better than engineers originally targeted, he said. For example, they expected group delay performance of 50 ns, but the unit has measured about 20 ns.



Shively's FM combiner, set up and ready for use.

The combiner went on line 22 October and . . . has performed flawlessly . . .

The combiner replaced a 20-year-old Alford combiner, which had been in use since 1969. The Shively 10 band-pass combiner is considered state-of-the-art and has the capacity to serve 10 stations with the signal quality and isolation required for today's FM broadcasts, according to Shively Labs.

Currently, nine Class B stations are on

the system: WOJO, WVAZ, WBEZ, WNUA, WKQX, WUSN, WXEZ, WLUP and WFMT.

WBBM had originally agreed to take one unit of the new combiner when the contract was written but decided to place an antenna on the taller Sears Tower, leaving one unit open, Lomas said.

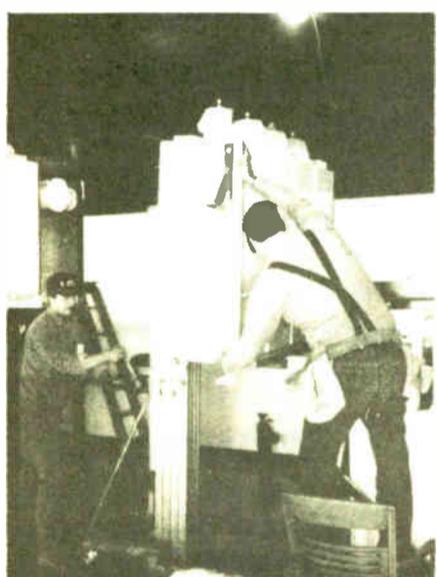
CEs were generally impressed with the quality of the installation and the initial performance of the Shively combiner, but they said they are reserving long-term performance evaluations until it has been on the air for a while.

Early results

"It seems to be working well," WKQX CE Joel Hodorff said. "But it is a little too soon to tell from a listener standpoint."

Initial measurements show that the Shively combiner is more efficient than the old combiner, he said. WKQX's 5.6 kW transmitter input power measures 6 kW ERP at the tower, Hodorff said. The old combiner required 6.6 kW to achieve 6 kW ERP, he continued.

"If it improves the sound to the listeners, I'll be pleased," Hodorff said.



Workers ease one of the combiner elements into place (left), fit the elements into a rack (center), and start the process over with another element (right).

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WUSN CE Bob Larson echoed Hodorff's remarks. He noted, however, that his station needed a little more power to equal the old ERP.

The extra power requirement probably is caused by WUSN's unit location in the combiner system, which is the last one in the series, he suggested.

Despite good initial measurement results, Larson said, "The final test is what the listeners say."

More improvements to the system may be forthcoming, according to Larson. An upcoming engineering study will assess the feasibility of increasing antenna height with a new tower, he said.

A taller tower

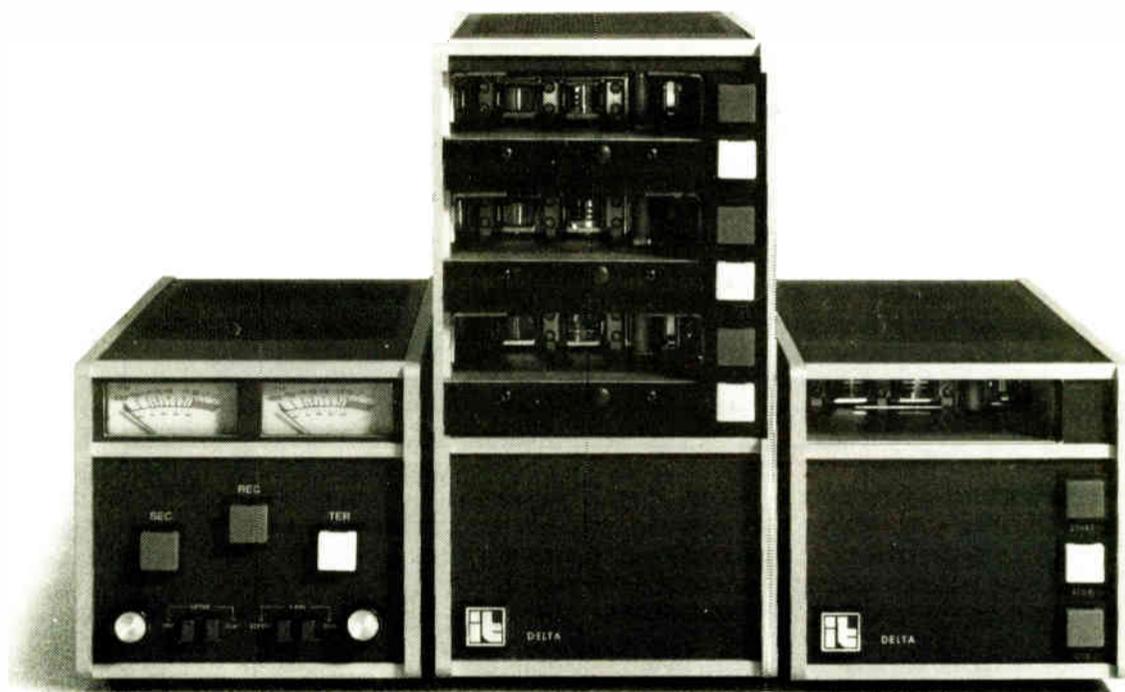
"I think that if we get the antenna a little higher that will help even more," Larson said.

The Shively combiner was put together and installed in a large renovated room on the 97th floor of the 1127' Hancock building.

Installation began 25 September and was completed in about 28 days. The rapid pace of the combiner installation was the result of tight-knit teamwork of the companies involved in the installa-

(continued on page 19)

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Radio Hearings on Capitol Hill

(continued from page 1)

far beyond the technical standards" the FCC uses in regulating radio frequencies, Suberbielle said. "Without improvements which both the broadcast industry and the government need to make, that disparity can only grow wider and more intolerable."

Stewart noted that AM stereo is used by approximately 600 stations with about 90 percent using one of two standards. That standard is Motorola's C-QUAM.

"It seems clear that this one system has emerged as a de facto standard," he testified.

But he continued, "Some additional stations might install stereo if we had an official standard, but this action would likely not influence those who believe it is not necessary or not affordable—or who don't want to put more money into AM."

Feeling good

NAB Science and Technology VP Michael Rau said he has a "good feeling" about the technical bill and agreed it was better received by committee members than the renewal bill. He, however, maintained the renewal bill has more than 100 co-sponsors.

Citing evidence that challenges and abuses of the licensing renewal process are way down, committee members were not convinced radio licens-

ing reform legislation is necessary.

They said the bill would duplicate the effort of the FCC's renewal abuse regulations put into place earlier this year.

HR 1136 would eliminate the FCC's two-step comparative renewal process and give stations up for renewal a certain expectancy without having to go through the challenges.

If a station is found not to be serving the public interest, then challenges could be made against the renewal, according to the bill.

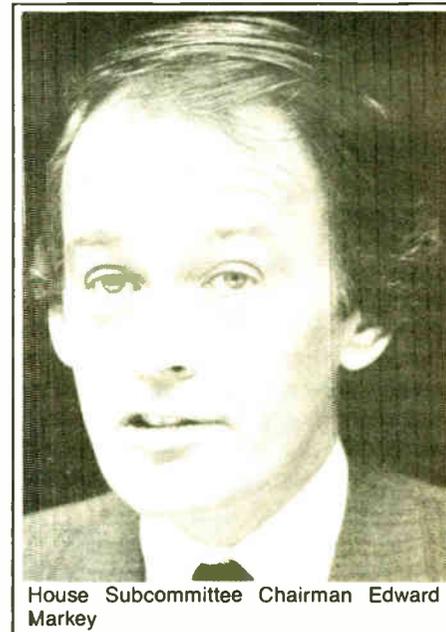
Representatives of several broadcast groups testified in favor of the bill,

including Federated Media President John Dille III, Sheridan Broadcasting Corp. Chairman Ronald Davenport and Inner City Broadcasting Corp. VP Lois Wright.

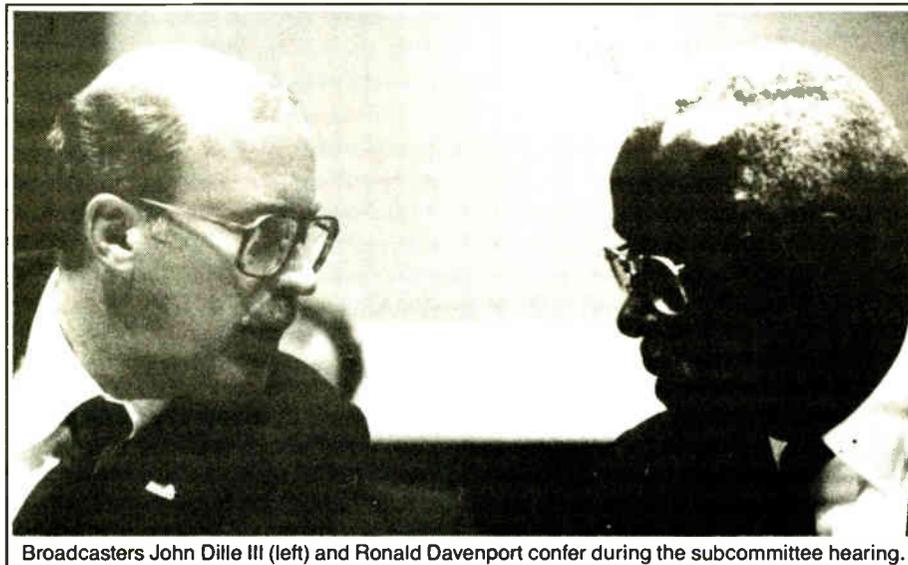
Eliminate payoffs

Proponents believe that giving current broadcasters some expectancy ensures immunity against blackmail tactics by parties who file competing applications in order to receive payoff money from the licensee.

Supporters of the bill also said that broadcasters' incumbency should be given significant consideration at



House Subcommittee Chairman Edward Markey



Broadcasters John Dille III (left) and Ronald Davenport confer during the subcommittee hearing.

cial reporting, seem to be working.

Rep. Matthew Rinaldo (R-NJ), the chief architect of HR 1136, said unscrupulous challenges to a license are still possible under the new FCC regulations, which could be made stronger if codified by Congress.

"The time to reform the renewal system is way past overdue," Rinaldo said.

Self-serving law?

During questioning of the witnesses, Rep. Al Swift (D-WA) said the proposed law may be a bit self-serving to protect existing licensees.

He said it does not address such licensee issues as minority ownership, but seems to be concerned with only protecting the licenses.

"You are essentially doing this out of sense of paranoia," Swift said.

HR 1136 would not only eliminate illegitimate challenges, but also legitimate challenges, he added.

Rep. Jim Cooper (D-TN) said he believes the comparative renewal system is inherently a good system, minus the abuses.

He disagreed with the contention that broadcasters with a track record should not have to face competition from challengers who are basing their applications only on promises.

Cooper said members of Congress have to defend their records against challengers' promises every election year.

Promises, promises

Rep. Thomas Tauke (R-IA), however, argued that expectancy should be considered in licensing renewal.

"If someone is doing a good job, they should have some expectation of renewal," Tauke said.

Media Access Project Director Andy Schwartzman testified against HR 1136. He said the bill would "make things worse" and perpetuate the "mediocrity" that the NAB supports among its members.

He said deregulation has resulted in a new breed of broadcasters who are only interested in short-term profits rather than quality service to the community.

Deregulation has led to such FCC policies as exclusion of misdemeanor convictions of licensees in evaluating license applications, Schwartzman said.

HR 1136 would further such policies, he added.

Schwartzman suggested making the licensing process tougher including more licensing hearings and restoration of the three-year minimum license holding periods.

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renewal time especially when the stations are comparing their track record to the promises of challengers.

Although there is widespread industry support for HR 1136, subcommittee members closely questioned the need for the bill.

Subcommittee Chairman Edward Markey (D-MA) said the latest FCC licensing figures show that 1800 licenses were up for renewal this year, but there have been no challenges.

"I am not sure if a law is needed," Markey said based on that figure.

Markey said he knows that abuses of the renewal process have been a problem, but the FCC regulations, which outlaw payoffs and tighten finan-

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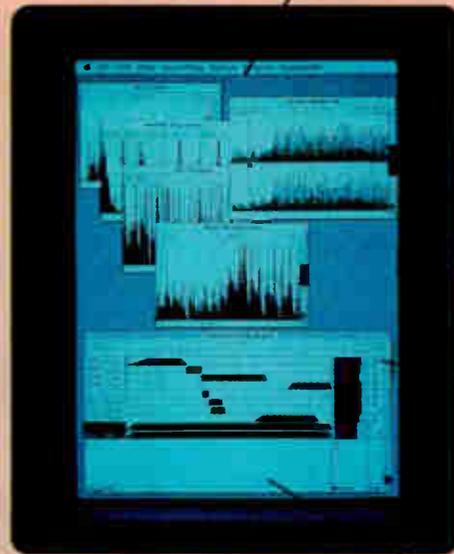
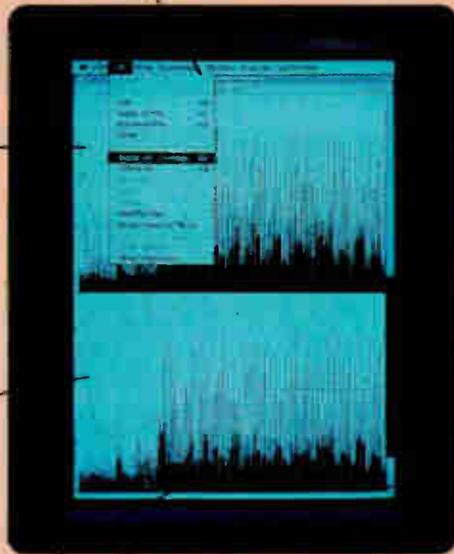
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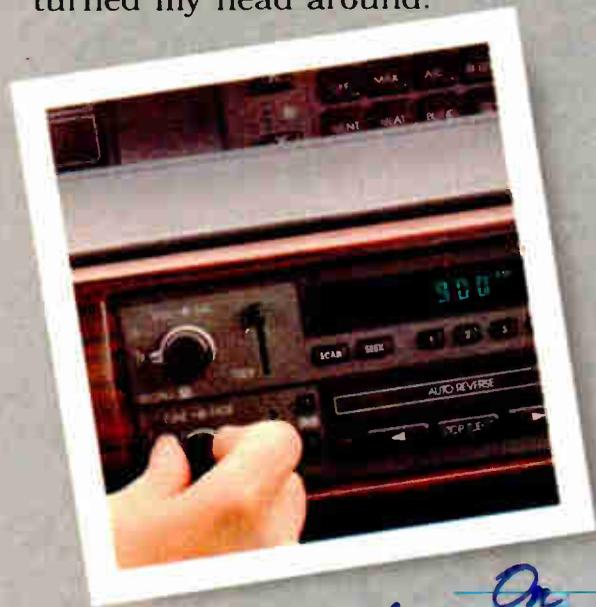
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WSEA AM serves the Delmarva region and South Jersey from Georgetown, Delaware. They recently acquired a 10 kW day/1 kW night directional authorization, a Harris DX 10 digitally modulated solid state AM transmitter—and a new Corporate Chief Engineer, Terry Dalton. "By the time WSEA's owner Great Scott Broadcasting hired me," Terry recalls, "they had already decided on the Harris. I could understand that, since the fifteen year old Gates at WSEA still passes its proof of performance tests. But I needed to be sold on the new Harris transmitter. I'd heard about the DX series' all-solid-state design and its digital modulation, but I didn't expect them to make much difference."

Terry ran his DX 10 into a dummy load at full power continuously for six weeks before putting it on the air. "I was ready to jump on the slightest malfunction," he admits, "but I couldn't find anything. That kind of stability and reliability was one thing that turned my head around."

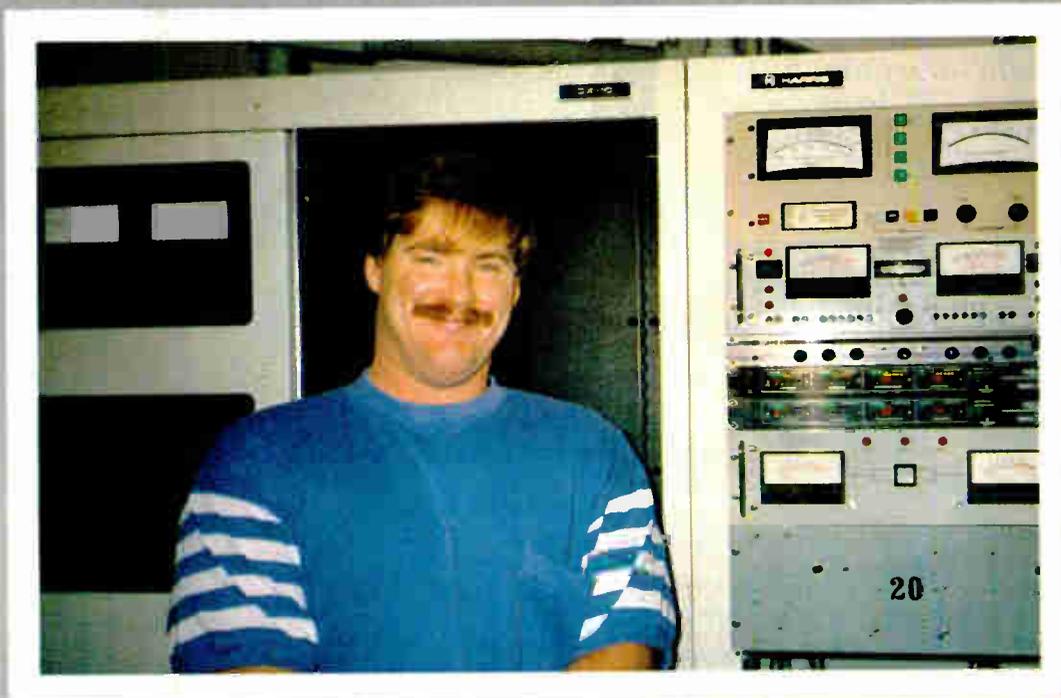


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The other was performance—in A/B comparisons we ran with the old Gates, the two signals were like day and night. We had NRSC-2 pre-emphasis on both and an Optimod 9000 with the high end cranked all the way up on the Gates—but the Harris DX

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Chief Engineer Terry Dalton

AND "THE BLOWTORCH" WSEA'S NEW HARRIS DX 10 DIGITALLY MODULATED AM TRANSMITTER.

was still cleaner and brighter. The low end from the DX 10 was tight and punchy, with none of the old transmitter's boominess."

When WSEA finally put their new DX 10 on the air, they did it with no announcements at all. "That very first day," Terry reports, "we got calls from people picking us up in places where they never could before. Others commented on how much better we were sounding, even on car radios. We were still running 1 kW under our old non-directional authorization. But we were burning up every other AM in the market, including some that put out an audibly overmodulated signal. Our sales department immediately named this new DX 10 'The Blowtorch'."

Terry verified the DX 10's increased coverage personally on a drive to New Jersey. "I used to lose WSEA around Cape May," he says. "This last time, the signal stayed clear all the way to Atlantic City—a 35 mile increase in range without any more power."

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"I was ready to find things wrong with the DX 10," Terry admits, "But its performance and reliability have me 100% sold. As far as I'm concerned, any new Great Scott Broadcasting AM stations will have Harris DX transmitters."

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FCC Acts on 95 Complaints of Indecency

by Benn Kobb

Washington DC The new FCC under Chairman Alfred Sikes continued its campaign to cleanse the airwaves of indecent broadcasts, fining four radio stations \$20,000 in all and issuing inquiries to four others.

The Commission, meeting 26 October, also approved a Notice of Inquiry into the validity of a 24-hour ban on broadcast indecency.

The FCC acted on 95 complaints, citing explicit sexual content in talk shows and music, that were made over more than a two-year period.

Indecency, as defined by the Commission, is "language or material that, in context, depicts or describes, in terms patently offensive as measured by contemporary community standards for the broadcast medium, sexual or excretory activities or organs."

Current FCC policy prohibits broadcast of indecent material when there is a reasonable risk that children may be in the audience.

Stations fined include WIOD, Miami, \$10,000 for broadcasting four songs and a mock beer commercial termed indecent. WZTA-FM in Miami received a \$2000 fine for playing one song and KFI in Los Angeles was fined \$6000 for allegedly indecent listener call-ins.

While the titles of the other songs the FCC targeted were quite graphic, KLUC-FM in Las Vegas received a \$2000 fine for broadcasting "Erotic City" by Prince.

Receiving letters of inquiry from the FCC were KCCL-AM/FM, Paris, AK; KSD-FM, St. Louis; WWWE, Cleveland; and WXRK, New York.

The KCCL complaint concerned heated on-air arguments between the station's general manager and his son. KSD allegedly broadcast a reading from Playboy magazine. The WWWE and WXRK actions concerned talk show content. The FCC also had cited WXRK in 1987 for the Howard Stern show, which is simulcast from New York to Philadelphia and Washington, DC.

The FCC mails inquiry letters when the language or material broadcast appears actionable under law, but needs additional facts before proceeding to a Notice of Apparent Liability (fine).

In response to FCC inquiries, several stations contended that FCC inaction on the same material broadcast elsewhere led the stations to conclude that the material was permissible to air. Some stations also argued that the popularity of their programming proved that the material is widely accepted.

The FCC stated that its "caution and careful deliberation" sometimes results in enforcement actions and opinions about year-old broadcasts. Also, the agency said, "Broadcast indecency is a violation of federal law and its popularity in any particular community does not change that fact."

The Commission dismissed 51 complaints against 40 stations (34 TV and 6 radio) because the broadcasts occurred after daytime hours.

The agency also dismissed 14 complaints against 14 stations as defective. Those complaints lacked required elements such as tapes, transcripts or excerpts, and identification of the station, date and time of broadcast. The FCC

asked those submitting defective complaints to resubmit them if the needed material could be provided.

One complaint was withdrawn and the FCC dismissed the remaining 21 complaints because, in its view, the broadcasts did not meet the legal definition of indecency.

For future cases, the purpose of the FCC's Notice of Inquiry is to gather data necessary for court challenges.

The notice will likely be the FCC's most detailed examination yet of the ra-

dio listening and TV viewing habits of children age 17 and younger.

The FCC will ask commenters to outline how pervasive and accessible the broadcast media are in children's lives and what alternatives to the 24-hour ban might be available. These alternatives could include program rating codes; pre-broadcast warnings and technology that restricts children's access to indecent broadcasts.

The Commission also will investigate "the availability of indecent material for

adults through non-broadcast means."

"The ban is justified because of the unique accessibility of broadcasting to children," said Commissioner Sherrie Marshall.

"How many children are listening to transistor radios under the covers at night? What is the size of the child audience out there?" she said.

For information on the complaint action, contact Edythe Wise in the FCC Mass Media complaints and investigation branch at 202-632-7048.



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SF FM Beats the Odds in Quake

(continued from page 1)

45 minutes for a maintenance check during the late evening hours of that first day.

Like most broadcasters in the San Francisco area, the station relied on generators for several days because electricity was knocked out or shut off to prevent fire.

Gooch said it was miraculous the station suffered only slight damage when compared to the destruction of nearby Interstate 880 and the other end of the Bay Bridge, where a 50' section of the upper deck collapsed.

"I should have got it the worst," Gooch said. "I'm just lucky."

The only noticeable damage was to one of the directional towers. It rocked back and forth during the quake, tearing out some of the sediment packed around the tower's 60' anchors. One of the support posts also was bent, which will have to be replaced, Gooch said.

Old tower holds up

Gooch said the oldest of the towers, which is 45 years old and made from black iron, held up the best and did not show any signs of movement.

The road leading to the towers, however, had considerable cracking, he added.

When the earthquake hit, Gooch was riding with GM Mike Grinsell, about 20 miles from the station on Interstate 280, a major highway that extends north and south along the west side of the Bay Bridge. They felt the vibration and Gooch assumed it was a flat tire.

"We pulled over and I thought, 'Oh God, I'm with the GM. That means I am going to have to change the tire,'" he recalled.

When he pulled over and stepped out of the car, Gooch thought it strange that everyone else was pulling over to watch him change a tire.

However, he quickly realized a faulty

tire was not the cause of the rumbling as the overpass shook and light poles began swaying like saplings in the wind.

"You had to hold on to the car to keep your balance," Gooch said.

Signal problems

Immediately after the earthquake, Gooch and Grinsell noticed the station's signal was intermittent. Amidst the confusion, they headed for the station—not knowing how long it would take to get there.

... KABL DJs had to be ferried across the bay to the studio.

Traffic snarls and road disintegration forced them to take alternative routes, resulting in a two hour trip just to go 20 miles, Gooch said.

Once they made it to the station, Gooch stayed put most of the first three days following the quake, excluding supply runs and a check on the FM transmitter in Sausalito.

Transportation remained nightmarish for most San Francisco residents and those who ventured to work at KABL as well.

Because of the Bay Bridge damage, KABL DJs had to be ferried across the bay to the studio.

Those first three days were an adventure because workers were without electricity, water or restroom facilities and food, according to Gooch.

Gooch said he made several food and bottled water runs and portable toilets were finally delivered three days later.

A long trip

When Gooch finally ventured out, it took him five hours to reach the FM transmitter as he meandered through the city via shortcuts he knew from his many years in the area. The trip normally is a 45-minute drive.

Besides keeping his own station on the air, Gooch stopped by and helped KEAR-FM's CE, who was having generator problems, get his station back on the air.

Pitching in and helping those who needed assistance was the right thing to do and is a philosophy of those who live in the San Francisco area, Gooch emphasized.

"We usually keep to ourselves, but when there is an emergency, we help each other," he said.

Despite only slight damage to KABL facilities and Gooch's successful efforts to keep the signal on the air, he said his good fortune paled in comparison to the earthquake's aftermath.

"It's pretty devastating. There are thousands and thousands of people without homes," Gooch said.

A terrible calamity

He said a quick look outside the studio window served as a grim reminder of the heavy loss of life and damage caused by the collapsed, crumbled stretches of I-880.

"It's so sad," Gooch said. "All those people killed on the overpass. It's just a quarter mile away. It's nothing I ever want to go through again."

RAC Technical Subgroup Adopts Nighttime RSS Calculation Report

by Benn Kobb

Washington DC The technical subgroup of the FCC Radio Advisory Committee (RAC) on 25 October adopted a report on adjacent channel nighttime RSS calculation of interference for AM stations.

FCC allocations criteria have never included consideration of adjacent channel skywave interference for nighttime. The FCC supports a method for using a 25% exclusion criterion to calculate RSS, but is considering the use of a single RSS to take into account both co-channel and adjacent-channel stations.

The group was to present the report at the full RAC meeting scheduled for 7 November. If the RAC accepts the report, it will be presented to the FCC as comments to the Commission's upcoming public hearing on AM im-

provements.

Some subgroup members were concerned that the single RSS approach could increase overall AM interference.

The committee consensus was that no increased interference be permitted to any station. The committee agreed that the FCC should, at a minimum, not permit greater interference to Class I skywave service areas than that permitted under the current rules.

A working party recommended that protection from nighttime adjacent channel skywave interference be determined as follows:

The protected station contour will be the greater of the normally protected groundwave contour for the station class; or the co-channel RSS computed using the 25 percent exclusion method.

The permitted limit of an adjacent channel station at the protected station contour will be the greater of the

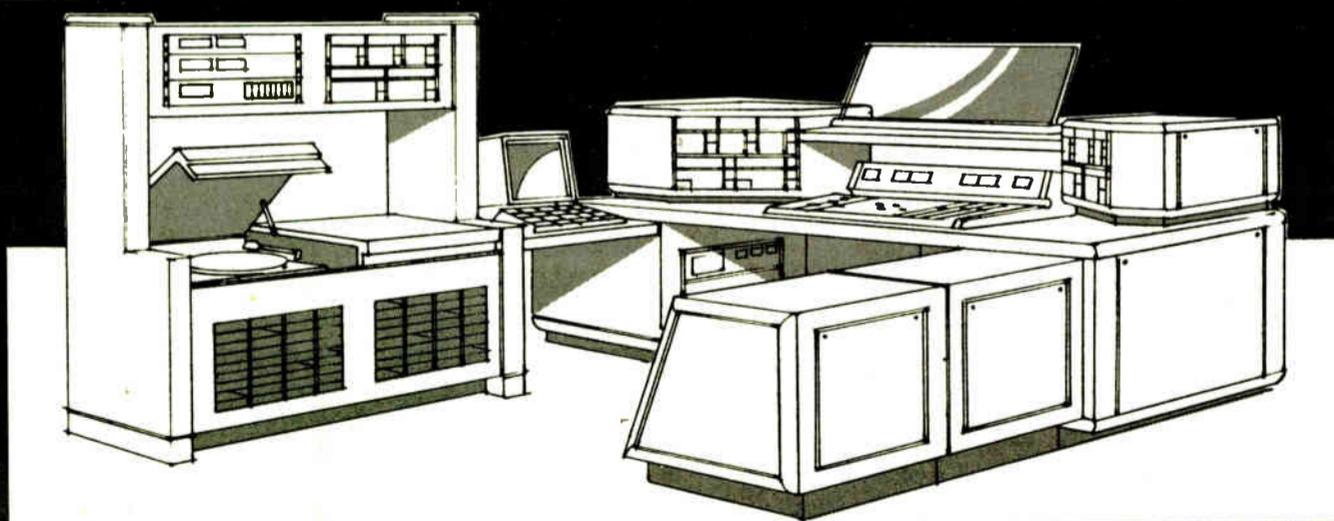
protected station contour times the 25% exclusion or the RSS of the adjacent channel times the 25% exclusion.

Stations whose authorized facilities currently exceed the permitted signal strength calculated by this method would be grandfathered at their current level.

Class IV stations would be excluded from consideration of both caused and received nighttime adjacent channel skywave interference.

Other nighttime non-directional stations would be permitted to increase the RSS of an adjacent channel station by a maximum of 0.25 dB, as a result of a change in site.

For information, contact subgroup chairman Wallace Johnson at Moffet, Larson & Johnson, 703-824-5660 or RAC chairman Larry Eads at the FCC, 202-632-6485.



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World Radio History

NRSC Meets On AM "Mark"

by Judith Gross

Washington DC NRSC AM subgroup members have decided to seek more active participation from receiver manufacturers in developing a certification mark for higher fidelity AM radios which meet the NRSC design standard.

As the group met here in late October to discuss the mark, it also got a preliminary look at a prototype NRSC receiver from Denon America.

The decision to seek more input from receiver manufacturers was prompted by a sparse response to a request for comment on the specifications which were drafted at the committee's June meeting at the summer CES show.

The NAB received only 15 responses, of which only four were from consumer electronic companies.

Most of the responses asked for minor changes in the technical requirements for the certification mark, including lowering the lower limit of the frequency response of radios bearing the mark to 50 Hz from a previous 85 Hz.

Commenters requesting the change said that some receiver designs incorporate a low end rolloff which limits the performance of a receiver's abilities to receive low frequencies.

Discussion also centered on whether to include parameters for distortion and how radios will be tested for compliance

with the specs.

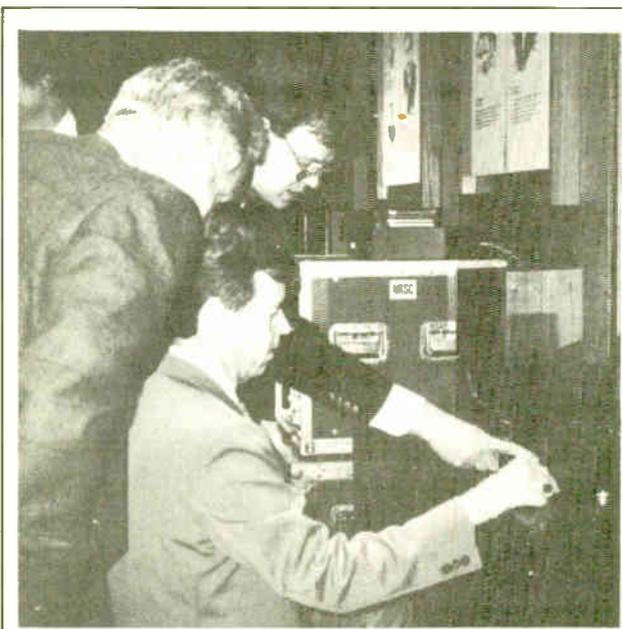
The consensus from the discussion was that the draft spec should be broad enough to allow receiver companies to incorporate desirable features without overburdening the requirements in a way which would discourage the manufacture and marketing of new AM radios.

The group decided to eliminate an optional requirement to include AM stereo. It also decided to eliminate a "brick wall" representation of the 7.5 kHz upper frequency limit from two figures so that receiver designers would feel free to go beyond the 7.5 kHz limitation if they wished.

More input sought

A modified certification mark spec was drafted and the committee decided to circulate it for a second round of comments by mail.

George Hanover, the EIA's representative at the meeting, told the committee



NRSC AM committee members examine Denon's new NRSC AM receiver.

that more input was needed from receiver companies. "We have to do something more aggressive than just send it out by mail," Hanover said.

John Marino, of NewCity Broadcasting and Charles Morgan of Susquehanna Broadcasting, among other broadcasters present, questioned the poor response by receiver companies.

Broadcasters were also concerned

about the few comments which did come from consumer electronics firms indicating that the additional cost of designing better radios for AM might be a factor in delaying their development.

"We legislated ourselves to 10 kHz (occupied bandwidth) because we thought better radios were coming," Marino said.

Hanover said that it was difficult to speculate on whether the lack of participation by manufacturers indicated disinterest in bringing new radios to market or was a sign that receiver companies are already designing such products.

Frank Foti, from Cutting Edge Technology was one among several committee members who suggested that a "spokesman" or "targeted presentation" was needed to get more response from consumer companies.

The committee decided that a telemarketing effort, undertaken by EIA and NAB staff, would be a necessary adjunct to sending the certification mark draft spec out for comment. The possibility of a follow-up letter alluding to proposed Congressional legislation which would mandate certain improvements in receivers was also raised.

NAB Staff Engineer Stan Salek agreed to circulate the revised draft spec for a second round of comments due back by 15 December and incorporate them into a second revision in time for the committee's next meeting three days later.

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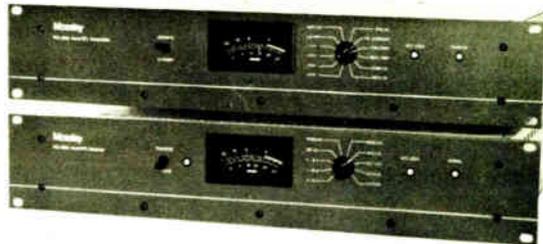
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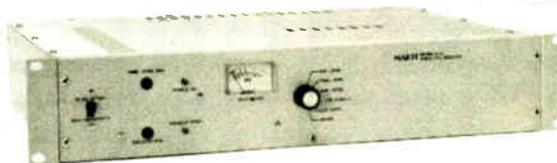
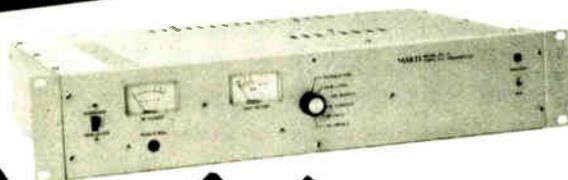
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More Multipath Study Needed

Washington DC "In Round II studies, we hope to fill in the holes from Round I."

The subject was FM multipath and the speaker was Harry Simons, CE of WAEB, Allentown PA, where an extensive study of multipath is underway.

Simons, along with Ted Schober from Radiotechniques and Tom Becker and Ralph Chambers from Air Systems Technology reported in late October to the NRSC Working Group on FM Multipath Studies about the progress of the tests.

Simons reported that Round I tests had included characterizing multipath using transmitter pulsing with ground measurements taken in a specially equipped van provided by General Motors and Delco.

The results of those tests, he said, have not yet been compiled into a formal report.

Other tests included trying to determine the effect of ICAM—AM incidental modulation—through a series of listening tests.

Inconclusive results distributed at the working group meeting showed that ICAM level changes under heavy or light multipath conditions were generally not perceived while level changes under multipath conditions which could be considered "moderate" were perceived.



Harry Simons (WAEB), Tom Becker and Ralph Chambers (Air System Technologies) review FM multipath studies.

Other multipath tests focused on antenna patterns. Two WAEB antennas, an ERI and a Shively, were measured by Air System Technologies in a plane with equipment which calculates the signal in real time.

The readings were taken by flying three-mile radius loops around the antennas. Several consultants have voiced the opinion, in this and previous meetings, that three miles is too wide a radius and the readings under such conditions would include ground reflections.

A radius of a quarter-mile was recommended for a second round of tests from the air.

Schober, agreeing with several working group members, raised the need for laboratory tests to verify the field results. Schober suggested using a multipath simulator to look at different co-channel protection ratios.

Simons maintained, however, that more field work is needed before lab tests could be done. He added, however, that several companies' previous commitments might make it difficult

to continue field tests until the beginning of next year.

NRSC FM subgroup chairman Wes Whiddon asked the committee to begin to focus the massive body of tests and results in order to achieve the working group's original goal of defining multipath and recommending remedies.

Simons, whose station is conducting the tests jointly with participating companies as a non-NRSC activity, conceded that in the first round of tests each group had its own goals and that the original purpose of the multipath studies might have been diffused in the process.

The committee asked Simons to submit a report on the tests to date by 19 December, when the working group will meet again and offer suggestions for future testing.

A separate proposal for more tests suggested by ERI will be defined by committee members' suggestions and submitted to the antenna company by that date as well.

"We need to sit down and prioritize what we want to accomplish," Simons said. But he added that the multipath work will be somewhat easier from this point on because "we know how to do it now."

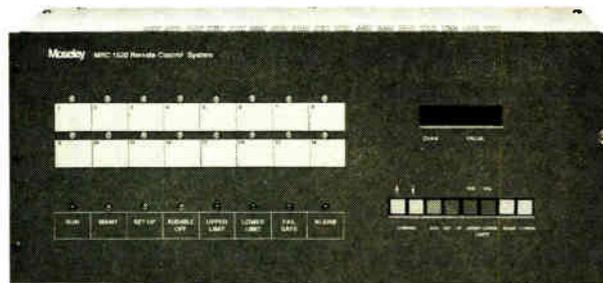
"Information from Round I will help us decide how to go about Round II," he said.

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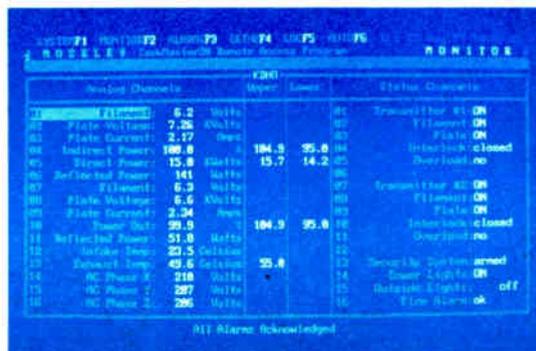
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Desktop Audio Intros

by Judith Gross

New York NY The battle of the digital audio workstations heated up as new entrants into the field began to jockey for position at the 87th Audio Engineering Society Convention.

The past few years have seen desktop audio technology move from high-end post production systems into a price and application range which bring it into the grasp of radio stations, especially those with well-stocked production rooms.

The newest entrant into the workstation field is Symetrix, which introduced its DPR-100 Digital Audio Workplace™.

Symetrix is calling the DPR-100 a full-function workstation. It uses the Apple Macintosh II/IIx/IIcx solely as a system controller and graphics interface and offers a variety of functions, including digital recording, mixing, editing and processing in real time.

One of the interesting features about the DPR-100 is the graphics capability, which provides different "screens" for each application.

Friendly features

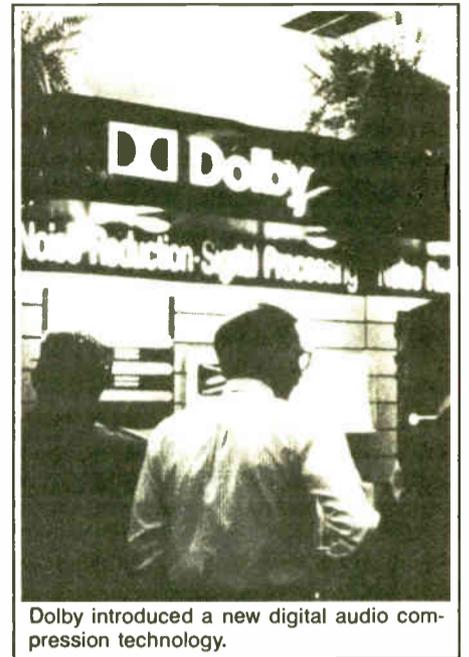
Audio editors used to working with console faces will recognize the look of the screens. There is a main controller screen with edit and mix and transport panels, an EQ screen, a dynamics screen for processing, signal routing and synchronization screens.

Symetrix plans to offer the workstation in a variety of configurations to fit the user's needs and plans product availability for next spring.

Still featured in a demonstration environment and still drawing crowds is the AKG DSE 7000 RAM-based digital workstation which acts as an eight-track recorder, editing system and mixer.

AKG has targeted the broadcast market by designing the workstation for the production of jingles, spots and other short recordings. The company is busily readying the workstation as a product.

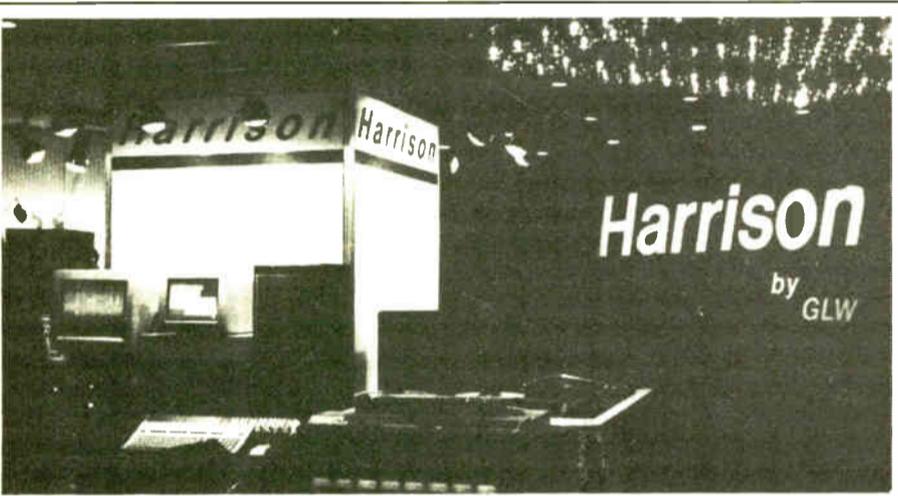
AKG has also been busily reorganiz-



Dolby introduced a new digital audio compression technology.



Professional dbx products are now manufactured by Orban, a division of AKG.



Harrison by GLW—one of the few companies featuring broadcast consoles at the show.

ing in the wake of the recent acquisitions of Orban and dbx professional products. The company bought the dbx pro line from Carillon Technologies and has moved the manufacture and marketing of dbx products to Orban's facility on the West Coast.

AKG also announced that it plans to respond to the demand for Type II dbx noise reduction by resuming manufacture of the 941 and 942 Type II modules which had been discontinued last year.

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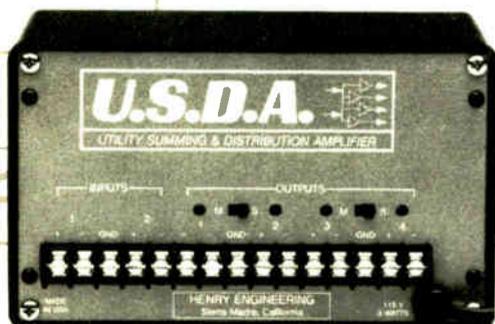
Use U.S.D.A. to add a mono output to a console... use U.S.D.A. to combine the output of a stereo tuner to feed a mono PA system... use U.S.D.A. to create isolated stereo and mono outputs simultaneously from a single stereo input... all without sacrificing the separation of the stereo source signal.

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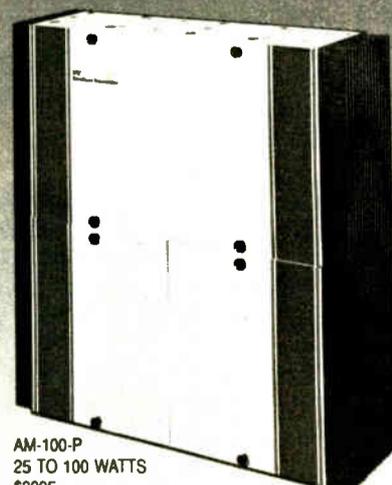
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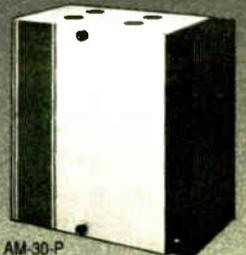
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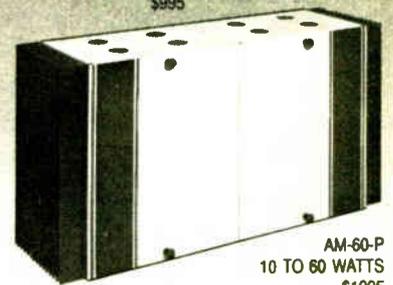
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Are Key at AES Show

AKG also said the 140X 1/2-rack Type II processors would be available beginning in the second quarter of 1990.

More acquisitions

Another recent acquisition, that of Integrated Media Systems by Studer, has put Studer firmly in position to make strides in the digital audio workstation race as well.

The newly formed Studer Editech Corp. introduced new Dyaxis products, including color monitor capability, at the AES show as well.

Studer also introduced the A729 CD system controller, with the capacity for

recognizing 100 CDs and storing three start and end cue points per disc, as well as a number of analog recording products.

Otari Corp. also announced at the AES show that it, too, is poised to enter the digital marketplace. The company said it had reached an agreement with Digidesign to develop a professional disk recorder for availability in mid-1990.

And as a result of its acquisition of Sound Workshop professional audio products, Otari's newly-formed Console Products Group introduced new console designs: the Series 54 and the TC-100.

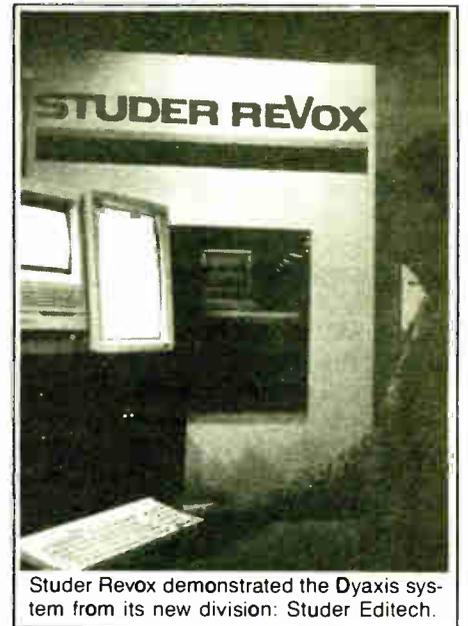
Few consoles featured at a professional

recording convention such as AES are aimed at the radio market. But Harrison, under new ownership by GLW featured new software for its Series Ten.

DAT and new tech

Talk about DAT was not as loud nor as controversial as in past AES shows, now that the copying compromise has been reached.

Both Sony and Panasonic showed their portable DAT recorders which have



Studer Revox demonstrated the Dyaxis system from its new division: Studer Editech.

... Studer Editech Corp. introduced new Dyaxis products ...

been slowly but steadily finding favor for field recording and production.

Panasonic also featured, although not yet as an available product, its DAT editing system.

Two companies ventured into a different realm of digital technology, one which may have far-reaching broadcast applications.

Dolby introduced its DP501/DP502 professional audio coding products, an encode/decode system using bit rate reduction techniques to code two data channels at one-sixth of the data rate of

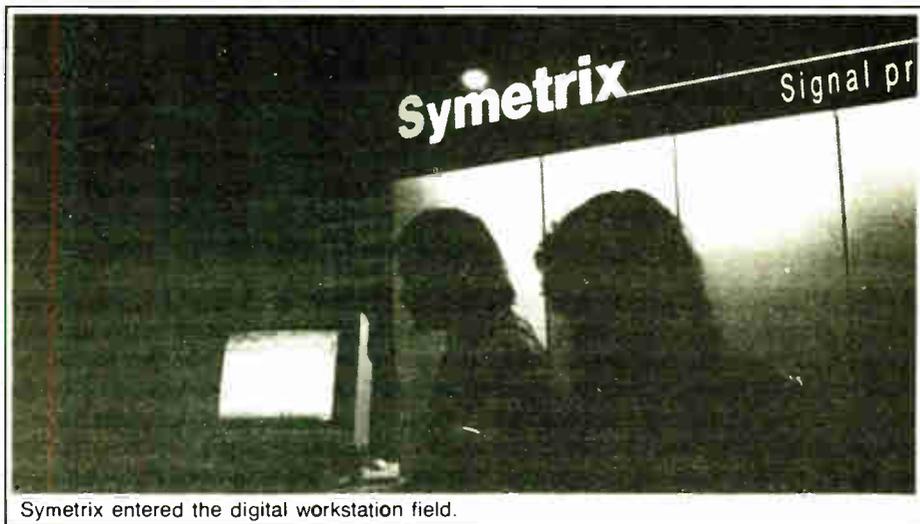
48 K sampling.

It uses a proprietary compression technology called ATC (adaptive transform coding) and can be used in combination with spectrum efficient modulation techniques.

Solid State Logic also ventured into this arena with its apt-X 100, a digital audio data compression system which has already been sold as a product.

Developed by Audio Processing Technology, a subsidiary of SSL, it features real-time compression of 16 bit PCM samples to 4 bits per sample.

The use of either of these systems for the distribution of audio signals with no degradation could make them the technology of tomorrow for such important functions as STLs.



Symetrix entered the digital workstation field.

Shively Combiner Takes Place of Alford in Chicago

(continued from page 8)

tion and setup, Lomas said.

The companies included Micro Communications Inc., Manchester, NH; RF Technology, Norwalk, CT; Interstate Erecting Company, Milwaukee, WI and WLP Associates and Admiral Heating and Ventilation and Commercial Light Company, both of Chicago.

Installation challenges

The installation posed several challenges for the various workmen and engineers, Lomas said.

Some of the challenges included the time-consuming process of drilling holes through a 14" concrete floor to run the 6" cables, Lomas said.

Also, 230 V custom-designed condensers were made for the cooling tower in order to accommodate the extra cooling that

the combiner room required, Lomas said.

A new power divider for the tower also had to be designed and built, he added.

The nine stations went off the air at 1 AM, 22 October and stayed off the air until the changeover from the Alford combiner was complete at 6 AM that morning.

Larson said the initial connection simply required each CE to unhook the cable from the Alford combiner and connect the new cable to the Shively combiner.

After several hours of on-air operation the first day, the stations shut down for a few hours again 23 October for tests and measurements, Lomas said.

For more information about the Shively combiner, contact Charles Lomas at Communications Site Management, 312-951-1399, Joel Hodorff at WKQX, 312-861-7979 or Bob Larson at WUSN, 312-649-0099.

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World Radio History

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Hot Spot Study May Prompt RF Reviews

by Steve Crowley

Washington, DC RF hot spots have been a nuisance for engineers ever since the FCC required broadcasters to consider radiofrequency radiation when evaluating the environmental impact of their facilities.

Though ambient fields usually fall below the ANSI field strength limits, localized intense fields, sometimes only within a few inches of a conducting object, can greatly exceed those limits.

Most of us know the ANSI protection guide that pertains to our station—for example, 4000 volts squared per meter squared for the FM band. Those field strength values are based on a whole-body specific absorption rate (SAR) of 0.4 watts/kilogram (W/kg).

The ANSI standard contains a few exclusions to the field strength limits. If it can be shown that the whole body 0.4 W/kg SAR standard is met, and peak SAR does not exceed 8 W/kg as averaged over any one gram of body tissue, the field strength limits can be ignored.

Measurement

This would seem to be a way to take into account the high field strengths of hot spots. But how do you measure

SAR? The ANSI standard says that measurements to determine SAR "would be difficult and could be done only by a properly qualified laboratory or by an appropriate scientific body... In no case could a routine field survey determine conformance with the criteria of this part of the exclusion."

A new study prepared by consultant Richard Tell indicates that SAR measurement need not be as complex as implied by ANSI standard.

CONSULTANTS CORNER

Prepared for the National Association of Broadcasters and funded by several broadcast organizations, the study concludes that if typical field strengths are below ANSI values, hot spots do not generally result in whole-body SARs in excess of the ANSI standard, regardless of the strength of the enhanced field.

The study also notes that due to the high variability in coupling to the body from the source, high field strengths accompanying hot spots—such as those

measured by common broadband equipment—are not good indicators of power absorption.

Instead, the study points to contact current—current flowing through the body when touching a reradiating object—as a meaningful alternative to field measurements when evaluating the peak power absorption.

Contact current can be considered "worst-case" exposure; exposure is greater than would exist if a person were simply near the reradiating object. Practically, maximum power absorption and, hence, worst-case SAR, will be in the wrist, which has the smallest cross sectional area through which contact current can flow.

A new technique

Tell devised a simple surrogate SAR measurement technique for his tests. A piece of pipe is passed through a toroidal RF transformer connected to a field strength meter. The pipe is held and touched to the reradiating object.

The field strength meter responds to the current flowing through the hand and wrist. From knowledge of tissue conductivity and the effective cross sectional area of the wrist, the SAR may be calculated.

Tell's tests revealed that even though hot spots may greatly exceed field strengths in the ANSI guideline, the SAR may be much less than the 8 W/kg criteria needed for exclusion.

Reradiating objects are not the only sources of localized intense fields. Standing waves below elevated antennas result in field strengths that vary with elevation near the ground. This can cause measurement results that underestimate the power density at ground level.

The report indicates that if a maximum of either electric or magnetic field strength can be found when the probe is moved vertically, then that value can be used as an indication of the maximum plane-wave equivalent power density that exists in the region.

Other conclusions

The study also reaches useful conclusions regarding the accuracy of measurements using common broadband, isotropic measurement equipment. Interaction of survey probes with nearby field sources appears to be minimal, at least in the VHF band where the tests were conducted. Interaction may be important at frequencies above 1000 MHz.

The NAB indicates it will use the Tell report to seek relief for broadcasters experiencing hot spot problems. Additionally, the present ANSI standard is under review and will likely be modified.

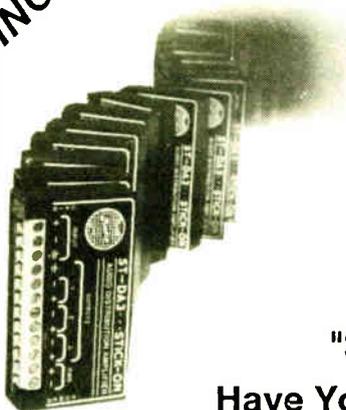
Proposed is an increase in the peak SAR to 20 W/kg. Spatial averaging may also be adopted to reduce the impact of hot spots in RFR surveys. This same ANSI review, however, will likely result in more restrictive whole-body exposure field strength limits, especially in the VHF band.

The FCC's Office of Engineering and Technology has recently released another report, also prepared by Tell, that deals with the unique RFR concerns of AM broadcasters. I'll discuss that report in an upcoming column.

■ ■ ■

Steve Crowley is a registered professional engineer with the consulting firm of du Treil, Lundin & Rackley, Inc., 1019 19th Street, NW, Suite 300, Washington, DC 20036. Phone 202-223-6700 (FAX 202-466-2042).

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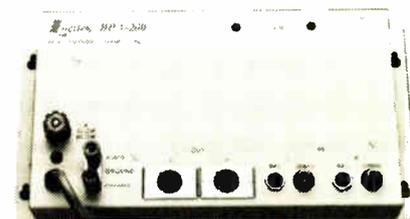
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When it has to work right

Returning to VOA Greenville

by Thomas L. Vernon

Harrisburg PA During the last part of our tour of the VOA's Greenville facilities, we looked at different types of high power transmitters, demonstrating an interesting combination of old and new technologies at the transmitter site. This month, we'll continue with a look at their antennas, as well as some of the support services and unique problems involved in the operation of such large facilities.

Unlike AM broadcasters who employ vertical radiators, shortwave stations rely on curtain, rhombic and log periodic antennas to beam their signals to distant points on the globe. The transmitter sites at Greenville have a total of 29 curtains, 38 rhombic, three log periodics and one dipole antenna.

Curtain and rhombic antennas are the mainstay of international broadcasting at Greenville. The log periodics are low gain, broadband devices that were designed to relay programs to the Dixon

Curtain and rhombic antennas are the mainstay . . . at Greenville.

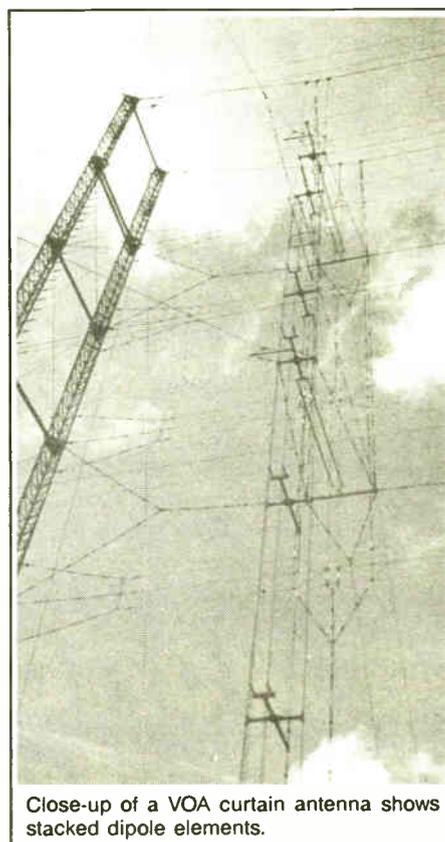
and Delano, CA transmitting stations. Since most feeds are now done via satellite, these antennas are seldom used.

Curtain antennas are basically a stacked dipole array, two elements wide and four elements high, with a wire grid reflector behind the active elements. This arrangement produces a narrow beam pattern from 30° to 36° horizontal and 10° vertical. Three different sized curtains are used to cover shortwave broadcast bands in the 9 to 11, 15 to 17 and 17 to 21 MHz portions of the HF spectrum.

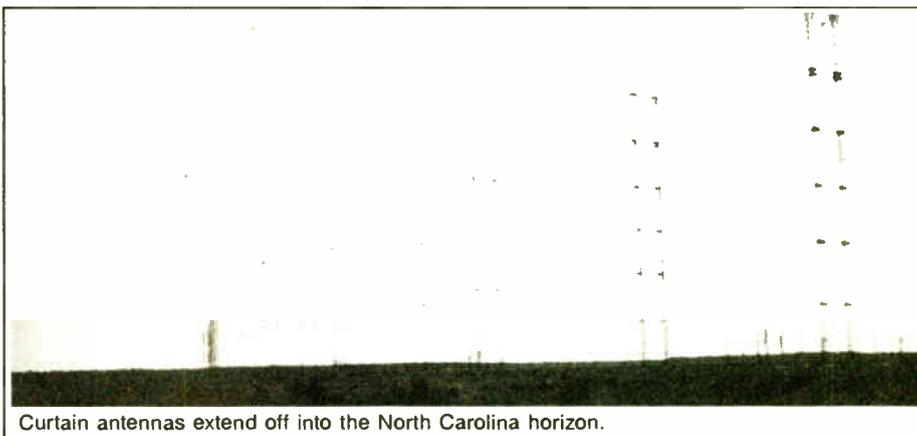
Stub tuning elements are located at the base of the antenna to optimize matching into the 300 ohm open wire transmission line in both SW bands covered by the antenna. Feeders are routed symmetrically to the tuning stub. The rhombic antennas at Greenville have three wires on each side to aid in broadbanding. A long section of open wire transmission line shorted on one end is used as the terminating resistor.

Potential hazards

Surprisingly, lightning damage isn't a major concern at Greenville. The vertical towers are grounded and surges seldom get past the switching matrix to harm transmitters.



Close-up of a VOA curtain antenna shows stacked dipole elements.



Curtain antennas extend off into the North Carolina horizon.

One of the biggest problems is the potential for fires in the antenna fields. Under some circumstances RF arcs can develop between the open wire transmission lines and ground. These arcs may be up to 6' long and consume 50 kW of power.

This won't always result in a transmitter shutdown but sustained arcing can set dry brush afire. This in turn can destroy the wooden structures used to support the open wire transmission lines.

Because of the size and remoteness of these sites, detecting and extinguishing brush fires is given high priority. To this end both of the transmitter sites have their own small fire trucks, and VOA engineers are trained in fire fighting techniques by the forestry department.

Antenna facilities such as these require constant maintenance, retuning and seasonal adjustments. Both transmitter sites have a crew consisting of a lead rigger and two assistants. These crews also take care of the antennas at receiver site C, which require less frequent attention.

The warehouse facilities at both transmitter sites are well stocked with spreaders, standoff insulators and other antenna hardware, in addition to the spare parts stocked for transmitters.

Changing operations

Since its completion in 1963, the mission of the Greenville relay station has changed somewhat. Initially, shortwave programming originating from Greenville was

(continued on page 35)

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FROM THE TRENCHES

by Alan Peterson



Sample One For Me

Dear JG:

Ah, the holiday season in Massachusetts . . . there's something about the smell of hot mulled cider, the warm metallic aroma of a woodstove and the stink of a blown electrolytic cap that just makes radio here in the northeast such an experience.

Spoke on the phone a few days back with a buddy I used to work with. After exchanging the news about our respective careers I reminded him about a letter I wrote a month before, requesting copies of sequences and samples I created on their Esoniq sampler.

I was told in return that there's no one around who can access the sequencer and that the keyboard was now in use just to make toots and honks.

"What about referring to the manual?" I asked. "That was written for musicians, not technicians. If a musician can work it out, surely a born-button-pushin' DJ could accomplish it." No go.

Now this took me a while to figure out. What could've happened? How could such a technically proficient aggregate of creative kooks lose the vision? The one machine that thrust this operation two years ahead of the whole market was now an expensive version of a Magnus organ and was collecting dust in its disk drive.

Did my old nemesis NICORI (Nobody Is Capable Of Running It) creep in to spoil the fun? Techno-Lemmings? Teenage Mutant Ninja DeeJays? This actually made me uncomfortable.

A friend from Long Island (or Lawn-Guyland, as they say out that way) shed lots of light on the problem: "Al, what did you expect? One, you put an organ right in the middle of your production room surrounded by a flock of non-musicians and Two, what're you going to do with a sampler now that Max Headroom is yesterday's potatoes?"

Hoover! (no, I mean "Eureka!") An answer from above. Immediately I tore through my favorite publications for a rebuttal. Amazingly, nearly all had the same slant—stations can modify and make their own music . . . but only if somebody knows how to play a keyboard!

Indeed, I remember selling our machine to our corporate VP (sort of an "oh pleeeze let me keep it" desperation display) by loading a beautiful smoky saxophone sound and soloing on *Harlem Nocturne*. Since it was infinitely more impressive than, say, sampling a burp and playing the *Looney Tunes* theme, he was sold.

But all this proved is yes, the sampler is a musical instrument. Only a select few people are going to get anything out of it.

Jude, to me, samplers are one of the most powerful production tools to come down the line since Marconi began taking requests from across the oceans.

True, you could say a sampler is a musical instrument in the hands of a musi-

cian. But in a production studio it becomes 68 little two-second cart machines ready to hold whatever sounds you can feed it.

Nobody needs keyboard training—put an effect on this key, then "X" the key with a grease pencil. Load a tire screech here, a crash there and a hubcap rolling away over there. Some machines that can hold more than one sample would save time and not swallow up whole tracks on a tape deck . . . tap-tap-tap, all done. One effect not loud enough? Tap-tap-tap: There.

So what if Max Headroom is dead and buried? Sampling voices is still useful. Sample "hey, shut up over there," play lots of keys randomly and mix in a little reverb . . . you've got an argument going on between two campus dorm buildings.

Sample a contest winner's voice, then manipulate it through the rack. Clients are blown away by hearing new sounds. So are copywriters and AE's. Although I admit that at one station, I ran into the opposition: "I don't like that spot. It sounds too *modern*" (gee, what a revelation . . . this is the same guy whose production library consists of horn and string bossa-nova tracks, circa 1961).

And musically, is there anyone who, after a moment's practice, couldn't plunk out "shave-and-a-haircut, two bits" on a piano? Plug in the String Ensemble sound disk and right there in your own studio is the Easy Simoleon Municipal Symphony Orchestra for that next commercial project ("You hired who? For how much?").

Remember Stevie Wonder on the *Cosby* show, making a rap record with the Huxtable's voices sampled into a Synclavier? Sample the news department for that end-of-the-year tape. The point is, don't limit yourself to the obvious. Be daring. Grandma used to say "make cookies when the jar is empty" . . . lovely woman but definitely not a broadcaster.

It's my wish for the coming holiday season that every producer who wants something for his little pleasure dome finds it in his stocking (or under the Menorah) and dazzles the entire rest of the market with it.

To commit and then to ignore can be fatal in the trenches.

As I write this, I'm flipping through the new catalog Alesis sent me; these guys have a digital reverb for under \$200, a parametric EQ for about \$150, a limiter, a noise gate . . . all designed for musicians. Can radio stations utilize these little joy-toys?

Happy Turkey Day and on the pumpkin pie—give me a double.

Flanging to the max,
—Al

■ ■ ■

Al Peterson is snowed in at WSBS/WBBS Great Barrington, Massachusetts, where the snow comes early and icicles grow tall. He didn't stuff the Thanksgiving turkey 'cause it wasn't empty. Send Christmas cards via RW, PO Box 1214, Fall Church, VA 22041.

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The Best RPU May Be Wireless

A Look at the Options In Getting Good Audio From Your Remote Site

by Barry Mishkind

Tucson AZ Getting good, clean audio back from the site of remote broadcasts has long been a struggle for some stations.

Some engineers are heard to groan audibly when they are told about an upcoming RPU broadcast. Others have developed a system, using one technique or another and are ready for virtually any possibility.

Considering the variety of formats, no one system is going to serve every station's audio quality expectations and budget limitations, most can find something that fits them well, either wired or non-wired.

Cellular telephones are a bridge between standard hard-wired telco loops and totally RF-based systems, with part of the system using the telco network and the cellular part being wireless.

However, even with a cellular system, using a frequency extender and other audio processors, the signal is still coming through the telco wire. And there are at least one or two places where cellular service is still not available.

Some stations have taken the view that

they should control their audio from microphone to transmitter wherever possible. One of the most flexible ways is the RPU transmitter, often called a "Marti," after the popular Texas manufacturer of RPU gear.

Near studio quality

Once a station has its transmitter and receiver, usually on the 160 MHz or 450 MHz bands, it can go out to a remote site and feed the program back, with qual-

ECLECTIC ENGINEER

ity approaching studio conditions.

That appeals to many station managers and sales managers, since a one time purchase of equipment will allow remotes to be set up with little or no notice and no additional expense. Some stations find this to be a profit center.

Are there any problems with this approach? First and foremost is the frequency. While a station can broadcast for up to 720 hours a year without a specific license, the frequencies are non-exclusive and crowded in many markets. That means cooperation and coordination.

In smaller markets, or for some long established stations, there is no problem. They have a frequency, possibly even a repeater, and no competition for its use.

In most larger markets, there is a fre-

quency coordination committee, a volunteer effort from the local SBE chapter. They try to schedule frequencies and times so everyone can get on the air with their remote.

Often it works well. Political conventions, disaster coverage, even Papal visits have been successfully coordinated by hardworking engineers.

To facilitate this process, some stations buy frequency agile RPU equipment and can broadcast with either horizontally or vertically polarized antennas. This way, several stations can use a frequency in opposite directions without interfering with each other.

Unfortunately, there are times when

by schedule.

Another kind of backup should be considered if you are thinking of using an RPU transmitter system for your remotes. Inevitably there will be two remotes scheduled at the same time, or very close. Rushing setup and take down is a good way to ensure premature failure of the equipment from accidents.

Facing reality

The reality of life is that there will be needed maintenance. Many engineers like myself send out backup equipment to a remote, since over time an antenna gets bent or the cable connector will be torn off or the RPU transmitter itself will

. . . no one system is going to serve every station's audio quality expectations . . .

there are just no frequencies available, there is poor cooperation, or the demand for usage is so great that coordination takes as long a lead time as dealing with the telco.

Other inconveniences

Then there is the equipment lead time factor, at least for the first time you use an RPU transmitter. Don't expect it to show up the day after you order it. Give the manufacturer time to set it up correctly.

Similarly, there are locations from which you just cannot get RF back to the studio or a repeater. It may be a distance problem, or it may be a lack of line of sight or even a large building complex with no way to get the RF out.

The response to this has been a combination of technologies. A regular or cellular phone may kept ready as a backup. Or, as mentioned last month, a series of loops to the telco central office can be connected to the studio loop

need attention.

A backup set of gear is actually cheap insurance, as one lost remote often can equal its cost.

All in all, for flexibility and control of remotes relatively close distances from the station, RPU transmitters are a good way to go.

Speaking of close distances, let's go the other way and talk distant. Like the next county or another state or Russia.

Getting audio back from such sites used to be limited to dial-up phones. Loops were nearly impossible or extremely expensive. Here again is where frequency extenders have helped a lot.

Up, up in the sky

Here in the late '80s, soon to be '90s, satellite technology has begun to be a viable choice for many situations.

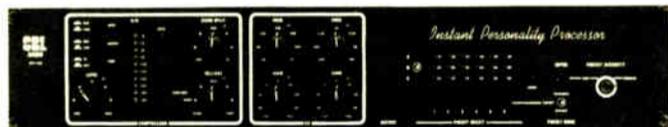
Several companies are currently brokering time on satellite transponders for audio backhaul from remote remotes.

(continued on page 32)

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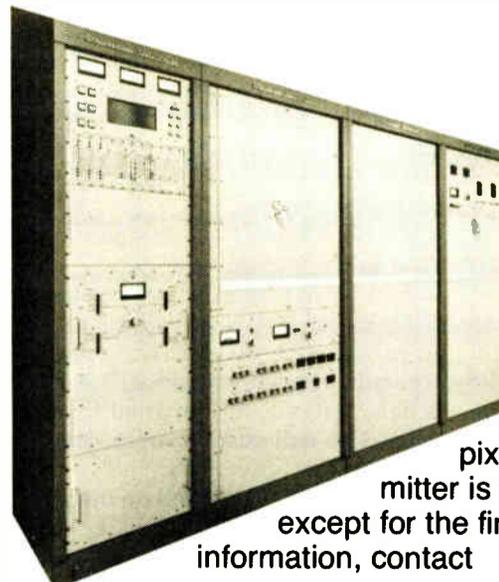


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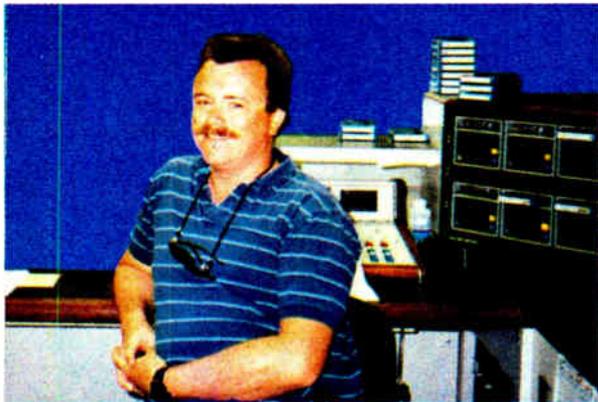
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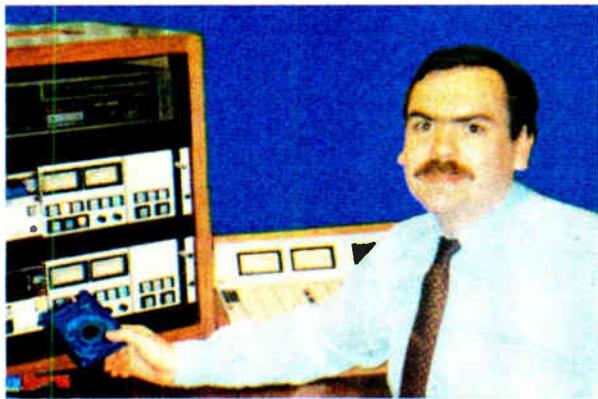
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Our professional CD player has other features professionals enjoy working with. Like one-touch memorization by time code, A-B repeat, and our exclusive rocker control search buttons. It's the digital equivalent of dragging your

finger on the edge of a record.

A great deal of thinking also went into things like our balanced outputs (10 dBm nominal into 600 ohms). There's even a port for a wired remote. And separate power supplies for digital and analog circuits. Given this, it's not surprising that its S/N ratio is 112 dB.

If you're a professional CD player, chances are you're ready to hear what our professional CD player can do.

Call your Technics representative. You'll find that our pro CD player isn't the only thing from Technics that's a pleasure to work with.

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Circle 63 On Reader Service Card

My Life as a Contract Engineer's Wife

How I Learned to Stop Worrying and Love the Phone

by Judith M. Hebert

Pasco WA This is one phase of broadcasting that they never could have prepared me for in college: being the wife of the contract engineer.

For a few years, five to be exact, I was the "guy" on the air. Usually, when I had engineering difficulties, it was me against the mechanical monster with no help. It was quite different being the one who was in trouble as opposed to now when my husband is the one whom people call.

My husband, Dave, works for many of the small market stations in eastern Washington. I, on the other hand, have been in programming all of my career.

Currently, I am news director at KALE/KIOK FM. There's a tendency for me to get just as excited as the caller does when he or she goes off the air and can't figure out what the problem is. This happened one day when Dave was talking to me on one of our phone lines on his way back from a job near the Washington border with Canada.

While I was talking to him on our private line, a station in Idaho was calling for help to get back on the air. I must have looked like those guys at the stock exchange with telephones stuck in each ear and speaking an esoteric language.

I was trying to sound credible but did not have the faintest idea of what I was trying to tell the guy. Whatever Dave said must have been effective because the guy went away, either dazzled or bewildered by my performance.

Dog days

Trouble calls are totally unpredictable, never come in ones, and never come on days when there is nothing on TV and the whole family is healthy.

One Sunday we were shaving the dog (sheepdog) when we got a call from a panicky DJ who had something wrong with both of the stations he was running. That day Dave took three trouble calls. He had to keep leaving the dog in various stages of completion. First he looked like a poodle with a lion cut, then an afghan and finally a whippet when he finished the task the next day.

I'm a liberal arts major. That means I don't have to know how anything works and except for some rudimentary explanations that got me through my third phone test years ago, I have no real understanding of electronics. If you can turn it on, it

works. If you can't, it's broken.

I try to go with Dave on his trouble calls and transmitter inspections. This sometimes requires good sportsmanship and other fine qualities.

Field trips are fun

There is a transmitter that often decides it has had quite enough after a rattlesnake gets inside and wraps itself around. No one told me about this until

I got there but it was one place that I did not wander off to check out the surroundings.

Although I am not good with electronics, I do have a good sense of the practical. It was I who told Dave that the drainage ditch surrounding a tower was too deep to wade. It was I who told him that the goat at the remote mountain location where we were doing a proof was not receiving visitors that day.

Perhaps it was I who should have said "I told you so." When the two guys who looked like they could have starred in *Deliverance* said that the point we were looking for was where I said it was.

In acquiring me as a wife, Dave has also added two step-children, ages three and six. When trouble calls come early in the morning Dave has to dress and take the kids to the sitter.

Sometimes they want to know where he is taking them in the dark. But through all of this I am learning to smile at disaster. For it is through thunderstorms, ice and wind, that we will make those extra trips to the bank.

■ ■ ■

Judith Hebert is the better half of Dave, of Dave Hebert & Associates, a consulting firm in Pasco. You can reach them at 509-545-9672.

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CART MACHINES

Want to Sell

ATC PB-150 tube mdl, seems complete, gd for parts, etc. \$100/BO. J Sigmon, WBZK, POB 398, York SC 29745. 803-684-4241.

ITC Omega Series (2) playback desks, program cards need minor repair, otherwise excel cond, \$800 ea pls shpg. D Kelley, KISZ, POB 740, Cortez CO 81321. 303-565-1212.

BG Engineering BGE-1T new 10 minute digital up timer for retrofit into Spotmaster/ITC cart decks, BO; new semiconductors, IC's, lamps, motors, switches, rack ears, accessories for PDII, Delta, RP, SP, 3D, WP, Series 99 cart decks, BO. B Royster, KOM, 1019 Cordova, San Diego CA 92107. 619-223-3413.

Telex MC-PR III RP audio, excel cond, \$995. L Chatman, IVA, 424 Commerce Ln Ste 1, Berlin NJ 08009. 609-768-5006.

Automated Broadcast Controls w/(4) Otari ARS-1000DC reproducers, (2) 24 cart Carousels, 80 event sequence controller & audio controller, w/manuals, gd cond, \$10,000 pls shpg. B Herrera, KCRT, 100 Fisher, Trinidad CO 81082. 719-846-3355.

Sentry complete automation system including (5) Revox PR-99 stereo PB machines; Instacart; (2) IGM Carousels; (2) Audicord stereo cart machines; PC compatible computer w/software & interfaces, excel cond. B Ferguson, WMMJ, 400 H St NE, Washington DC 20002. 202-675-4800.

BE 2000 R/P, 2 decks, one has new motor, manual, \$700/both; (3) Ampex 602 R-R decks for parts, BO. B Oostenburg, KCKY, POB 6, Coolidge AZ 85228. 602-963-9290.

UMC Beaucart RP stereo record w/spare parts, manual, 3 tones, \$1125. B Carr, WRED, 1201 Fremont Pk, Toledo OH 43469. 419-837-9696.

ATC Criterion Series mono R/P, gd cond, \$300. B McKittrick, 331 Mulberry, Catasquiqua PA 18032. 215-264-5295.

SMC 510 single cart player (2), \$150 ea/BO. J McDonald, 303-669-3442.

Telex MC-PR III R/P, like new, \$950. L Chatman, IVA, 424 Commerce Ste 1, Berlin NJ 08009.

Rapid-Q ROM-2 R/P mono, fair cond, \$200 or trade. D Kohn, KESM, 200 Radio La, Eldorado Springs MO 64744.

Fidelipac Zenith & height gages for head alignment, never used, \$50. D Bailey, 3422 Beech, Rowlett TX 75088. 214-475-9796.

BE 5302B mono, triple decker, gd cond, \$1300. E Trevino, KBOR, Box 3407, Brownsville TX 78523. 512-541-6348.

3M/ITC Delta I stereo, gd cond, presently working. E Trevino, KBOR, Box 3407, Brownsville TX 78523. 512-541-6348.

SMC 792 mono, gd cond, \$900. E Trevino, KBOR, Box 3407, Brownsville TX 78523. 512-541-6348, Fax 512-542-4109.

3M/ITC Delta I stereo, gd cond. E Trevino, KBOR, Box 3407, Brownsville TX 78523. 512-541-6348.

BE cart tape winder, almost new, w/trimmer, both in original packing, \$425. G Cahill, Invisible Inc, POB 5786, Hudson FL 34674. 813-725-5003.

BE/Spotmaster TP-1A cart winder, without timer, \$100, will throw in 100 plus carts for \$150; (3) record amps, mono, for RCA RT-27BA-27 series cart machines, \$40 ea. F Vobbe, Great Northern Bldg Co, POB 5031, Lima OH 45802. FidoNet 1:234/16.

Want to Buy

ITC 3D mono w/WRA record amp, triple deck. C Waltman, KNEW, 66 Jack London Sq, Oakland CA 94607. 415-836-0910.

Parts & manuals for RCA 7 Series; record amp for RCA 7 Series; parts & record amp for Harris Criterion ATC Series. C Gill, POB 371, Indianapolis IN 46208. 317-923-2800.

Rapid cue R/P mono or stereo, any model, schematics & operative units, must work, need several, may be interested in units for parts. N Williams, WTJZ, 553 Michigan, Hampton VA 23669. 804-723-1270.

Eraser splice finder. KDKB, POB 6184, Kingman AZ 86402. 602-753-KDKB.

Tapemaster P & RP 700, any cond from junk to excel, call or write w/descriptions & lowest prices, complete or parts only. T Crockett, Hot Tracks, Box 10501, Blacksburg VA 24060. 703-953-0222.

Stereo record in gd working cond, used carts 40 sec, 70 sec, 100 sec, 2.5 min. A Moll, KLXQ, 128 Memory Trail, San Antonio TX 78232. 512-496-0677.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Tandberg 74B 4 trk, 3 speed, portable case w/plastic lid, service & user's manuals, no mics, mint, BO pls shpg; VM 700 portable 1950's consumer unit, fair cond, BO pls shpg. S Delahoyde, Box 33063, Phoenix AZ 85067. 602-937-9088.

Tascam 38 1/2" 8 trk, low hrs, excel cond, \$1875; Tascam 40-4 4 trk w/dtr, low hrs, \$925. K Flory, The Production Co, Box 1027, Siloam Springs AR 72761. 501-524-4626.

Scully 280-14SP, mono 14", fair cond, \$250; Kahn Symetra-peak SP 58-1A, gd cond, \$50; SMC 282 time announce, gd cond, BO; CBS Audiomax 4450 stereo, gd cond, \$200; CBS Volumax 4100, mono, excel cond, \$200. J Thomas, WLEW, Bad Axe MI. 517-269-9931.

Scully 280B 2 trk stereo in factory roll-around cabinet, manuals, new heads, spare capstan motor & other parts, excel cond, \$1000 pls shpg. B Mountjoy, WIDD, 610-1/2 Hattie, Elizabethton TN 37644. 615-543-5849.

Stancil Hoffman CRM-7 logger Young, WJON, POB 220, St Clair

Crown motor, capstan, Dale H bi-directional, Crown player, new athon 702-7 & 702-10 portable t bi-directional, auto reverse, call prices. E Davison, 135 N Illinois, IL 62702. 217-787-0800.

Ampex AG-440C 1/2" 4 trk in around cabinet, manuals, heads I tie wear, spare set of R/P electro spare parts, vgc, \$1000 pls shpg. WIDD, 610-1/2 Hattie, Eliza 37644. 615-543-5849.

Technics 1520 isolated loop R control in fair cond, \$500. R San POB 83111, Lincoln NE 68501. 41

Scully 270-2 (2) 14" stereo reproducers, 3.75-7.5 ips; also (6) capstan motors, BO; Ampex 35 only w/Schaler electr, excel cond, heads, parts, relays for 350 & BO; PR&E Multisync MDA motor ble speed amp for Ampex & Scull B Royster, KOM, 1019 Cordova, S 92107. 619-223-3413.

Telefunken M15A 24/32 trk 15K & varispd, \$25K; Telefunken M15/ \$4K; Tascam 80-8 w/dtr rack Nakamichi 550, BO. R Rhodes, NANY 10101. 212-245-5045.

Pioneer CTF-2121 stereo (2), ic need minor repair, \$60 ea or \$100 mon, WBZK, POB 398, York SC 684-4241.

ITC 850 Series, gd cond, BO. D 1 901 E Pike Blvd, Weslaco TX 785 1548.

IBM System 34 computer w drive, 6 yrs old, excel cond, use bine traffic system, \$3500 pls sh WJLK, 3342 Perry, Camillus NY

Otari 8 SD 1/2" 8 trk w/calibrati tremely clean & reliable +4 or - tions, \$2500/BO. M Mantell, 1st I 15 Perkins, Brockton MA 024C 1844.

Revox B77 excel cond, \$1000/BO. J-Con Ltd, 200 E Racquet Club, Springs CA 92282. 619-323-439

Teac X-2000R 10.5" 1/4 trk, 7.5-3 bi-directional 6-head system, aut motor transport, very low hrs, \$1000. G Curry, Int'l Minist Peachtree Corners Circle Ste 2E GA 30092. 404-449-6766.

Revox A-77 15/7.5 ips w/Dolby B \$450/BO; Revox B-77, 15/7.5 ips, \$1250/BO. B Henry, KLLK, 12 W lts CA 95490. 707-459-1250.

Otari MIX5050-4, 14" 4 trk, lapped, \$950. B Petrucci, Rouse: E Old Hickory, Madison TN 371 8516.

Ampex 1200 24 trk matched i mods, great shape, heads have b many spares, \$30K/pr, will cons breaking set. D Hewitt, Remote f 334, Lahaska PA 18931. 215-79

Ampex 601 tape transport, as \$30; (3) Rotron 115 V Whisper far ment cooling, \$10 ea or \$25/ea Welch Media, POB 1455, Monck 29461. 803-761-7585.

Recorderx 330M cassette duplica- tor & 3 slaves, 16X duplication s matic rewind, erase heads, long-li ord heads, LED level meters, \$700 ry, Int'l Ministries, 4725 Peachtr Circle Ste 250, Norcross GA 300E 6766.

Sony/MCI JH-110B-2 R-R consoek (2), light use, new heads & pinchr capable, (2) technical manuals & control, \$2600/ea. B Kohz, KBAY San Jose CA 95150. 408-370-7377.

Otari 5050B2 7.5 & 1.5 ips 2 trk, less than 1 yr old, excel cond w/manual, \$950/firm. S Mahaffey, Mahaf Prod, 3592 N Delsea Ste 12, Vineland NJ 08360. 609-692-3439.

Otari ARS-1000 in excel cond, (4), \$700 ea. C Knerr, KCNA, 139 SE J St, Grants Pass OR 97526. 503-474-7564.

Scully 1/2 trk tape heads (28) play; (12) mo- no Magnacord Presto, play; (16) Magnacord stereo lapped Presto, play, sacrifice price. Call 616-782-9258.

Ampex AG 440B 2 trk, 7.5-15 ips in Ruslang console (2), \$700; Ampex 351-2 2 trk 7.1-15 ips w/Novonics 360 electronics in Ruslang console (2), \$400; Ampex 351 FT 7.5-15 ips in Ruslang console, \$250; Ampex 351 electr (4), \$100. B Reider, WGUC, 1223 Central Pkwy, Cincinnati OH 45214. 513-556-4444.

Scully 280B 4 trk 1/2" in factory roll-around cabinet, manuals, new heads, spare capstan motor & other parts, excel cond, \$1200 pls shpg. B Mountjoy, WIDD, 610-1/2 Hattie, Elizabethton TN 37644. 615-543-5849.

Ampex 350 FT w/Novonics electr in roll around walnut floor cabinets (2), \$800 ea, w/roll around floor console, \$1700. B Mountjoy, WIDD, 610-1/2 Hattie, Elizabethton TN 37644. 615-543-5849.

Revox tape recorders, top-shape factory rebuilds, top-shape. Accessories. A77, \$850; B77 (1/4 trk 7.5 ips), \$1000; G36 (tube mdl) 1/4 trk 7.5 ips, \$500. Send phone number & address to: JM Technical Arts, POB 8156, Hermitage TN 37076.

Ampex AG-440A-I, gd cond, \$450; Ampex AG-602-2-p, new, \$775; Ampex PR-10-2-p, very gd cond, \$850; many others, call Martin at 219-322-7090.

Want to Buy

Sony TC 788-4 4 trk in gd cond & w/maintenance manual. C Fuller, Voices, POB 153, LaGrange IL 60525. 312-579-9578.

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Any time you care to scan the broadcast equipment classifieds, you can find most of the major names in our industry—with one notable exception. Products manufactured by Pacific Recorders & Engineering seldom if ever show up in these pages.

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Scully 280-1 (2), ea in Ruslang roll-around cabinets w/overbridge, \$3000/pr; (4) Scully 270-2 stereo PB, late mdls, manual, \$3K/alt; Ampex AG-440B electr chassis, as-is, \$100; Telex 4-chnl, slow-speed logger system, current mdl, \$2000/alt; Tape-A-Thon Programmer III, current mdl, \$5000. E Stolz, KWOD, 1425 River Park, Sacramento CA 95815. 916-929-5000.

Scully 255 reproducer, 1/2 trk, stereo, BO. KDKB, POB 6184, Kingman AZ 86402. 602-753-KDKB.

Ampex 350, 7.5-15 ips, FT, cabinet mounted, \$400; Teac A1200, complete, cond unknown, \$100/BO. J McDonald, 303-669-3442.

High speed cassette duplicator mono or stereo to record 10 at one time in working cond, need not be Elabrite. R Sweat, KCCF, 600 Bdy Ste 220, Kansas City MO 64105. 816-421-1065.

ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

MCI/Sony capstan & reel motors, any cond., recdgy heads, most mfgs, machines, new, used. Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-825-0601, in FL 305-859-4805.

CONSOLES

Want to Sell

Autogram AC-8/TC-10 spare parts, lamps, switches & bridging input transformers, BO. B Royster, KOM, 1019 Cordova, San Diego CA 92107. 619-223-3413.

Numark DM 1550 4 chnl DJ mixer, 2 phono inputs, 2 line inputs, 2 mic inputs, 6 band graphic EQ, always in road case, excel cond, \$150. B Fisher, KPOK, Box 477, Bowman ND 58623. 701-523-3883.

Autogram AC-8/TC-10 spare parts, lamps, idging input transformers, BO. M, 1019 Cordova, San Diego CA 3-3413.

1550 4 chnl DJ mixer, 2 phono inputs, 2 mic inputs, 6 band w/ays in road case, excel cond, r, KPOK, Box 477, Bowman ND 23-3883.

h Systems 8 16 input, 8 subs, 3 effect sends, +4 or -10 level cond, \$3000/BO. M Mantell, 1st 15 Perkins, Brockton MA 02401.

Executive 10 chnl stereo solid-in clean, vgc w/manuals, \$1000 Aountjoy, WIDD, 610-1/2 Hattie, TN 37644. 615-543-5849.

d cond, BO; Cetec 2000 8 pot, r supply, gd cond, BO. D Wolfe, Pike Blvd, Weslaco TX 78596.

Grandson 18 input console, eck 33X16 rdg console 3-band atch bay plus 24 tr harness, Freeman, Pranava Prod, 1227 ay, Los Angeles CA 90069. 213-

o 80 complete w/pwr supply, iders new, works fine, 3 mic in-, includes book, \$800. C Ben- 40 Domino Ln, Philadelphia PA 13-8900.

10 chnl, all plug-in amps, digi- complete set of spare PC boards, wn, WPRS, POB 367, Paris IL 35-6336.

AS 8 chnl stereo, excel cond, all tras, \$5500. R Trumbo, KNLF, incy CA 95971. 916-283-4144.

AC-6 6 chnl 23 input stereo, in- includes ESE built-in timer, shpg. D Kelley, KISZ, POB 740, 1321. 303-565-1212.

1 12x8x8, lots of extra features, t cond, \$2900. K Flory, The o, Box 1027, Siloam Spring AR 4-4626.

pee A/B 20x16 w/(8) 9-band ull patch bay, producers desk, rich, Box 869, Greenville CA 34-6929.

112, 12x4x2, \$1500. C Green, rogramming. 800-937-2100.

12 in, stereo out & mono & mon- 3, \$500. D Bailey, 3422 Beech, 5088. 214-475-9796.

), modified to 7 inputs, complete & manuals, gd cond, BO; Kel- :ote broadcast console w/(2) roof speakers, gd cond, BO. J , POB 1070, Sunbury PA 17801.

7500 stereo console parts, P&G in preamps, etc. J.C. Aegarter, W Center, Milwaukee WI 53210.

w/4 pots; (2) Ramko solid state; 2 tube type w/6 pots; AT1 8 chnl stereo w/pwr supply, call for details. Adolph,

IL 16x8 monitor mix console, 9 EQ pads, solos, etc, \$950. B ise St Prod, 804 E Old Hickory, 37115. 615-868-8516.

20 20 chnl, mint cond, 6 mos Miller, Airborne Audio, 11647 W nexa KS 66214. 913-492-8822.

i 5000, 24 inputs, 4 outputs, 3 band, 5 frequency EQ, Duncan spare modules & case, \$2300. ouse St Prod, 804 E Old Hick- TN 37115. 615-868-8516.

Midas Pro Custom Recording, 16x8, Remix switch-over, (8) Pro 5, (8) Pro 3 modules, peak meter, clock/timer, flight case, \$10,500. H Al-rich, Box 869, Greenville CA 95947. 916-284-6929.

Harris Micromac 16 input mainframe, manu- als, spare pwr supply, \$10,000/BO. V Killion, KRVN, POB 880, Lexington NE 68850. 308-324-6717.

RCA BC8A dual mono console, clean shape, \$500 plus crating & shipping. J Kreines, DeMott/Kreines Films, 5330 Kennedy, Mill- brook AL 36054. 205-285-6179.

Allen & Heath Systems 8 16 input, 8 subs, 16 monitors, 3 effect sends, +4 or -10 level options, excel cond, \$3000/BO. M Mantell, 1st Impressions, 15 Perkins, Brockton MA 02401. 508-580-1844.

Gates/Harris Executive 10 chnl stereo solid-state console in clean, vgc w/manuals, \$1000 pls shpg. B Mountjoy, WIDD, 610-1/2 Hattie, Elizabethton TN 37644. 615-543-5849.

RCA 8 pot, gd cond, BO; Cetec 2000 8 pot, 16 input w/pwr supply, gd cond, BO. D Wolfe, KRIX, 901 E Pike Blvd, Weslaco TX 78596. 512-968-1548.

Auditronics Grandson 18 input console, \$3800/BO; Speck 33X16 rdg console 3-band sweep EQ, patch bay plus 24 tr harness, \$3795/BO. G Freeman, Pranava Prod, 1227 Sierra Alta Way, Los Angeles CA 90069. 213-457-8390.

Gates Stereo 80 complete w/pwr supply, excel cond, includes ESE built-in timer, \$4200/BO pls shpg. D Kelley, KISZ, POB 740, Cortez CO 81321. 303-565-1212.

QRK Omega 10 chnl, all plug-in amps, digi- tal switches, complete set of spare PC boards, \$4500. B Brown, WPRS, POB 367, Paris IL 61944. 217-465-6336.

Ramko DC8M5 8 chnl stereo, excel cond, all manuals & extras, \$5500. R Trumbo, KNLF, POB 117, Quincy CA 95971. 916-283-4144.

Autogram AC-6 6 chnl 23 input stereo, in excel cond, includes ESE built-in timer, \$4200/BO pls shpg. D Kelley, KISZ, POB 740, Cortez CO 81321. 303-565-1212.

Tascam M-50 12x8x8, lots of extra features, low hrs, mint cond, \$2900. K Flory, The Production Co, Box 1027, Siloam Spring AR 72761. 501-524-4626.

Sphere Eclipse A/B 20x16 w/(8) 9-band graphic EQ, full patch bay, producers desk, \$8000. H Alrich, Box 869, Greenville CA 95947. 916-284-6929.

Ramaa WR 8112, 12x4x2, \$1500. C Green, Century 21 Programming. 800-937-2100.

EV EVT 5212 12 in, stereo out & mono & monitor, mint cond, \$500. D Bailey, 3422 Beech, Rowlett TX 75088. 214-475-9796.

RCA BC5A (2), modified to 7 inputs, complete w/spare parts & manuals, gd cond, BO; Kel- don KD20A remote broadcast console w/(2) TTs, (2) waterproof speakers, gd cond, BO. J Keller, WKOK, POB 1070, Sunbury PA 17801. 717-286-5838.

McCurry SS-7500 stereo console parts, P&G faders, plug in preamps, etc. J.C. Aegarter, Salcom, 5431 W Center, Milwaukee WI 53210. 414-445-2300.

BE 4BEM 50 w/4 pots; (2) Ramko solid state; Collins 212 F-2 tube type w/6 pots; AT1 8 chnl stereo w/pwr supply, call for details. Adolph, 915-949-2112.

Interface 104L 16x8 monitor mix console, 9 freq, 3 band EQ pads, solos, etc, \$950. B Petrucci, Rouse St Prod, 804 E Old Hickory, Madison TN 37115. 615-868-8516.

Tascam M-520 20 chnl, mint cond, 6 mos old, \$4250. D Miller, Airborne Audio, 11647 W 83rd Terr, Lenexa KS 66214. 913-492-8822.

Sunn Magna 5000, 24 inputs, 4 outputs, 3 aux sends, 3 band, 5 frequency EQ, Duncan faders & (2) spare modules & case, \$2300. B Petrucci, Rouse St Prod, 804 E Old Hickory, Madison TN 37115. 615-868-8516.

Midas Pro Custom Recording, 16x8, Remix switch-over, (8) Pro 5, (8) Pro 3 modules, peak meter, clock/timer, flight case, \$10,500. H Al-rich, Box 869, Greenville CA 95947. 916-284-6929.

Harris Micromac 16 input mainframe, manu- als, spare pwr supply, \$10,000/BO. V Killion, KRVN, POB 880, Lexington NE 68850. 308-324-6717.

RCA BC8A dual mono console, clean shape, \$500 plus crating & shipping. J Kreines, DeMott/Kreines Films, 5330 Kennedy, Mill- brook AL 36054. 205-285-6179.

MICROPHONES

A Basic Utility Tone Generator

by Bill Higgs

Louisville KY I suppose maybe I'm a bit old fashioned in spite of relative youth (thirtysomething), but I have always considered lightweight test equipment suspicious.

My father, a retired government radio engineer, spoke glowingly of large signal generators and measuring instruments, heavy with large chokes for hum suppression, oil-filled capacitors, mysterious silver-plated circuitry, and meters the size of a clock face. A sturdy steel chassis and rack mounting holes were also necessities.

I inherited a certain amount of this awe of these "boat anchors." My first audio

BOTTOMLINE BROADCASTER

oscillator was the venerable HP model 200A, about 40 pounds worth. It had the requisite weight and heft, several large octal tubes and a pretty good output signal. It also took three men and a good sized boy to carry it.

Searching for a more compact piece of equipment, I graduated to a 200D. It was lighter, about 20 pounds. It came with a handle, so I suppose it could be called portable, but it still wouldn't fit in my toolbox.

Finally recognizing the need for something more portable and in keeping with the times, I invested in one of the small Fostex boxes, which continues to serve me well.

The down side

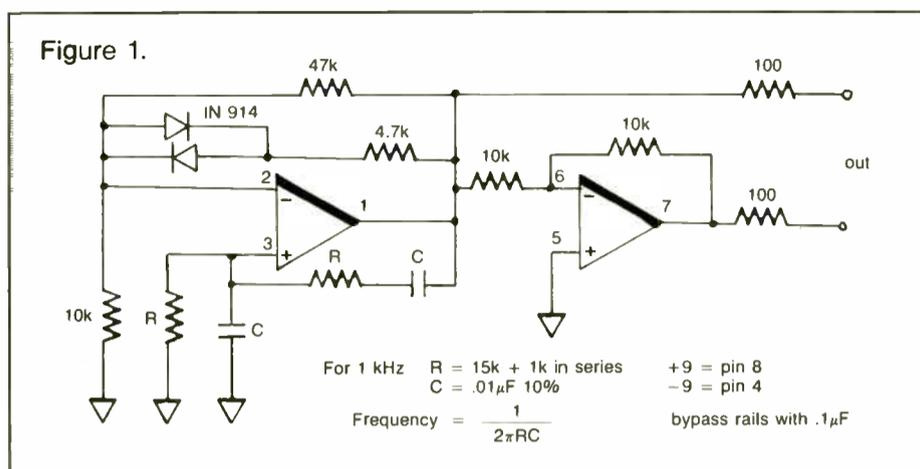
There are two problems with this unit: It is unbalanced, so I had to carry a transformer with me for checking loops and balanced lines. Since my balancing transformer is a 111C repeat coil, this rather defeated the purpose of the little Fostex.

Also, I often had occasion to place a tone on the opposite end of remote lines. I needed something cheap, repeatable and of decent quality. Disposable, if you will.

Loop oscillators were once used by local telephone companies for circuit testing and were frequently abandoned. These little yellow boxes with the 9 V batteries worked well for what they were designed for, but tended to be raspy after the batteries ran down a bit.

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Many engineers picked up several of these wee gadgets, but the freebies are becoming scarce. They can be purchased, but the cost is now often in the \$20 range.

Beginnings

My first attempt at making a cheap tone oscillator consisted of a 99 cent code practice oscillator board from Radio Shack (I did say cheap!). It worked tolerably well into a small speaker, but lousy into an audio pair. It seems they used the speaker impedance as part of an LC circuit to set the oscillator frequency. No speaker, no output, no good.

Fortunately, I came across a simple circuit that solves the problem. A one-chipper, the schematic can be seen in Figure 1.

For years, the "standard" audio oscillator circuit has been the classic Wien bridge. The idea of this circuit is that equilibrium is established between positive feedback (which creates oscillation) and negative feedback (which limits and controls gain).

My old 200 series oscillators were variations on these circuits. In them, a lamp was used as a nonlinear element in the negative feedback path. Actually, the circuit worked pretty well, as the bulb was

operated well below ratings.

Our circuit uses the same principle, but the diodes are used as the nonlinear element. As shown, the circuit puts out a 1 kHz tone, but values are shown for other frequencies.

Building the oscillator

The oscillator is built on a small piece of perfboard, and the layout is not particularly critical. Even so, keep the leads short, particularly in the feedback networks.

The chip is either an LM1458 or an LM4558. Or, if you have one laying around, an NE5532. The original circuit used an MC3403A and a single supply,

but I needed a balanced output. I found that 9 V batteries were cheaper than 100 μF capacitors, so I went with a dual supply version of the circuit.

Adjust the trimpot to yield the best distortion figure based on your diodes. I suppose ideally that the diodes should be matched, but I have not found it necessary for general use. We are not going to proof the system with this thing.

You purists may want to try both silicon and germanium diodes to see which works best in your particular circuit. You can tweak on the 47 K resistor if you need to vary the output; less resistance gives more output and vice versa. If the output is too high it is better to add an "H" pad.

A deluxe version of this little gadget should cost less than \$5 and it does a decent job of ringing out lines. No lab instrument this, but it tells you if the line is working and gives you some idea if it has trouble on it.

But, if the truth be known, I miss one thing about my old tube-type boat anchor. It kept my coffee warm.

Bill Higgs is on the engineering staff of WHAS-TV, was CE for WXLN/WFIA and has also done station consulting work. He has a PhD. in Theology, which helps explain his patience with small market broadcasting. He can be reached c/o WHAS-TV, 520 W. Chestnut St., Louisville, KY 40202.

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A Road Test of the Tascam DA-50 DAT

by Ty Ford

Baltimore MD In last month's *Producer's File*, I began a two-part report of DAT machines featuring the Sony 2500 and the Fostex D-20.

At last count, there were over two dozen DAT machines on the market. They range in price from \$995 for the Aiwa XD-999 (considered by some as Sony's consumer farm-league brand) to the top of the line Nakamichi which lists for \$10,000 but can be had for \$9500.

Although the thought of arranging for a studio test drive of each and every one of them appeals to my relentless curiosity, that thought is tempered by the reality that recordable CDs are starting to make waves from the Orient.

Imagine, recordable CDs that cost only a few bucks each. Fill them up, save any parts you wish to DAT, hard disk, optical or some yet to be announced storage medium and then toss the original in the trash.

If you think this could never happen, please call me. I've got a neighbor down the street who keeps asking where he can get 8-track tapes for his pickup truck. The two of you should meet.

Because nobody knows who's controlling the timetable for this new CD tech-

nology, we must be content with the latest marvel . . . DAT. Nothing short of Dolby SR in the analog domain comes close to the "cleanness" of sound that DAT provides for so little money.

Incidentally, the weak spot in DAT technology is the recording of very low level signals. Because only two or three of the sixteen bits are used to record low level audio, lots of quantizing errors happen. From a commercial standpoint you probably don't want your audio to get

PRODUCER'S FILE

that low, unless you're a classical music station using DAT for archiving your program library.

If low level fidelity is important to you, try jacking a mic (normally -40 dB to -60 dB) directly into the line level input of a DAT recorder and listening for playback fidelity.

The Tascam DA-50

In an attempt to deal with these low level quantizing anomalies, Tascam has developed a proprietary design called the ZD (zero distortion) circuit. Random



Tascam's DA-50 DAT recorder, with RC-50D remote control

noise is added to elevate low level signals so that they may be quantized more accurately. The noise is then filtered or cancelled out. Tough to do with random noise, but then that's why the circuit is proprietary.

The Tascam DA-50, at \$3999, falls in the middle of the price spectrum. Equipped with digital optical and SPDIF (or EIAJ) coaxial inputs and outputs (but not AES/EBU), it also offers balanced and unbalanced analog inputs and outputs and records at 32 kHz, 44.1 kHz and 48 kHz.

There are a few of the early DA-50 still floating around which don't record digitally at 44.1 kHz. They're easy to identify because they have a skip on/off switch. The later model dropped the

switch but included the ability to digitally record at 44.1 kHz. Upgrades for the earlier DA-50 allow digital recording at 44.1 kHz and are available for free, according to Jim Lucas at Tascam.

Absolute and program time

The DA-50 records and displays absolute time. When recording from the beginning of a tape, absolute time is automatically recorded in the subcode. Absolute time shows the elapsed time from the beginning of the tape on the multipurpose counter on the face of the unit.

With absolute time, even if a tape is not rewound before it is played, the machine will read the correct time as soon as play begins. In addition, the DA-50 will continue to add absolute time at any

(continued on page 32)

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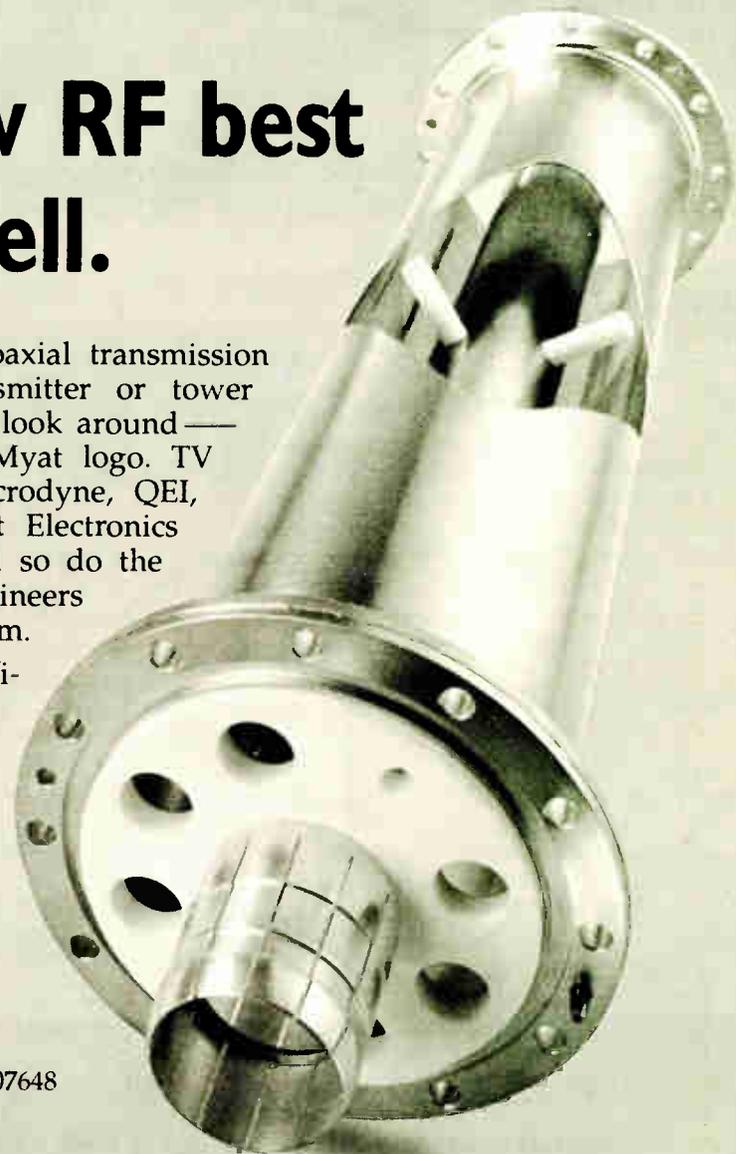


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Jumping the Obstacles in WV

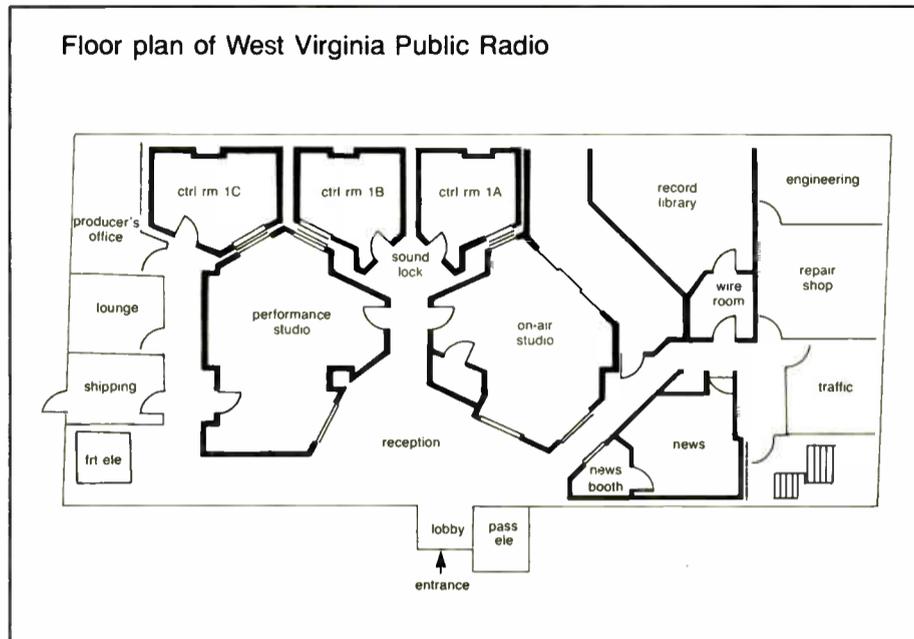
Building a Studio in the Face of Planes, Trains, And Automobiles

by Dee McVicker

Charleston WV Director of Engineering Francis Fisher insists that the jetway overhead is not a problem. Nor are the railroad tracks and an interstate ramp, which are far too close to West Virginia Public Radio's new studios by conventional standards.

But then, the public network is anything but conventional. West Virginia Public Radio is a network of eight satellite transmitters, the furthest approximately 250 miles from the new studio in Charleston.

With the state's public listeners and eight auxiliary transmitters relying exclu-



Fisher sketched around the obstructions to come up with two studios situated diagonally between the columns. The result turned out to be one oversized studio that looks much like a lopsided baseball diamond and another that appears to take on the shape of a Volkswagen van with its passenger doors extended.

Once the large studios were penciled in diagonally, all other rooms were fit into place around the two. "We have corridors going around the outer perimeters of these rooms and other rooms off of that," offered Fisher. "It's not anything like a railroad kind of design. It sort of meanders; it has sharp angles everywhere."

The performance studio is sized, in Volkswagen van fashion, to handle, say, 12 singers or a quartet. Since better than half of the public network's programming is local, although admittedly some is "just needle drop" according to Fisher, a good sized performance studio was needed for multitrack production.

Every Saturday night, for instance, a Charleston local comes into the studios to produce a live musical. Said Fisher, "It's produced in the way these shows were produced 50 years ago: A group of performers gather around a microphone."

Off to the center stage of this live performance, the Charleston local produces the show from an adjoining control room equipped with a Harris Executive console, two new Studer A807 recorders, two new SP10 Technics turntables, a new Pacific Recorders & Engineering Tomcat recording cart machine and Tomcat play-

back cart machine, a new Studer A721 cassette machine and two new Studer A727 CD players.

A quartet performance, on the other hand, might require a 24-track production—which the performance studio can easily accommodate. In another control room facing off to the side of the performance studio's center stage is a 24-track Harrison MR4 console.

Fisher decided on the Harrison because, he said, "it was an industry stan-

dard for recording studios and it was in our price range." Fisher also purchased wares similar to the control room's two-track twin, as well as a Studer A80 24-track recorder, a Urei LA-4 compressor/limiter and dbx processing modules.

On-air and news setup

Similar in size to the performance studio is the on-air studio, which has a PR&E BMX Series II console presiding. An adjoining control room, with a Harris Executive console, also allows operators to air programming to state-wide listeners.

With the signals stretching out over miles of West Virginia terrain, Fisher bargained that the playback of prerecorded material needed to be of high integrity in order to survive the pipeline to the state's four corners.

The on-air playback machines he installed are Revox C270 reel-to-reels, Studer A721 cassette machines, SP10 Technics turntables, Studer A727 CD players and PR&E Tomcat playback cart machines.

West Virginia Public Broadcasting's news, an important source of information for many of the state's communities, likewise makes the long journey over several satellite hops to get to rural West Virginia.

The studio that the public network's

(continued on page 35)

FACILITIES SHOWCASE

sively on the new studios for public programming, it is no wonder that Fisher decided to pad the studios' ceiling six and a half feet deep with fiberglass—and to throw conventional studio design to the wind.

Taking up two floors of a four-story building in Charleston, West Virginia Public Radio succeeded in buffering its studios from the jets overhead, the trains 200 feet away and the traffic on an interstate ramp that literally joins the building. To do this, the new facility—in its last stages of construction as of this writing—needed to be completely restructured.

Specifications for acoustical integrity were provided by acoustical consulting firm John Storyk and Associates, which suggested 50 dB isolation for some walls and 60 dB for others. With the exception of proprietary material used for the floating floors, commented Fisher, all of the refurbishing material used is readily available at a typical lumber yard.

Diagonal studios

The public network applied unconventional logic when it came time to pencil in the new studios. The columns on the studios' first floor, clustered together obtrusively, invaded what would be considered a more conventional floorplan for two large studios, a master control room and a newsroom.

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Test Driving Tascam's DA-50

(continued from page 30)

blank space on the tape after the last recording.

As for program time, or the length of each separate recorded section, it is also automatically tallied by the machine. For this feature to function, "Start ID" cues must be put at the beginning of each section. To make it easier, Start IDs are automatically recorded when the machine is put into record, and audio is sensed.

The auto sensors can be fooled by feeding audio which drops to a low level for more than three seconds. When this happens, an extra Start ID is placed on the tape at the point where the audio returns.

Since Start IDs can be erased or moved manually even after audio has been recorded, you have the option of reprogramming all of the cues to meet your needs.

Program numbers are also automatically added. They tell you which cut is playing or cueing up. If you decide to add or delete Start IDs, the DA-50 can automatically renumber the program numbers so they remain in sequence.

A fist full of features

If you've had any exposure to DAT machines, you're probably already familiar with features like record mut-

ing, direct search play, all repeat playback, block repeat playback, blank search, timer operation, cue/review and skip playback. The Tascam DA-50 covers all these functions nicely.

The DA-50 is capable of digital transfers via either a 75 ohm coaxial port or a fiber optic port. According to the manual, "If a copy inhibit code is detected in the source, digital dubbing is impos-

sible and the DA-50 will drop out of the recording mode. If this condition exists, the "Digital" indicator will blink rapidly in the display window.

The first generation DA-50 has found a niche as an excellent mastering recorder.

sible and the DA-50 will drop out of the recording mode. If this condition exists, the "Digital" indicator will blink rapidly in the display window.

Keeping the head clean is extremely important with any DAT machine and the DA-50 is no exception. Unlike analog tape heads that suffer a loss of high frequency response when they get gummed up, a dirty DAT head completely drops out the audio. Don't try cotton swabs and denatured alcohol on the DAT head. The word from the bench is that *this will damage the head*. Instead, use a DAT cleaning cassette.

DAT designers have been careful to create multiple interlaced data redun-

dancy so that if one data bit is lost, the circuit automatically pulls the data from another part of the tape.

Most of the better DAT recorders also have some sort of interpolation circuitry. If data loss causes drop-outs, this circuit automatically fills in the blanks with what it supposes should go there, based on its analysis of the most recent data.

The DA-50 also comes with a desktop

remote control (RC-50D) unit that duplicates all of the front panel with the exception of the on/off switch. I liked the size and layout of the controls better than any other remote I've used so far, but didn't care for the sluggish response.

I either had to keep my finger on the buttons a lot longer than I wanted to, or punch them really hard to get the machine to respond. Jim Lucas said the problem had been corrected on DA-50s that were put out after the one I tested.

The first generation DA-50 has found a niche as an excellent mastering recorder. According to Lucas, "A SMPTE-capable DAT machine at a reasonable price would be a real winner. If it's going to be sitting there at eight to ten thousand dollars, isn't an (analog) center track with time code and noise reduction going to be just as good? It's got to come down to a price that makes sense."

Although he had "no comment" concerning such a machine with a Tascam label, it's no secret that the lucrative video production market has made it clear that it is interested in exactly that

kind of box . . . at the right price.

But the main problem that remains with DAT technology is not the varying standards or occasional dropout that currently exist.

Broadcast DAT

Some would say that digital radio production will not be practical until on-air consoles and transmitter front-ends are digital. Most people would agree, however, that it only takes a better than average set of ears to be able to distinguish a CD from a record played on the air.

If the production studio and on-air playback systems were completely digital, a qualitative difference should be perceptible, even if the on-air console were analog.

It will be interesting to see how quickly and completely the manufacturers turn their backs on analog. If makers of DAT machines can provide quality units with the operating features needed for production and on-air operation at a competitive cost that can be positioned to be better suited than cart machines and reel-to-reel machines, the corner will be turned.

The biggest obstacles to that maneuver are the relative ease of editing reel-to-reel tape and the individual freedom cart operation provides.

How could life be the same without a stack of carts waiting patiently on the console for their moment of glory? I imagine Magnecord felt the same way when the first cart machines started eating up their share of the "commercial-playing tape machine" market.

Stations like WMTR, WKSZ and WZLZ who have committed to DAT for on-air use are to be commended for having the guts to "go where no one has gone before." Radio needs more of that kind of thinking.

■ ■ ■

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

Options for Your RPUs

(continued from page 24)

And the cost has been coming down to a point that many stations are using satellites more and more.

Stadium sites where pro teams play often have permanent uplinks. If you are going to a such a location already set with uplinks, the cost can be kept from getting too great. Or you may be close enough to run a microwave link from the event to the uplink.

Backhaul companies will not stress cost savings as much as audio quality. The audio is "perfect" when it gets to you, especially if you have your own receive dish. But the cost is not bargain basement yet.

Another idea is to piggyback on an-

other signal being uplinked. If TV coverage of the event is being backhauled via satellite, you may be able to get on a sub-carrier of the TV signal at reduced cost. In some cases you could even use consumer satellite receivers to recover the audio.

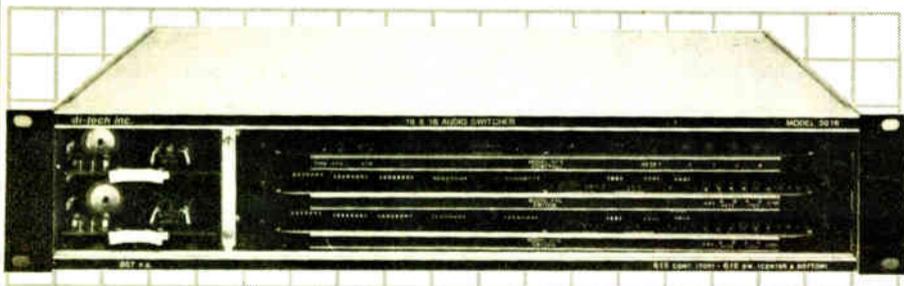
Satellite backhaul is also ideal for sending your staff to Russia, or South America or some other promotionally important location.

Indeed there are a lot of options for getting remote audio back to the studio. May all your remotes be winners!

■ ■ ■

Barry Mishkind, aka RW's "Eclectic Engineer," is a consultant and contract engineer in Tucson. He can be reached at 602-296-3797.

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Home Brew Remote Control

by Philip Hess

Pittsburgh PA Often it's been said that necessity is the mother of invention. Being an engineer at a college radio station with a limited budget means I must be inventive in solving those requests for "little black boxes."

Such was the case after some remodeling in the air studio. I'd recently raised the console to install remote control facilities for the various pieces of equipment in the room.

GREAT IDEA

One problem which remained, however, was the rim drive QRK turntables. In the past we'd been keying a relay from the PGM/AUD switches on the console. Since the "B" inputs were used for long form sports programming the turntables would run during an entire basketball game. Clearly something better was needed.

Start with a switch

I purchased two-circuit Dialco switches from Hall Electronics in Virginia (refer to the Equipment Exchange for their ads) and I used them for this project.

The switches fit into a 7/8" square cutout. A Greenlee hole punch does a nice job here. The equipment end of the

control cable was terminated in a 12-pin Molex plug to ease installation problems and make future modifications easy.

When I built the remote control center I put in two Dialco lighted switches for each input, similar to those in the ITC SP series cart machines. After some

to one side of the relay by means of the normally closed switch contacts of the OFF button.

The positive side is connected to the other side of the relay by way of the normally open switch contacts on the ON button. Additionally the ON button is

One of the other sets of contacts on the relay controls is the tally lights, if desired. The third set of contacts controls the motor on the QRK turntable.

Look carefully at the barrier strip in the center, near the back on the turntable. Frequently, but not always, the center two terminals will cause the turntable to run. Of the five turntables in use at the station, one will not work with this method. All were donated or purchased used, however.

The fourth and final set of contacts is open for timer resets, additional tally lights or other purposes. All the connections can be made on the relay socket.

I'd suggest wiring the socket outside the box you plan to mount it in.

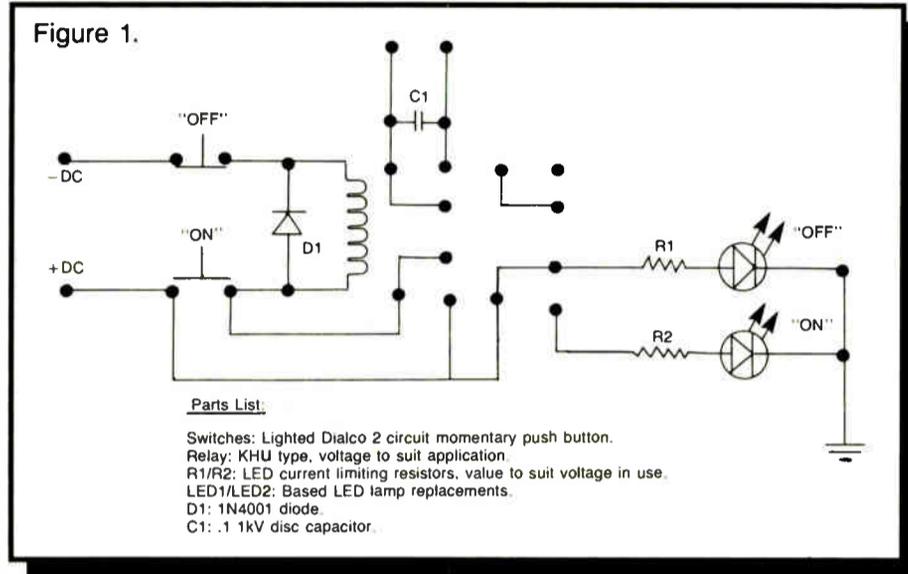
Other applications

After this circuit was built I've discovered other uses for it. For example, switching a Telco line between a hybrid and desk phone, placing the production room on air without using patch cords, remote control of the stations' transmitters and switching remote lines to a newroom console with limited inputs.

The parts needed are as follows. Switches: lighted Dialco 2-circuit momentary push button; relay: KHU type, voltage to suit application; R1/R2: LED current limiting resistors, value to suit voltage in use; LED1/LED2: Based LED lamp replacements; D1: 1N4001 diode; C1: .1, 1 kV disc capacitor.

The cost of building the remote start is very low, under \$15, if you buy everything needed for construction.

Philip Hess puts his great ideas to work at Point Park College in Pennsylvania. For submitting this Great Idea he receives a \$50 "Be My Guest" American Express certificate. If you'd like to enter RW's Great Idea Contest, submit your entry to PO Box 1214, Falls Church, VA 22041. Monthly Great Idea Contest Winners become eligible for the grand prize at year's end.



thought the old system in use was removed and the circuit shown in Figure 1 installed.

This circuit provides the required two button start/stop operation desired and duplicates that of the cart machines.

Construction of the circuit is easy. The negative side of the power supply goes

paralleled on one of the relay's four sets of contacts.

It is this connection that makes an ordinary KHU relay latch at the push of the start button. Once we get the relay to latch, un-latching is easy.

By pressing the OFF button we break the negative supply to the relay and it resets to the unlatched (off) state. Pulling the plug on the power supply will also cause the connection to break, which may be a disadvantage in some applications.

The diode provides protection to the relay coil and rids us of the "popping" sound when the relay engages.

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Working Around the Obstacles in WV

(continued from page 31)

news originates from rivals the on-air and performance studios; its news/announce booth and three electronic workstations are equipped with PR&E News-mixer consoles and Micromax cart players and Studer A807 reel-to-reels.

As a byproduct to the public network's unconventional design, line of sight extends all the way from the announce/news booth through the on-air studio and its rear control room.

"What this means," Fisher pointed out, "is it's possible to do a show, perhaps with four to five panelists in the on-air control room and during the course of the show you could take a five minute

break for news and the news reader would be sitting (within line of sight) in the announce booth."

Unshielded wire

In the master control room, which is shaped, in Fisher's words, like "a dog leg," Fisher paid special attention to grounding. His common point ground system based on 250 MCM cable exhibited very little noise throughout the studios, which encouraged Fisher and another of the public network's engineers, Dave McClanahan, to experiment with unshielded wire.

Said Fisher, "When I realized that our program signal here in Charleston

travels from the studio to the transmitter with unshielded wire, I thought, 'Why can't I do that in the building?'"

Fisher doesn't recommend this telephone company technique to everyone. In fact, he is emphatic that without proper termination and grounding, this

... the (West Virginia) public network is anything but conventional.

technique can be a real troublemaker. But, offered Fisher, "If you've maintained the integrity of a common point ground system and if all cables can be terminated in 600 Ohms, then it's safe to experiment with unshielded cable."

So far, Fisher and McClanahan have no regrets and have yielded a substantial cost savings in wire and labor because of this technique.

In dealing with the eight potentially menacing signals and transmitters, Fisher enlisted the help of Harold Hallikainen of Hallikainen & Friends.

Said Fisher, "We used his equipment to control the transmitters and we contracted him to develop a software program to keep it all straight."

This system originates in the master control room, where Hallikainen's DRC-190 remote control system coordinates the signals of all eight transmitters. In some cases, said Fisher, "the data that controls the transmitter actually travels more than a thousand miles before it finally gets to the site."

Fisher also plans a maverick approach to the new facility's wall treatment. "We're going to be using a product called Owens Corning 703. It's a rigid fiberglass that is two inches thick and comes in panels that are two feet on a side," said Fisher.

The only drawback, he conceded, is that facing needs to be applied over the fiberglass. But the acoustical properties, he claimed, are better than more conventional wall treatments—at half the price.

What remains to be done in the new facility is a minute's work compared to the hours spent finding unconventional solutions to very unconventional problems. Even so, Fisher said he's getting the hang of finding new ways to do things and he's not about to become complacent now.

■ ■ ■

Dee McVicker is a free-lance writer and regular contributor to RW. To inquire about her writing service, call 602-899-8916.

Touring Greenville

(continued from page 21)

broadcast worldwide. Other programs were sent to distant relay stations via an SSB relay system. Today the bulk of short-wave emissions from North Carolina reach out to Latin America and Africa.

The rising atmospheric noise level, jamming and competition from other international broadcasters have forced the VOA to construct relay stations closer to their target audiences. Satellite technology has made the old SSB relay system all but obsolete. Currently it's only maintained as an emergency backup for the satellite system.

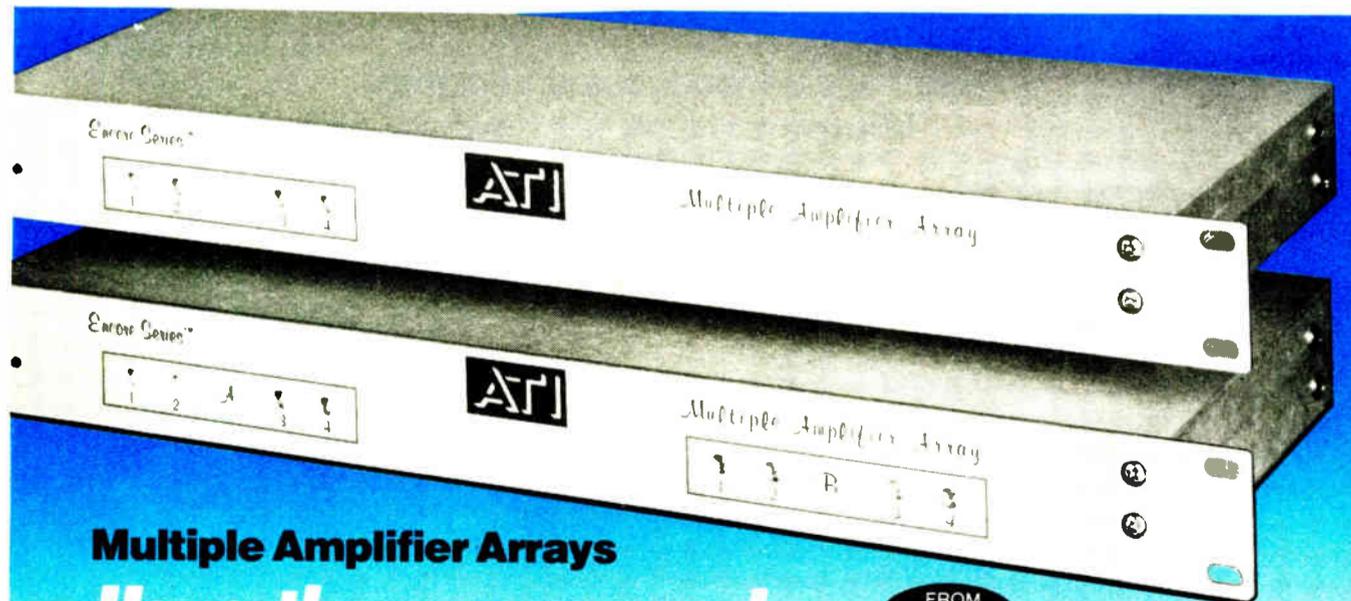
A new mission for the Greenville station is training. The rapid advances in communications and computer technology mean engineers must be regularly retrained or face obsolescence. Continuing education at Greenville will be the topic next time as we continue our tour of the Voice of America.

■ ■ ■

Tom Vernon, a regular RW columnist, divides his time among broadcast consulting, computers and instructional technology. He can be reached at 717-367-5595.



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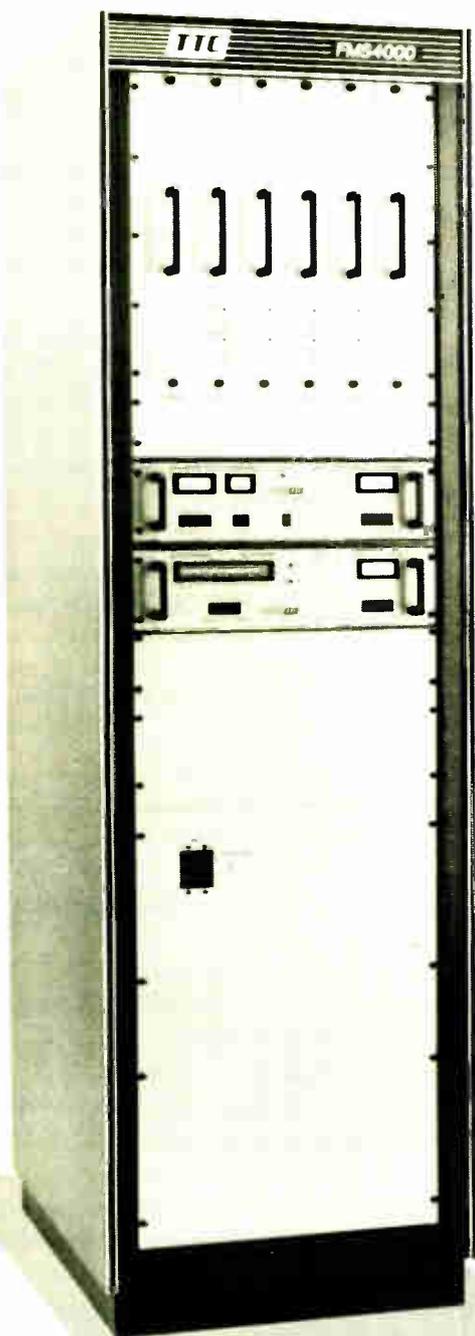


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BUYERS GUIDE

FM Transmitters, Exciters & SCA

Continental Debuts at WJVS

by David Clark, CE
WJVS-FM

Cincinnati OH When Rolls Royce builds a car, only the un-educated feel the need to kick the tires. I had heard that the same was true of Continental transmitters, but I suppose I needed to see it for myself to really believe it.

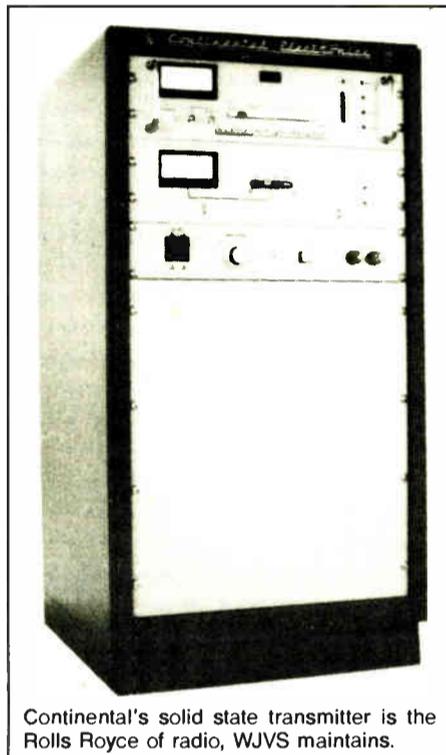
WJVS' Collins 830 series transmitter had, within its lifetime, suffered from a series of lightning strikes, power surges and interruptions and maintenance of uncertain quality at best. It was getting increasingly difficult to get some of the more obscure parts as they failed. For example, the "direct replacement" PA blower was from a Xerox copier!

We decided to make major repairs on the Collins and, soon thereafter, replace it with newer technology. At that point, the Collins could either be used as a standby transmitter or sold.

In search of a transmitter

Three transmitters were considered for this project. Based on the number of "I don't know's" and the disinterest displayed in providing any meaningful information on the transmitter, the first transmitter considered was dropped from the list, based on only one phone call. The irony here is that this was the most expensive transmitter we considered.

The second was a good piece of equipment with which I was familiar. The customer support was there and the company showed real interest in a sale. But we did not end up buying it, largely because of the offering from Continental.



Continental's solid state transmitter is the Rolls Royce of radio, WJVS maintains.

What Continental offered was a brand new, all solid state, 500 W transmitter. Although Continental had the reputation I was looking for, the "newness" of the product worried me. Too many times, I had heard horror stories about people who had bought the "Model 1-

USER REPORT

A' of something and had ended up being some company's product tester.

However, since WJVS is an educational radio station with limited funds, not having to buy tubes on a regular basis tipped the scales in favor of the Continental.

Unit arrives

The transmitter arrived in an eight foot, 19" rack. Its manual included complete schematics, a parts list, a factory test data sheet and seven pages of instructions covering subjects that included installation, operation and maintenance.

(I should note here that the companion exciter had its own complete manual. It had been purchased some months prior to the transmitter.)

Seven pages did not seem like nearly enough information to comprise a manual for a new transmitter. As it turned out, everything that was needed in terms of information was present.

From initial preparations to "transmitter on" took 45 minutes. The installation was not done in a rush. Simply put, there was very little effort required to make the transmitter work.

Power, audio, antenna and ground were disconnected from the old transmitter, in preparation for cleaning and

minor repairs. The two side panels for the Continental transmitter were removed, reversed, and re-installed, to give cable access where we needed it. The ground, antenna, audio and power were then re-installed.

Perfectly tuned

Exciter drive levels had to be adjusted for proper transmitter operation. At that point, the transmitter specifications looked like a carbon copy of the factory test data sheet. Although the transmitter tuning was checked, when all was said and done, I could have turned it on and simply gone home.

Nothing I did improved the tuning, because the transmitter had arrived tuned correctly. I can only guess why this was the case, because I know that we have an antenna on our tower and not a dummy load!

The transmitter contains automatic circuitry that detects over temp, high VSWR, over voltage and over power conditions. If any of these conditions exist, the transmitter turns off until the prob-

lem is corrected or ceases. What that means to me as a chief engineer is that compound transmitter failures due to broken air-flow switches and blowers, etc. are now a thing of the past.

It would be difficult not to be excited about both this transmitter and the company that built it. Continental was enthusiastic and honest about its product from the start. There were no surprises at all. Everything arrived when they said it would and in perfect condition. How often does that happen with any broadcast purchase?

Editor's note: David Clark co-owns a partnership that writes computer software, sells computers in the corporate market, operates a computer data distribution service and does broadcast consulting. He lives in the country with his wife and son, two dogs, two cats, two gerbils, three snakes, seven fish and five horses who all get along remarkably well. He may be reached at: 513-677-2913.

For more information on the 813A transmitter, contact Steve Claterbaugh at Continental: 214-381-7161, or circle Reader Service 90.

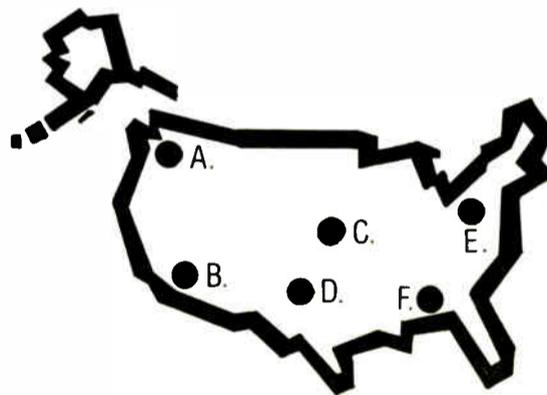
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KSD Hosts BE's FX-50 Field Test

by Dave Obergoenner, CE
KSD-FM/KUSA-AM

St. Louis MO Early in June of 1988, I was contacted by Ed Anthony of Broadcast Electronics and asked if I wanted to take part in a top secret project. The assignment was to field test a new FM exciter from BE that sought to push the state of the art in FM performance into digital quality territory.

USER REPORT

Because the exciter we were using at KSD-FM was nearly 10 years old I was up for the test. The first order of business was for Ed to come down from Quincy, IL and prove to us that this new box would be reliable for use on our highly competitive classic rock station.

Part of the problem with determining the performance of cutting edge technology is finding monitoring equipment that can measure up to that new technology. BE supplied not only the exciter but two new modified modulation monitors for the purpose. We used the Audio Precision test set for the measurements.

Unit measures up

Some real surprises came when we began to measure the performance (see Figure 1) of the FX-50. I could not believe my eyes! The graphs rolling out of the test set

Figure 1. FX-50 composite amplitude response

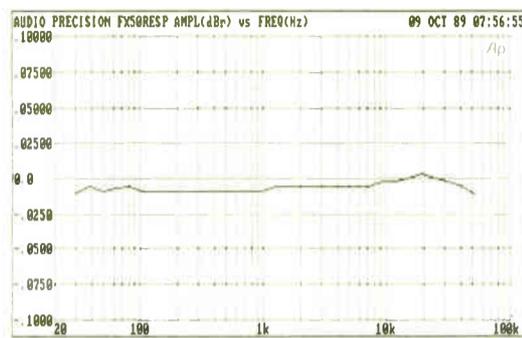


Figure 2. FX-50 signal to noise ratio below ± 75 kHz deviation, $75\mu\text{S}$ deemphasis

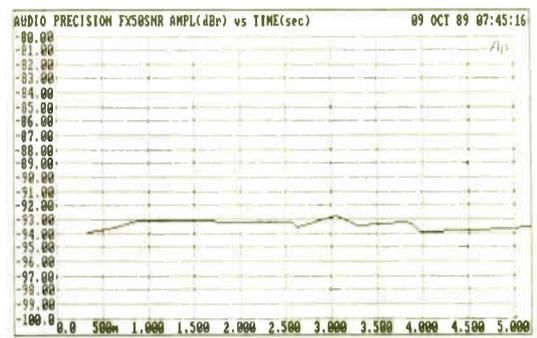


Figure 3. FX-50 composite THD + N vs. frequency, $75\mu\text{S}$ deemphasis (Noise limited after deemphasis)

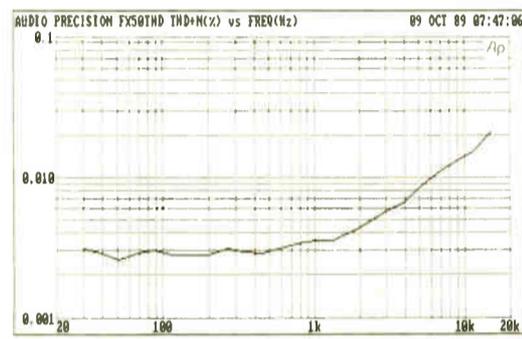
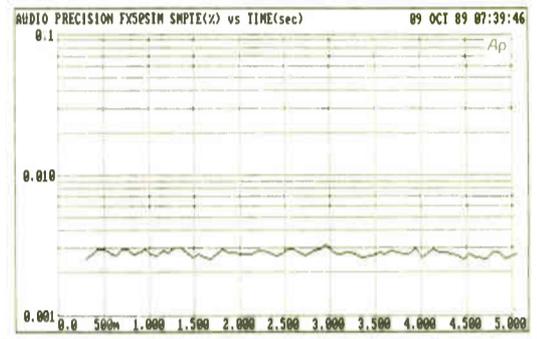


Figure 4. FX-50 composite SMPTE IMD, 60 Hz/7 kHz, 1:1 ratio, $75\mu\text{S}$ deemphasis



looked like we were testing a CD player (even better; show me a CD player that is only down 0.1 dB at 100 kHz).

The rest of the graphs speak for themselves. They show SNR at -93 dB (see Figure 2), mid-band THD at or below .005% (Figure 3) and IM distortion at or

below .003 (Figure 4). This is surely near the limits of even the best test equipment and the measurements have been rerun since the exciter's installation to prove that they have not changed.

By this time I couldn't wait to hear what the exciter would sound like. We plugged in the composite signal from the STL, called the studio and had them play some tunes.

The sound was great and later in the day came some more surprises. During the morning show of 23 June 1988, the air talent twice made references on-air to the fact that the station sounded much better.

These comments were unsolicited—they did not even know we had changed any equipment. By this time I was beginning to worry that our secret would get out, but it was kept all the way up to this year's NAB convention when the FX-50 was announced.

New oscillator design

The FX-50 uses a new computer-designed linear modulated oscillator that requires less precorrection compensa-

tion. A dual speed phase lock loop AFC is employed. This is an area critical to the low frequency response of any exciter. The FX-50 has the ability to fully modulate from 0.1 Hz to 150 kHz.

Reliable, high output power in the exciter is achieved with a 60 W MOSFET in a broadband output circuit. The characteristics of the MOSFET cause it to reduce its power dissipation as its temperature increases. The power amplifier is completely protected against open or short circuits.

Recently, equipment designer Greg Ogonowski has been making us aware of the importance of maintaining flat frequency response of exciters and STLs at sub-audible frequencies. With heavily processed audio, a lack of flat response down to below 1 Hz can cause a tilting of low frequency clipped waves, resulting in lessened modulation efficiency.

A good test of this can be run by injecting a 20 Hz square wave and looking for tilting on a scope. As you can see from the scope photo (Figure 4), the FX-50 shows no measurable tilt.

(continued on page 44)

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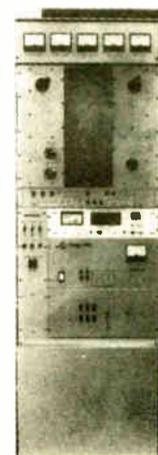


In the World

BUYERS BRIEF

Energy-Onix has designed the MK 7-5 transmitter primarily to meet the new Class A requirement of 6 kW ERP, which the MK 7-5, in combination with two or three circularly polarized antennas, achieves.

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exciter and a broadband solid state 300 W IPA.

With the grounded grid triode circuitry utilized, there is no requirement for neutralization, screen and grid supplies or screen and grid bypass capacitors.

Both the exciter and the IPA have independent power supplies and the MK 7-5 is also field convertible to 12 kW (available in single- and three-phase).

For more information, contact Bernie Wise at Energy-Onix: 518-828-1690, or circle Reader Service 88.



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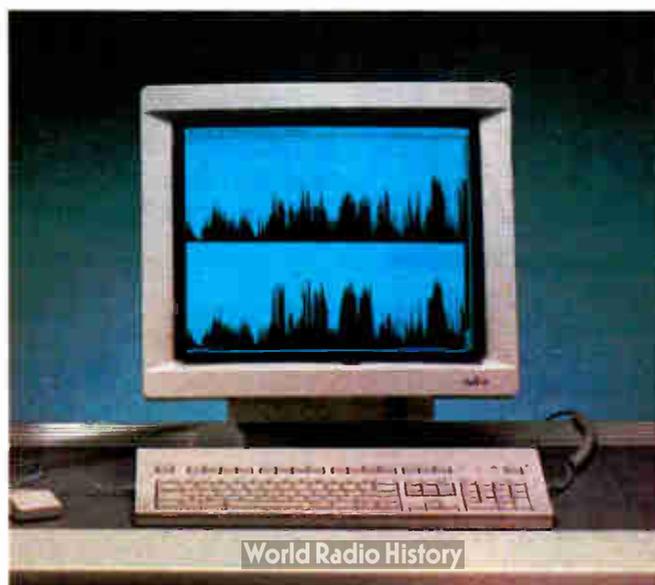
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Circle 79 On Reader Service Card

Sage Sold on Harris HT Series

by Gerald LeBow, Exec VP
Sage Broadcasting

Stamford CT This spring, with just weeks to go before the start of the ratings books, Sage Broadcasting put two new FM's on the air and completely revamped a third. Incredibly enough, everyone involved was still sane at the end of this major project. One of the main reasons was our choice of transmitter: Harris Broadcast.

We talked to several manufacturers about the three transmitters we needed: a 25 kW for WGNE in Daytona Beach, FL; a 30 kW for KSEZ in Sioux City, IA;

and a 3.5 kW for WFHN in Fairhaven/New Bedford, MA.

Harris responded quickly with a very attractive proposal. The company's prices were more than competitive, its

USER REPORT

leasing plan was convenient and its delivery schedules were as good or better than anyone's.

More importantly, I had confidence that Harris could meet those schedules

with transmitters that would work when they arrived. We had two new stations to put on the air, plus a third staring down the barrel of the year's only ratings book, so meeting delivery schedules was a very significant consideration.

Met delivery dates

Despite the problems that go hand in hand with the Christmas season, Harris came through on its January and February delivery dates as promised.

I was on hand for the installations at our two new stations, WGNE and WFHN, and I must admit I was nervous. With any device as complex as an FM

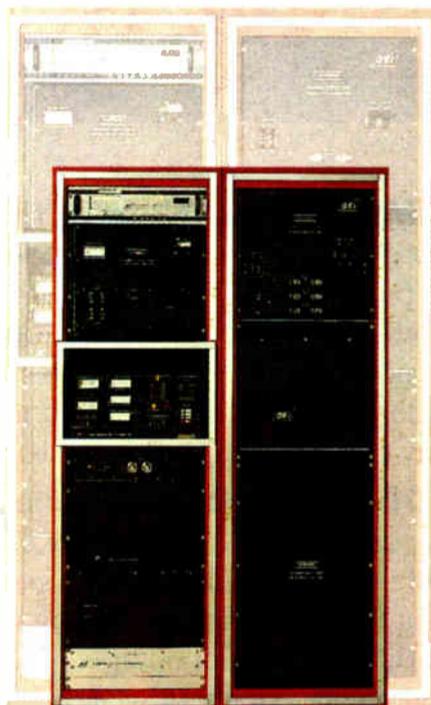
3.5-5-10 kW

WATTS

Now here's a curious fact:

Most FM transmitter manufacturers design "families" of similar transmitters with different power levels. The 3.5, 5 and 10 kW family, for instance, or the 20 and 30 kW's. Yet only QEI has designed its transmitter families so you can economically upgrade power levels right in the field. Our new 20/30 kW FMQ 20000B/30000B, for example, drives its single tube final amplifier using interchangeable solid state IPA modules. This advanced design lets you upgrade from 20 kW to 30 kW overnight. And speaking of power, ours is the only 20/30 kW transmitter that you can order with the option of single phase power.

Here's another thing that's hard to fathom: Everyone's transmitter needs spare parts at some point in its life. Yet QEI is the only manufacturer to include every solid state component of the transmitter, exciter and remote



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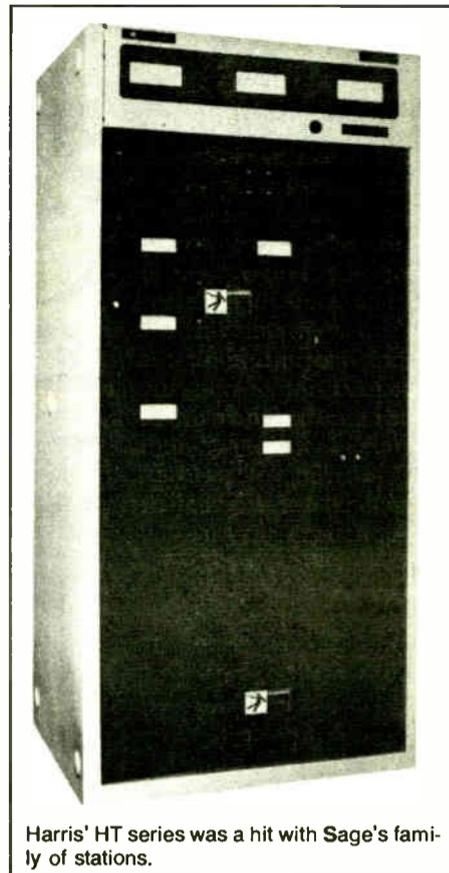
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World Radio History



Harris' HT series was a hit with Sage's family of stations.

transmitter, you have to expect problems once it has been shipped and installed.

But both the HT 25 FM in Daytona Beach and the HT 3.5 FM in Fairhaven worked right out of the box. There was a moment of confusion over the AC power wiring at the installation in Sioux City, but as soon as that was straightened out, the HT 30 FM was also fine.

I talk to the engineers at each of our 18 stations nearly every day. So whenever there is a problem, I hear about it.

We certainly will look at Harris again when we need more transmitters.

Our three Harris transmitters have been on the air for six months, and they have been as close to trouble-free as we could have wished for.

We have experienced no loss of air time, and the minor problems we have encountered were attended to with utmost dispatch by the Harris service department. All three stations have told me how pleased they are with the performance of their HT FM transmitters.

Helped ratings book increase

We took a big gamble installing these three transmitters so soon before the spring ratings books, but the performance of the people at Harris helped us make it pay off.

In fact, at KSEZ in Sioux City, we just had our biggest ratings book ever. I am convinced that the improved coverage from our new RF plant, including the Harris HT 20 FM transmitter, played a significant role in that increase.

Overall, you can say I am a sold customer: We certainly will look at Harris again when we need more transmitters.

Editor's note: Gerald LeBow is executive VP of Sage Broadcasting, and no stranger to the engineering side of the business. He may be reached at 203-357-1464.

For more information on the Harris HT Series transmitters, contact Ron Frillman at: 217-222-8200, or circle Reader Service 94.



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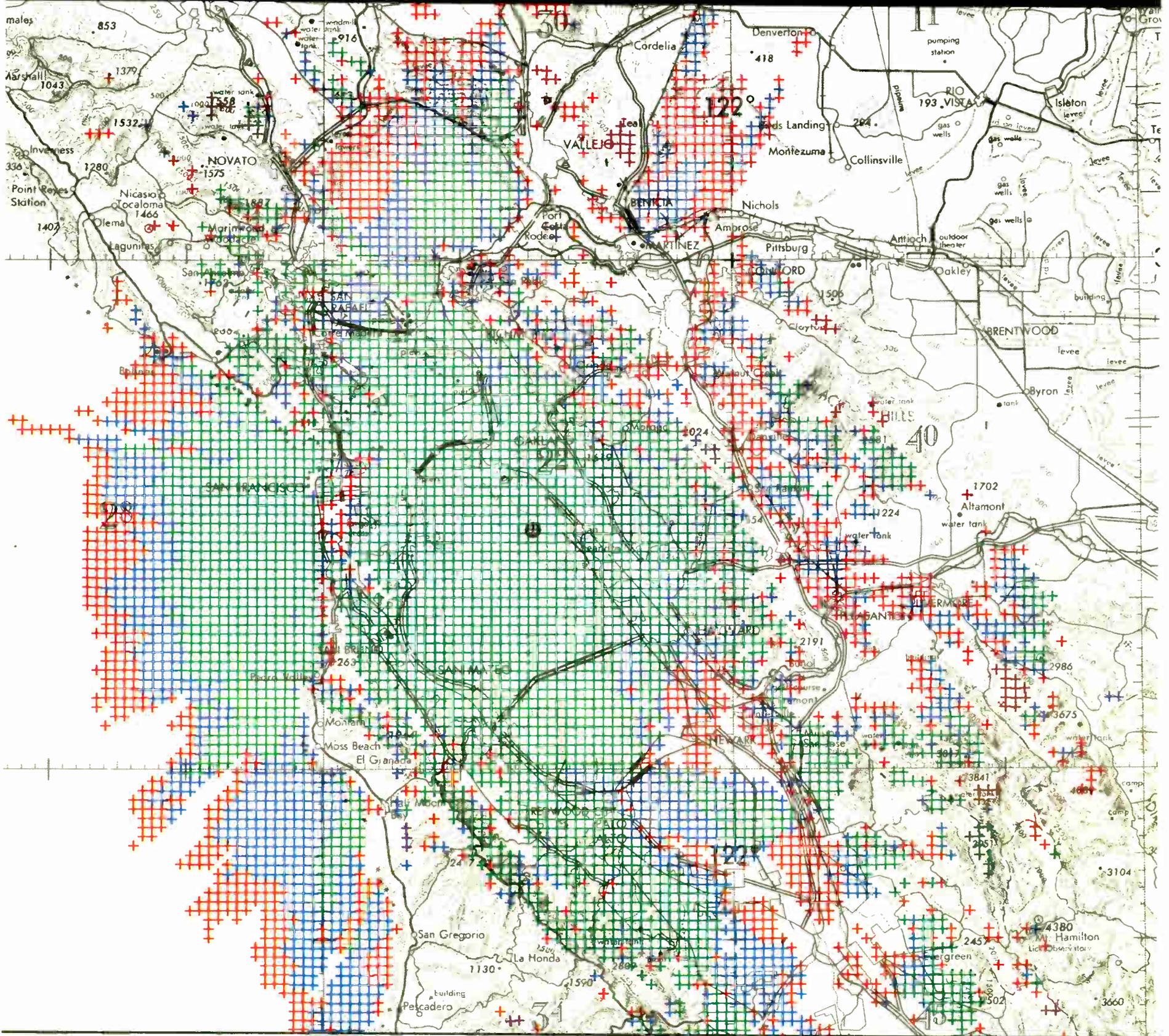
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Circle 33 On Reader Service Card

FM Solid State Still on Horizon

by Richard Farrell

Falls Church VA Transmitter manufacturers are not deaf to engineers' wishes for solid state FM transmitters at high power levels. Most, in fact, identify it as the transmitter of the future—it's just not going to happen anytime soon, they say.

"Probably not for five or 10 years," says Broadcast Electronics' Manager of Domestic Sales Bill Harland.

"Ultimately, the costs of solid state RF devices need to come down," says Jeff Detweiler, QEI's domestic sales manager. "Once they do, there will be a market for solid state transmitters at above the 1 kW power level."

"We will see solid state transmitters at higher power levels, but I could not say when," says Steve Claterbaugh, who heads Continental Electronics' advertising and sales promotion.

"The transmitters currently being manufactured are not efficient at the higher power levels. That is why no one has gone to the higher levels for solid state. Tube-types are still the most efficient at these higher powers," adds Claterbaugh.

Obstacles to solid state

Efficiency and cost, of course, are the key stumbling blocks to the acceptance of solid state.

"FM solid state is currently feasible to do," explains Ron Frillman, Harris Corp. manager of RF sales. "The problem is that the efficiency of a solid state FM transmitter in higher power levels is going to be anywhere in the vicinity of 52-54%, whereas in a single tube transmitter the PA is about 82% efficiency.

"So it is based on several conditions," says Frillman. "Would the broadcaster pay

more for a product? Probably not. Would he be willing to sacrifice efficiency for solid state? Probably not. So until the devices become more efficient and less costly, you will not see a lot of solid state."

There are, however, some solid state transmitters in use at low power levels in FM that the industry seems to have accepted. But some manufacturers argue that stations using these transmitters are still using inefficient equipment.

INDUSTRY ROUNDUP

"They are just as inefficient," says Bill Harland. "It's just that we are willing to pay the penalties for their use. The difference between consuming 500 W of electricity and 750 W is not something to be overly concerned about. But if you are talking about consuming 30 kW as opposed to 50 kW, then that is significant money."

Device costs prohibitive

Jeff Detweiler says that part of the problem lies in the lack of a strong demand for the types of devices used in the solid state high power designs. Consequently, the devices used in the high powered FET designs are very expensive.

"When you talk about high power solid state devices, you're talking about one component that has to dissipate a lot of heat," notes Detweiler. "Therefore heat synching becomes a problem as well. There is more concentrated heat and a need to build more efficient heat synching devices and incorporate some less traditional designs of actual trans-

mitters. And I'm not sure the industry is ready for that."

Manufacturers, though, may be taking the first slow steps in that direction. We are beginning to see companies offering FM solid state transmitters above the 1 kW level, along with solid state exciters—such as Harris' THE-1—among others.

Television Technology Corp. (TTC) for one, is now offering the 4 kW FMS-4000 solid state transmitter in 1 kW amplifier modules, while new entrant CTE introduced at this year's NAB a line of solid state transmitters and exciters. The company is currently offering 250 W to 5 kW of solid state power and expects to offer up to 20 kW in the near future.

Why bother?

Most still feel, however, that costs need to come down in order for the solid state units to overtake the vast installed base of tube transmitters.

And there is incentive, according to Ron Frillman, for both manufacturers and broadcasters to investigate solid state. Broadcasters want to eliminate tube replacement as well as have a device that is physically smaller and may ultimately run at a lower cost of operation.

Manufacturers, for their part, have equally compelling concerns. Ron Frillman says that if the current technology were up to speed it would be ideal

for the manufacturer. "A company would probably improve itself if it went to solid state today," says Frillman. "Because it buys the tube in the transmitter and doesn't build it, that represents a good percentage of its manufacturing cost.

"If it was all solid state, then the company would be building everything it had in the transmitter, which would improve the amount of income it generates from the transmitters it sells. So, from a manufacturing standpoint, a company has all the incentive in the world to go solid state," Frillman says.

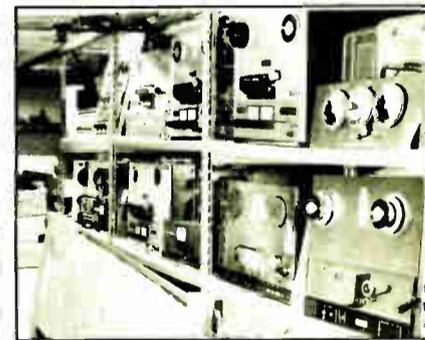
Don't hold your breath

But Frillman, recalling that it took about 10 to 15 years for all manufacturers to go to 1 kW solid state AM transmitters, foresees slow progress. "I think there will be a slow move in the solid state area, and then installed transmitter life cycles will start going out. When the replacement cycle comes, people will make the decision to go solid state."

For now though, from the manufacturing side of the fence, says Frillman, "the 'eagle' side of everybody says they want to be the first in the business to bring out high power FM solid state transmitters. But you have to get yourself back into the conscious world and realize that to be the first manufacturer to offer a high power solid state FM transmitter it will be more expensive for the customer to operate."

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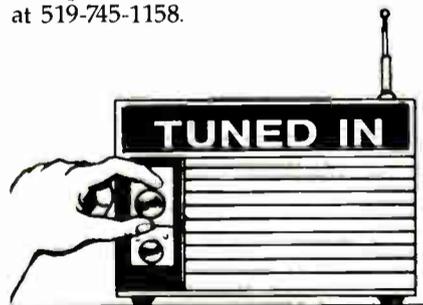
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Name change ... Tannoy North America has recently been renamed **TGI North America** following a joining of that company with **Mordaunt-Short**. The name change is effective as of July 1989, following the merger in January of 1988. TGI North America will continue to distribute Tannoy products in North America as well as expand its distribution network to include other TGI companies.

Any questions regarding the change can be directed to Bill Calma at 519-745-1158.



Earnings reports ... reporting net income for the first quarter ended 29 September was Harris Corporation, who realized \$25.6 million for that period, an increase of 11% over last year's comparable figure.

Gentner Electronics Corp. reported a rise in first quarter revenues of 23%. The company's first quarter revenues stood at \$1.25 million, compared to \$1.02 million for the previous year's first quarter.

New supplier ... A new supplier to the pro audio community is **Parsons Audio**, which will focus its energies on the equipment, systems and technical services of full-time high end pro audio users.

The company has been established by industry audio veteran Mark Parsons, who for the past five years worked at LaSalle Audio Systems, most recently as manager. Parsons may be contacted at: 617-431-8708.

Clarification ... Readers of September's Buyer's Guide who are interested in the Harris XD-001 DAT unit should direct all inquiries to Harris Corporation's studio arm, **Allied Broadcasting**, at 800-622-0022.

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QEI Produces Power at WAWZ

by Ron Habegger, CE
WAWZ-FM

Zarephath, NJ QEI Corporation has been in the low-power transmitter business for years, serving the Class A's while the Class B's and C's came to know QEI through its other products such as the Model 691 modulation test set and 675/695 exciters.

Many of you may have upgraded your old Gates FM 10s and 20s with QEI exciters. Now QEI has decided to take on the big guys by offering a triode version of the 20 kW-30 kW transmitter.

WAWZ recently replaced its 20-year

old, eight-bay antenna with a new four-bay ERI in order to better cover the hills of New Jersey and to penetrate the concrete jungle of New York. It required a new transmitter that would provide 20 kW.

WAWZ's GM decided to place an order for a QEI FMQ 20000B and no one has since questioned him on that choice.

Smooth installation

Installation was so straightforward and logical that only a terminal number listing was needed in order for the remote control to be connected. The RF plumbing was bolted into place. Wagers were then placed as to which way the blower would turn when the three-phase was applied. That was the only guesswork needed.

For stations with very remote transmitter locations, QEI offers a single phase 30 kW version of the transmitter, an option many manufacturers will not even discuss.

The complete transmitter is built into only two 24" x 30" x 76" cabinets without internal crowding. The power supplies, mains connect and breakers are in one cabinet while all of the RF, audio/remote connections and control circuits are in the other.

Where's the beef

QEI has provided plenty of "beef" in every aspect, from a heavy gauge frame to handle the gross weight of the plate transformer to large gauge wiring to handle the years of stress and thermal fatigue.

Some wire runs were "triple wired" for added safety margins and reliability. We all like to see neat wire harnessing and shiny solder connections with no flux left behind, and this transmitter gives you a feeling of security just by looking at its interior workmanship.

We have been spoiled lately with lots of meters on the new transmitters, and

we get nervous about any part of the machine that is *not* metered. QEI provides metering of powers (forward and reverse) between all amplifier blocks as well as metering of most currents and voltages. These meters are all clustered on the control panel and are certainly large enough to read.

There is also a fault display, updated by the processor, that holds an indication in memory even after a remote reset is initiated. This allows the engineer to take a look at the fault on a later visit to the remote site.

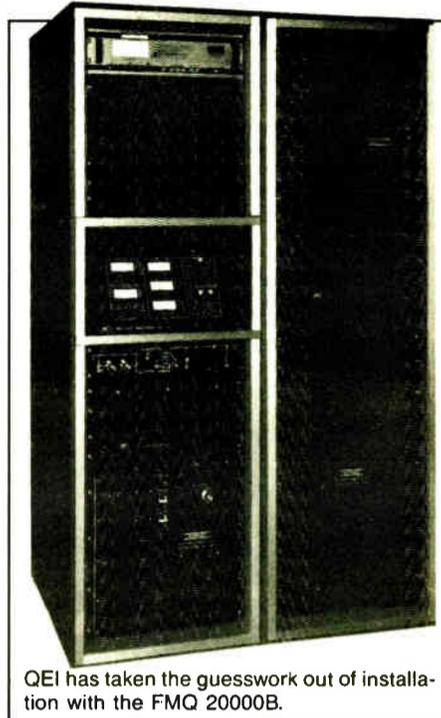
USER REPORT

It is important to note that the QEI ARC-27 remote control package will allow remote displays of fault conditions. But because this station elected to keep its Moseley MRC-1600, and QEI provides no status outputs in its standard transmitter, we are out of luck on that point. It is the only compromise that must be lived with until QEI updates that area.

We chose the well-known 695 exciter, which has such wonderful specs that the QEI people named it "Transparent Plus." The term is not new to our industry, but it aptly describes the unit's modulation capability.

The station is feeding the 695 with 10% SCA injection at 57 kHz, with virtually no IM distortion and a 15 W output from the 695 feeds the IPA modules. To the relief of this CE, there are no trimmer caps to play with.

If all of the above were not enough, what really makes the FMQ 20000B unique is its grounded grid PA design. Most manufacturers in the past have shied away from this time-proven technique because they say it is less efficient. Our PA is running at this very moment at 68%. That's not too shabby.



QEI has taken the guesswork out of installation with the FMQ 20000B.

Sacrificing 5% efficiency for a more wideband amplifier and using no tricky neutralization schemes make good sense. For example, there is no way one can mess up the cavity tuning when bumping around in there with the dust buster. Adjustments to the PA input and output (input via control knobs; output motor driven) tuning and loading are all that is needed to tune this transmitter.

We must credit QEI also for sending representation as promised for the initial turn-on after installation was complete. Some quick checks showed the synchronous AM noise to be -47 dB and asynchronous AM noise at -53 dB. The second harmonic was suppressed greater than 83 dB.

QEI's design engineers deserve much credit for providing a rock solid and very clean grounded-grid transmitter. They have convinced us that QEI can produce power!

■ ■ ■

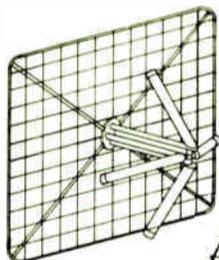
Editor's note: Ron Habegger may be reached at: 201-469-0991.

For more information on the FMQ 20000B, contact Jeff Detweiler at QEI: 609-728-2020, or circle Reader Service 93.

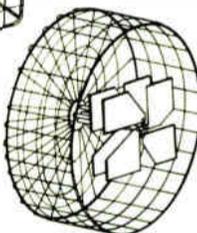


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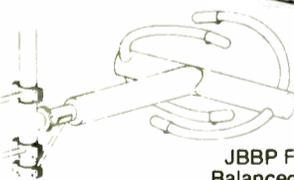
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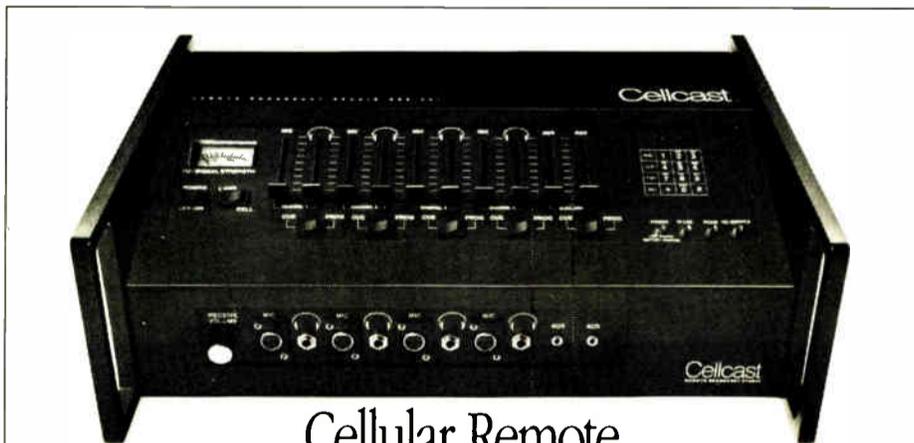
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BE Field Test

(continued from page 38)

The FX-50 also offers a number of other convenient features. The accuracy of the modulation metering on its front panel has been doubled. There is a new digital readout for forward and reflected power, voltage, current and AFC voltage. The rear has three subcarrier BNC inputs, two composite inputs—one balanced and one unbalanced—and even a spare fuse clip.

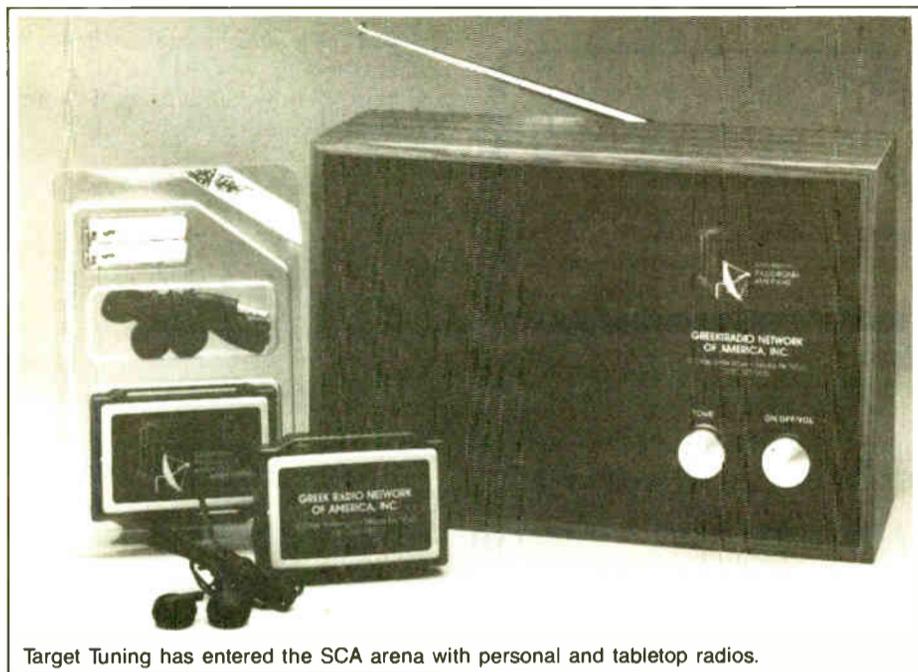
The FX-50 offers extreme reliability, great features and sonic quality comparable to CDs. In fact, the sonic quality has not varied in the year and a half that it has been in service here. It is also reassuring to see a company willing to take the time for such a thorough, real world field test of such a critical piece of broadcast equipment.

■ ■ ■

Editor's note: Dave Obergonner has been CE at KSD/KUSA for nine years. He also does consulting engineering for radio and TV stations in the Midwest area. He can be reached at: 314-997-5594.

For more information on the FX-50 exciter, contact Bill Harland at Broadcast Electronics: 217-224-9600, or circle Reader Service 92.

Target Tuning Hits The Mark with SCAs



Target Tuning has entered the SCA arena with personal and tabletop radios.

by **Daniel Flohr, President**
Target Tuning

Moonachie NJ In 1987, Target Tuning began delivering the Target Tuner, a fixed frequency, quartz crystal-locked, promotional FM radio. Over 450,000 units have been delivered around the world.

Early in 1989, the company moved all of its electronic production from the Orient to its New Jersey facility. It makes Target Tuning perhaps the first US company in more than 30 years to manufacture high volume, inexpensive radio electronics in America.

TECHNOLOGY UPDATE

With the success of the FM Target Tuners, the product line was recently expanded to include the Motorola C-QUAM AM Stereo Target Tuner.

In 1988, Target Tuning became aware of subcarrier broadcasting and the need for SCA receivers. It was clear that reliable, reasonably priced receivers that could be delivered in a timely manner were very much in need.

Our design goals were thus clear, and after a year of testing and prototypes, Target Tuning has introduced both the SCA Desktop and SCA palm-sized portable.

Testing the field

The design phase involved looking at and testing dozens of SCA receivers. With only a few percent of the main FM signal available to it, great design is mandatory in making the somewhat marginal SCA signal usable.

In evaluating the technology, which dated back to the 1960s, we saw that little use had been made of new linear integrated circuits (ICs) available for communications applications. Such parts offer far more sophistication, better performance, greater reliability, fewer discrete parts and lower total cost.

These ICs have features and incorporate literally hundreds of individual components that are next to impossible

to reproduce with discrete components.

The Target Tuner SCA design employs not only state-of-the-art components, but current RF technology and know-how.

Surface mount technology

The most unique feature of Target Tuning's production is the extensive reliance on surface mount technology (SMT). Although the capital expense of SMT is very high, the tremendous volume of our FM product gave us the ability to obtain and employ it for SCA production as well.

SMT uses special robot assembly machines to install all of the resistors, capacitors, transistors and ICs onto the circuit board. With only 10% of the parts being hand-installed, tremendous labor savings are realized. And with these machines checking all of the parts "on the fly," production errors are avoided and defective parts are located.

Two of the benefits of SMT lie in its ability to build products with high component densities and to build circuit boards that are consistent. This is especially critical in RF work where something as simple as varying component lead length (found frequently in hand-inserted, through-hole parts) can effect performance.

Our current SMT production plant can assemble one SCA circuit board per minute. In peak summer periods for our promotional FM radio, we have built, tested and shipped as many as 2000 units in a single day.

The future of SCA is bright, with very steady current growth. The network of radio reading services is well established. SCA is clearly the future for ethnic broadcasters who, with satellite program distribution, are growing more popular and widespread.

A host of other applications including energy management and data delivery are successfully using SCA. It is important for this industry that they be well serviced by receiver manufacturers. Target Tuning is looking forward to being a part of the future of SCA.

■ ■ ■

For more information, contact the author at 201-935-8880, or circle Reader Service 89.

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A Basic Primer On Class A Upgrades

Editor's note: What follows is an informational question and answer piece provided by Harris Corporation's Broadcast Division as a service to FM broadcasters. It attempts to answer some basic questions broadcasters may have about new FCC rules that allow Class A FM stations to increase their power in order to improve their market coverage. Harris does not intend the piece as formal legal consultation and urges readers to review the information with their consultants.

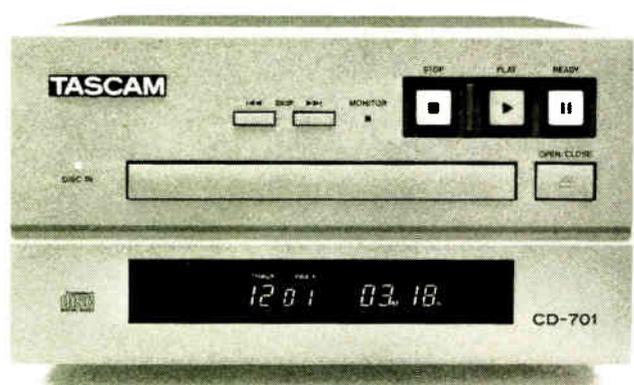
Q: Will increased power improve coverage?
A: It could. Higher power tends to extend maximum coverage, increase the coverage area and strengthen local signals. Figure 1 compares the 1 mV coverage radius and the coverage area for a Class A station with an antenna at 328' HAAT before and after the power increase.

Q: Will this power increase cause more interference?
A: Under these new rules, the FCC has revised minimum distance separation requirements applicable to Class A stations in order to maintain the current level of protection of service of FM stations in all cases. Additionally, power increases will be implemented on a selective, rather than on a blanket basis to reduce adverse effects on Class B and Class B1 service.

Q: Who will be allowed to upgrade?
A: Under the new rules, Class A stations that meet distance requirements in FCC RM-6237 will be permitted to improve their coverage by increasing their power. Other Class A stations that fail to meet distance requirements (short-spaced) may also be able to increase power by making a facilities change.

SPECIAL REPORT

Q: How will I know what my station can do?
A: In November of 1989, the FCC will publish a list of stations that meet distance criteria and may begin broadcasting with their new power beginning in December of 1989. These stations will need only to file a simple notification form with the FCC at the time they increase power. After this first list is published, the FCC will issue a second list of the short-spaced stations that will be able to increase power after they make a facilities change. These stations will need to file a formal application with the FCC, await the normal processing cycle and obtain a construction permit before increasing power.



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Q: How can my station increase its power?
A: Because every radio station is unique, you will want to discuss the best approach for your station with your consultant since there are many ways a station can increase power. In general, however, there are three ways a station can increase its power to 6 kW: higher power from the transmitter, increased antenna gain (more bays) or some combination of the two.

Figure 1.

	Radiated Power (watts)	1 mV Contour (miles)	1 mV Coverage Area (sq. miles)
Before	3000	15.0	707
After	6000	17.6	973

Q: What's the best solution for my station?
A: It depends. If you are satisfied with your current antenna coverage and pattern, you may be able to increase power simply by turning up your current transmitter or replacing your transmitter with a higher power model. You'll need to verify that your antenna and coax will be able to handle the increased power.

Figure 2.

Xmtr Power	# of Bays
4.4 kW	3
3.2 kW	4
2.6 kW	5
2.1 kW	6

Q: I'm satisfied with my station's antenna coverage and pattern. How much transmitter power will I need for 6 kW ERP?
A: Many Class A stations currently are using two bay antennas with about 300 feet of 1-5/8" diameter coax. The overall gain of this antenna system including coax efficiency is about 0.86. In these situations, the transmitter needs to produce about 7 kW in order for the antenna to radiate 6 kW: 7 kW x 0.86 = 6 kW.

Q: Is there a way I can change my antenna to reach 6 kW ERP without changing my transmitter?
A: If the rating and height of your present tower is adequate, it may be possible to modify your existing antenna or install a new one to provide the gain needed. Generally this approach is more complicated than a simple transmitter change as a result of tower rating issues, specialized antenna rebuild costs, possible changes in center of radiation, FAA and FCC review, rigger costs and more.

It is important to remember that antenna system changes can result in coverage changes. With increased power, most of the changes should be for the better. However, with an antenna change, coverage in certain areas may be negatively affected by lower signal strength and/or more multipath. In these cases, you will probably want a consultant.

Q: How many antenna bays are typically needed for 6 kW?
A: Figure 2 shows some typical combinations (Coax efficiency = 87%).

Q: Will I be able to increase the height of my antenna?
A: Possibly, but it may require reduced power. As before, a Class A station with an antenna above 328 feet HAAT must reduce power to the level that provides the same 1 mV signal radius as if at full authorized power from 328 feet HAAT.

Q: What if my station is "short-spaced" under the new rules?
A: Your station will be "grandfathered" and may continue to operate with its current facility. If you wish to increase power, you may be able to do so by making a facilities change. These changes may include relocating the transmitter site, switching to a directional antenna or limiting the power increase.

Q: What will it cost to get to higher power?
A: In some cases, nothing. A number of stations may be able to reach their new maximum power just by increasing the power output of their present transmitter. The only requirements are that both your transmitter and your antenna and coax are able to operate at your new power level.

Q: What if I'm not that fortunate?
A: Other stations may need to buy and install a higher power transmitter, modify a current antenna system or install a new one, or use a combination of these. Still, other stations may need to relocate to a new transmitter site.

Q: How can a directional antenna help if my station's short-spaced?
A: With a directional antenna, your station will be allowed to radiate at least three kW (from 328 feet HAAT) toward protected areas and up to 6 kW in all other directions.

Q: What extra costs can I anticipate for a directional antenna?
A: A directional antenna is three to ten
 (continued on next page)

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Increasing to 6 kW: What Will It Cost?

by Steve Claterbaugh
Advtg & Sales Promotion
Varian Continental Electronics Div

Dallas TX In an increasingly competitive marketplace, broadcasters are constantly searching for the edge that will separate them from the rest of the market. One class of radio station that has finally gained the attention of the FCC is the Class A broadcaster.

On 18 August, 1989 the FCC stated in its Report and Order that "1. The stations' existing audience would receive a stronger,

tower height may be limited by the location of the facility.)

All of these options have certain costs involved. Transmitters range from \$28,000 to \$35,000. (Not a bad investment, depending on the age and condition of one's present transmitter.) Some manufacturers accept used transmitters as trade-ins.

Upgrading the transmitter may also mean that a minimal amount of tower work will be needed. Still, it is sometimes possible to add additional bays to an existing three-bay antenna.

Comparison Of Minimum Distance Separation In Miles

	Co-Channel		200 kHz		400/600 kHz		10.6/10.8 MHz	
	Old	New	Old	New	Old	New	Old	New
A to A	65	71	40	45	17	19	5	6
A to B1	86	89	55	60	30	30	10	7
A to B	101	111	65	70	43	43	10	9
A to C3	—	88	—	55	—	26	—	7
A to C2	101	103	65	66	34	34	10	9
A to C1	122	124	80	83	46	47	20	14
A to C	138	140	105	103	65	59	20	18

more reliable signal," and "2. The usable signal would extend into new areas and thereby offer an additional choice to the radio audience in those areas."

Therefore, the FCC has set a new maximum power level for Class A FM stations of 6 kW ERP at a reference antenna

SPECIAL REPORT

height of 328' (100 meters). Although many stations will be able to increase power from their present transmitter facility, some will be short spaced.

If a station is short spaced, there are several options. These include moving to another site that is not short spaced, installing a directional antenna or operating at a power of less than 6 kW so as not to create interference.

A station should contact its consulting engineer to determine if it can upgrade. (See the accompanying minimum distance separation table.) The consultant can provide the station with the options available to achieve the 6 kW ERP. Options available are to increase transmitter power and use the existing antenna, or to increase the number of antenna bays and use the existing transmitter, or to increase tower height. (However,

Most antenna manufacturers will handle this type of request on a case-to-case basis. If the antenna is very old, it would probably be better to replace it entirely.

It is also possible to rent an antenna, remove the original three-bay and return it to the manufacturer to be matched up with three new bays. Then everything must be reinstalled on the tower at an additional expense. Discussions with the station consulting engineer will determine the best approach to accomplish the 6 kW power increase.

What does the increase in power mean to the broadcaster? The total area within the 1 mV/m (60 dBu) contour increases approximately 44% and the signal strength by about 41%. This relates to an increase from approximately 15 miles to 18 miles. In an area that is heavily populated, this mileage increase could mean reaching thousands more people and a better signal in the fringe coverage areas.

There are many specific details that must be looked at for each individual station. Owners and managers must recognize the benefits of upgrading and the costs involved. Engineering must make the change as painless as possible while reminding themselves that everyone will gain from the power increase.

Editor's note: Steve Claterbaugh can be reached at 214-381-7161.

Power Increase Answers

(continued from previous page)

times the price of a standard antenna. In some cases, a tower modification also is necessary. Consultants normally are needed to calculate the required protections and define the directional patterns, along with a legal representative to prepare and file FCC applications.

The directional pattern could also call for a new transmitter site in order to ensure that your signal is directed over the area you are most interested in covering.

Q: What can I do to prepare for the upgrade?
A: Check with your consultant to see whether you are likely to be on the list

of stations allowed to upgrade. If you expect a simple upgrade, ask your chief engineer, contract engineer or consultant for recommendations for needed equipment changes. Then contact manufacturers for price and availability of the necessary hardware.

If you are short-spaced and need to file for a facilities change, you should contact your consultant for recommendations and to help you define transmitter size, antenna characteristics, etc.

For more information, contact Harris Broadcast Division at 217-222-8200, extension 3401.

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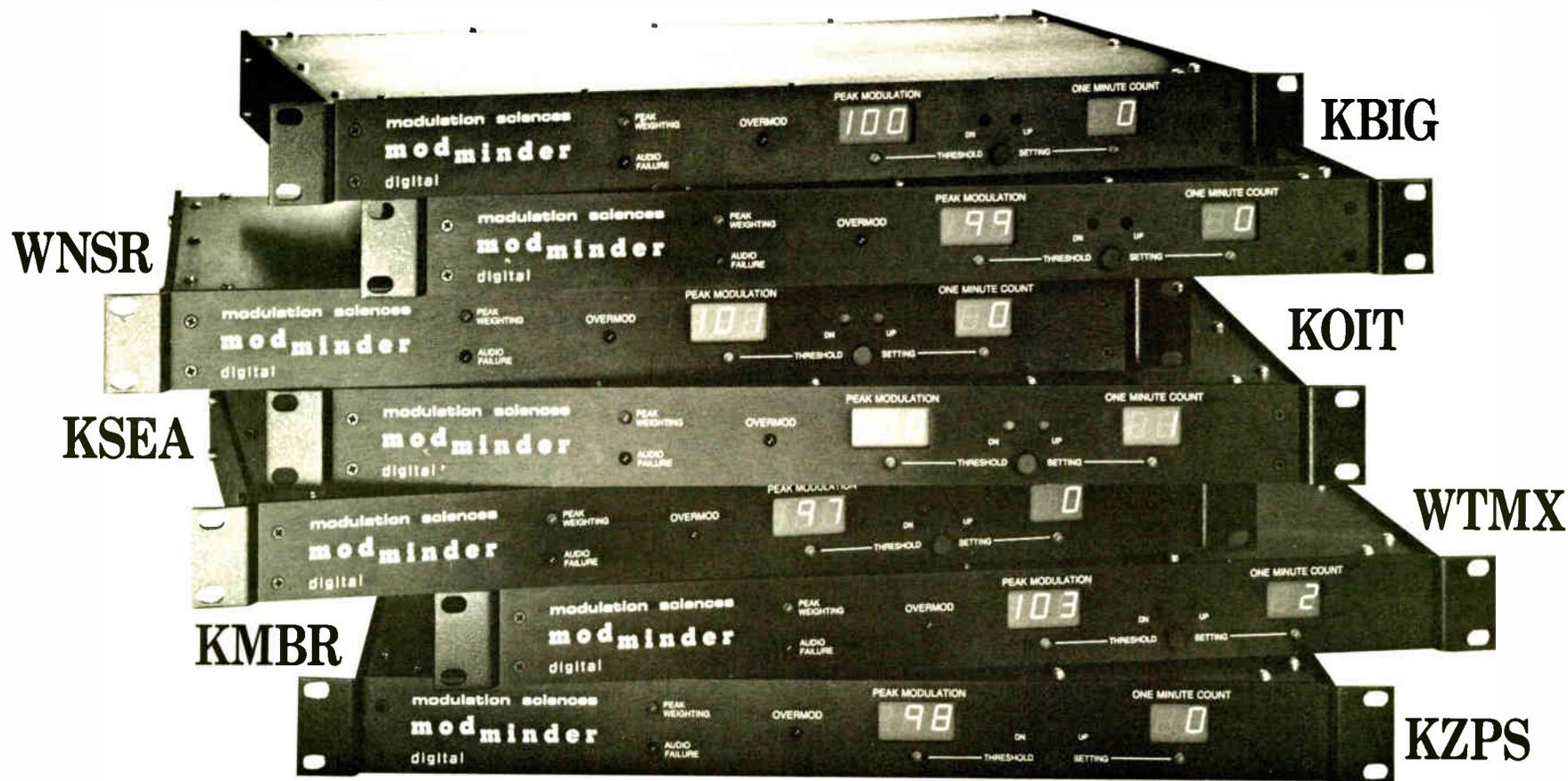
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World Radio History

TTC Passes Muster at CJSO-FM

by Louis Delisle, GM
CJSO-FM

Montreal CANADA In 1988, Pram Communications acquired CJSO-AM, located in Sarel, near Montreal. The goal was to go FM, as the existing four AM towers were, with time, surrounded by a jungle of Hydro Quebec towers and wires. The transmitter seriously needed to be replaced. So we acquired a TTC FMS4000, solid state transmitter.

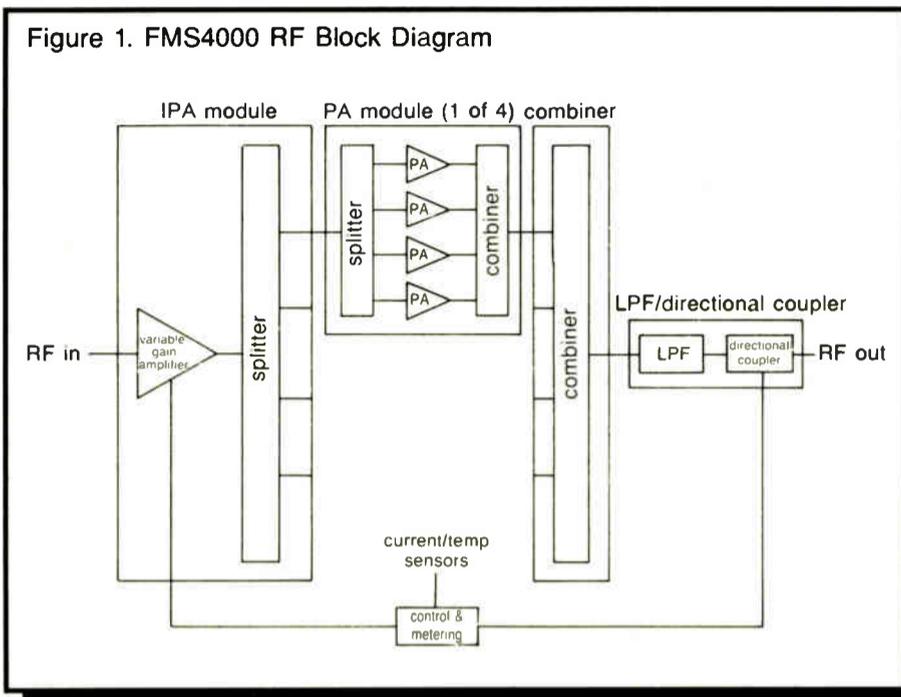
The FMS4000 is made up of three main sections. The first is the RF enclosure that contains all of the RF amplifiers and their associated circuitry.

The RF system of this transmitter consists of an intermediate power amplifier (IPA) module, four power amplifier (PA) modules, a combiner module and a low pass filter/directional coupler. Figure 1 shows a functional block diagram of the RF system in this transmitter.

The IPA module is used to amplify the exciter output (10 W) to approximately 200 W. This signal is then split four ways to provide approximately 50 W to drive each of the PA modules. All of the metering and control circuits are connected to this module and are interconnected and fed via one cable to the controller.

The exciter RF output connects to this module and is fed directly into an RF amplifier stage.

Figure 1. FMS4000 RF Block Diagram



ing at rated power output will be in the -2 V to -4 V range. This range of bias maintains the amplifier stage in Class C operation for optimum efficiency. This circuitry has also been designed so that if the bias control voltage is disconnected the bias will be held to 0 V.

PA module

The PA module provides amplification of the RF signal and supplies approximately 1 kW RF output. A total of four of these modules are combined to give the final 4 kW output.

RF from the IPA module is supplied to the PA modules for amplification. This signal is first split four ways, inside the PA module, using a Wilkinson splitter. This type of splitter provides a very low loss and good (20 dB) isolation between output ports.

Each output of the splitter feeds an RF amplifier stage. This amplifier stage is identical to the one on the IPA except for the bias circuitry.

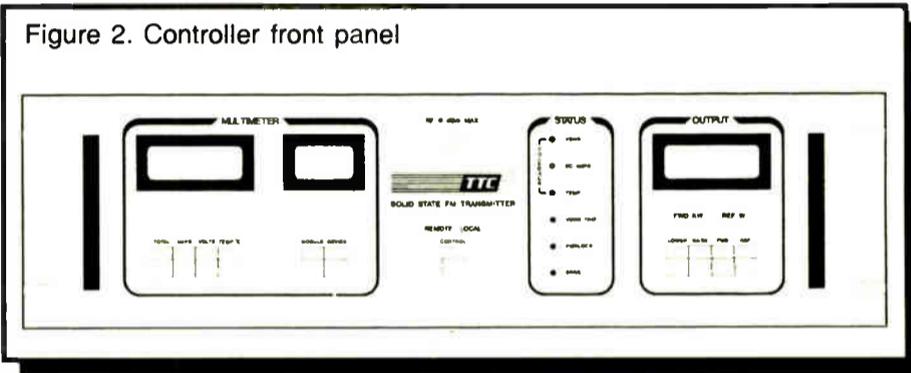
provides a very low loss and good (20 dB) isolation between input ports.

All control and monitoring circuitry is located in a separate chassis. The front panel of this unit is shown in Figure 2. This control unit is all solid state and uses CMOS ICs for all logic functions.

The power output of the transmitter is maintained at a constant, preset level by the ALC circuitry in the controller. The forward power sample from the directional coupler is fed into an RF sample and detects it to produce a DC voltage that is proportional to the RF power output of the transmitter. Once drive has been applied, the ALC circuit will ramp up the output power in a controlled manner to prevent any spurious emissions.

The output power reference voltage used for the ALC is derived from a CMOS digital pot. This circuit accepts an up or a down logic signal and increments or decrements the reference voltage whenever the appropriate signal is received. The output voltage is stored

Figure 2. Controller front panel



The circuit provides gain and input matching that is broadband over the full FM band—no tuning or adjustments are required.

Since no gain control is needed in this stage, the bias is fixed. This maintains Class C operation for best efficiency while increasing the gain slightly above the 0 V bias level. The outputs of the four RF amplifiers are fed to a Wilkinson combiner. This type of combiner, as with the splitter,

digitally in EPROM on the chip.

The antenna VSWR, PA currents and all temperatures are continuously monitored and are integrated into the power control circuitry to protect the transmitter from failures due to abnormal operating conditions. The fault monitoring circuitry also serves to allow the transmitter to remain on the air if certain sections of the transmitter fail.

Repairs while on-air

This transmitter was designed so that all maintenance and most repairs can be done without taking the transmitter off the air. Since the FMS4000 is all solid state there is no maintenance required except for a regular cleaning of the fan filters. The meter readings should be observed on a regular basis to insure that all devices are functioning correctly.

If a failure occurs in the control chassis a jumper is provided that disconnects the ALC circuit from the IPA. This allows the controller to be fully operational and interconnected to the transmitter but will not affect normal operation. This way it can be worked on while connected into the unit with no fear of causing the transmitter output power to change.

The TTC FMS4000 transmitter is a *fantastic* piece of equipment. Its conception, construction and ease of operation make it second to none. But best of all it sounds "digital." Anyone can hear the difference by sweeping the FM band ... to my full enjoyment!

Editor's note: For more information on the TTC FMS4000 in Canada, contact Pierre Voyer at 514-739-3368. In the U.S., contact Bill Kitchen at 303-665-8000, or circle Reader Service 95.

USER REPORT

This circuit provides gain and input matching that is broadband over the full US FM band (88 to 108 MHz) and no tuning or adjustments are required. The bias to this stage is supplied from the controller's ALC output and is used to control gain. This forms part of the ALC loop and ultimately controls the transmitter's final output power.

The typical bias voltage when operat-

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CTE Products Move Into the US Market

by Rob Meuser, President International Broadcast Support Services

Ontario CANADA Solid state transmitters are the dream of both engineers and general managers alike. The past decade has brought advances in both AM and television transmitters. Unlikely as it may seem, FM has lagged in this area.

TECHNOLOGY UPDATE

Now, due to the worldwide explosion of FM stations, solid state power is coming to FM. One company in this area is the Italian manufacturer CTE. Originally designed for the home market, CTE's transmitters have gained worldwide acceptance.

Despite this success, the American market is new turf for CTE. The company introduced its products to this market at the 1989 NAB.

The CTE line extends from its Model S-20 4 W to 30 W exciter/transmitters up to its Model VL 5000 solid state 5 kW transmitter. The forthcoming VL 10,000 and VL 20,000 will raise solid state FM to 20 kW capability. Other CTE power levels are 250 W, 500 W, 1000 W and 2000 W.

Constant feedback loop

Technically speaking, CTE offers several features that make the line unique, including a PWM power control unit. All functions such as over temperature, VSWR and automatic power control are controlled via a constant feedback loop.

Ultimately, the voltage to the final amplifier transistors is regulated in response to various conditions. This feature makes the transmitter exceptionally tolerant of faults and allows for automatic power control at any level down

to one-fifth power.

At a 2 to 1 VSWR, a typical unit will operate at 50% forward output power, with all spurious outputs down better than 85 dB. Because of the voltage reduction to the finals, the unit will stay cool and stable. The continuous power reduction upon fault is a feature that adds measurably to overall on-air reliability.

Loudness is always important in most operations. CTE has designed the S-20 exciter to be overshoot-free and nearly DC coupled, with a PLL corner frequency of .25 Hz. A 20 Hz square wave reproduction is easily possible. (Accord-

... CTE's transmitters have gained worldwide acceptance.

ing to recent studies, 1.5 dB of modulation is often lost due to low frequency problems in many modern exciters.)

Locks to frequency in four seconds

The PLL circuit allows for lock-up to any FM frequency in four seconds via front panel controls. This performance is not without some penalty. The SNR is 85 dB referenced to 100% modulation, while distortion is .2%.

Other CTE products include STL links, STL receiver/exciters and relay receivers. The net capability for CTE FM equipment is therefore not limited to just transmitters: translators, repeaters, boosters and synchronous repeaters are all possible.

Editor's note: International Broadcast Support Services is currently marketing the CTE lineup in the United States. For more information, contact Barry Honel at 404-389-1966, or circle Reader Service 91.

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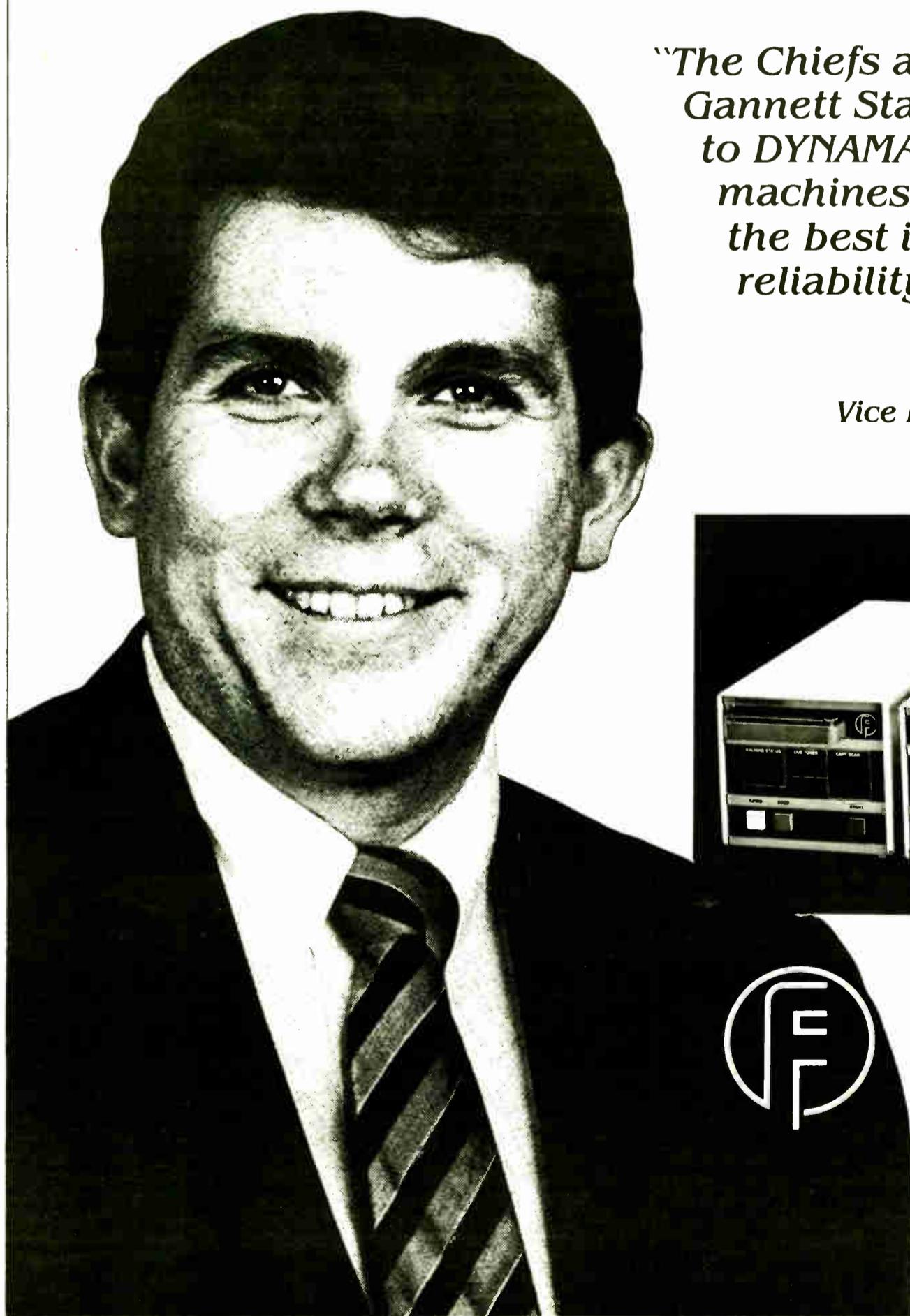
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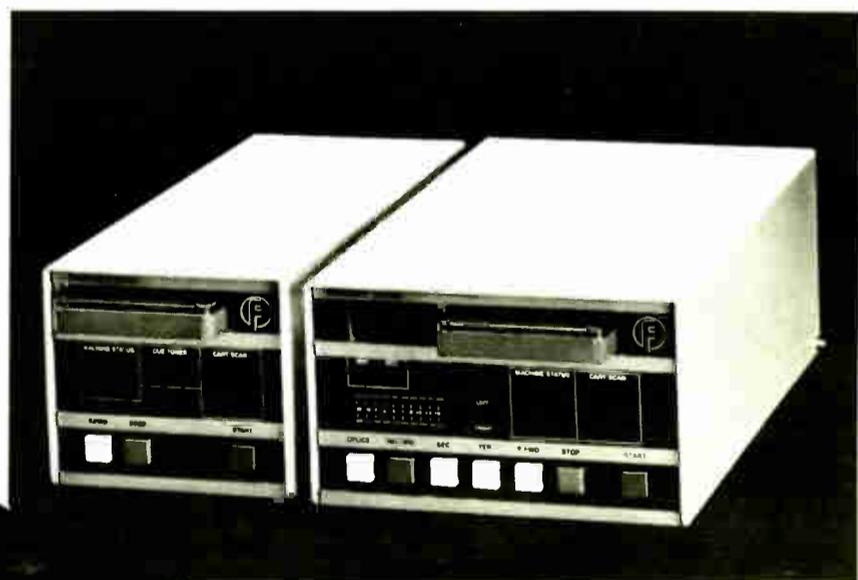
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