

# Radio World

Vol 13, No 5

Radio's Best Read Newspaper

March 8, 1989

## PCB Capacitor Sale Probed

by John Gatski

**Washington DC** A suspicious CE's inquiries have resulted in an Environmental Protection Agency (EPA) investigation of Baltimore-based Universal Capacitor for allegedly selling new PCB-filled capacitors without a permit.

The EPA is looking into charges that Universal Capacitor sold the CE 25 small GE capacitors, which were 20 years old and contained polychlorinated biphenyls, or PCBs, according to EPA spokeswoman Lisa Nichols.

Beginning in the 1930s, PCBs were used in electrical components such as transformers, capacitors and rectifiers because of their superior dielectric properties and heat transfer ability.

Because of potential carcinogenic, or cancer-causing, effects however, the manufacture and distribution of PCB capacitors or transformers have generally been prohibited since 1979. Small PCB capacitors, those with less than 3 pounds of PCBs, can be sold if a company has a government exemption, according to EPA regulations.

Used PCB capacitors, if in good, non-leaking condition, can be sold without an exemption, Nichols explained. All non-PCB capacitors built since 1979 must be labeled "No PCBs" as required by the EPA.

Nichols said Universal Capacitor does not have a permit to sell new capacitors that contain PCBs and the EPA is concentrating its investigation on whether

Universal is selling its capacitors new or used.

"If the company is selling them for new (without an exemption) there may be a problem," Nichols said.

According to the CE, who requested that he not be identified, "He (the salesman) did not say they were new, but he implied it. I paid new capacitor prices."

The salesman, who identified himself as Mike to the CE and who declined to

give his last name to RW, refused to talk about the sale of the capacitors or whether they contained PCBs.

"We have no idea what is going on with it. We're not going to be releasing any data to anybody at anytime on this transaction," Mike said.

The manufacture of PCB components was outlawed in 1979 because of the carcinogenic hazard that can result if the

(continued on page 7)

## Stations, Firms Take Sides in FMX Battle

by John Gatski

**Washington DC** Proponents and opponents of FMX are circling the wagons in the aftermath of a Bose Corp./Massachusetts Institute of Technology (MIT) study that sharply criticized FMX's performance under multipath conditions.

FMX proponents continue to support the FM signal enhancing process technology, charging that the Bose Corp./MIT study was flawed and was undertaken only to criticize FMX.

Some FMX proponents maintain that Dr. Amar Bose, an electrical engineering/computer science professor at MIT and chairman of the board at the Bose Corp., is working on his own FM signal enhancing system that will be marketed in the future. Bose has repeatedly denied the charges.

FMX critics, however, believe the study, released in January, confirmed what they have known the past few years: FMX adds noise and distortion under multipath conditions with even more noise on normal FM stereo receivers.

### FMX problems at CBS

In a recent development, CBS spokesman Helen Blieberg confirmed that the network's Chicago FM, WBBM, recently shut down the FMX generator because of "hiss and noise" complaints from listeners with "Walkman-type" radios. She said there were no complaints from listeners with better quality FM radios.

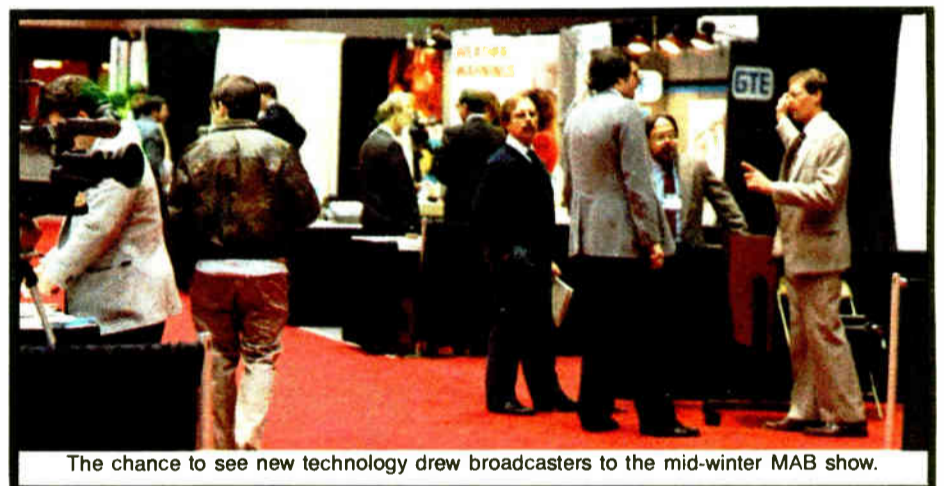
"They (WBBM and CBS engineers) decided to pull FMX for the time being until they test it out," she said. "As soon as this is resolved they will put it back on the air at the station."

CBS has four other stations on-air with FMX and plans to convert all of its 11 FMs to FMX.

Broadcast Technology Partners (BTP) officials said the problems at WBBM are not related to the Bose/MIT study. Engineering VP Tom Rucktenwald said BTP engineers are working with WBBM to

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## MAB Highlights Future Tech



The chance to see new technology drew broadcasters to the mid-winter MAB show.

**Lansing MI** From the opening laser light show and demonstration of tomorrow's technology today the stage was set as 127 broadcast engineers joined 250

broadcasters for the Third Annual Michigan Association of Broadcasters/SBE Chapter #91 Mid-Winter Convention and Broadcast Exposition 6-7 February.

The marriage of a state broadcasters association and SBE chapter for a joint conference/exhibition is unusual, but the results speak for themselves, according to MAB Executive Director Karole White, who said this year's attendance exceeded last year's by 300%.

The theme was "Technology—the challenge of the 90's" and a look at emerging technologies included demonstrations of DAT, graphic design workstations and digital audio workstations.

The engineering portion, chaired by Larry Estlack of SBE Chapter 91, of the program included two days of seminars.

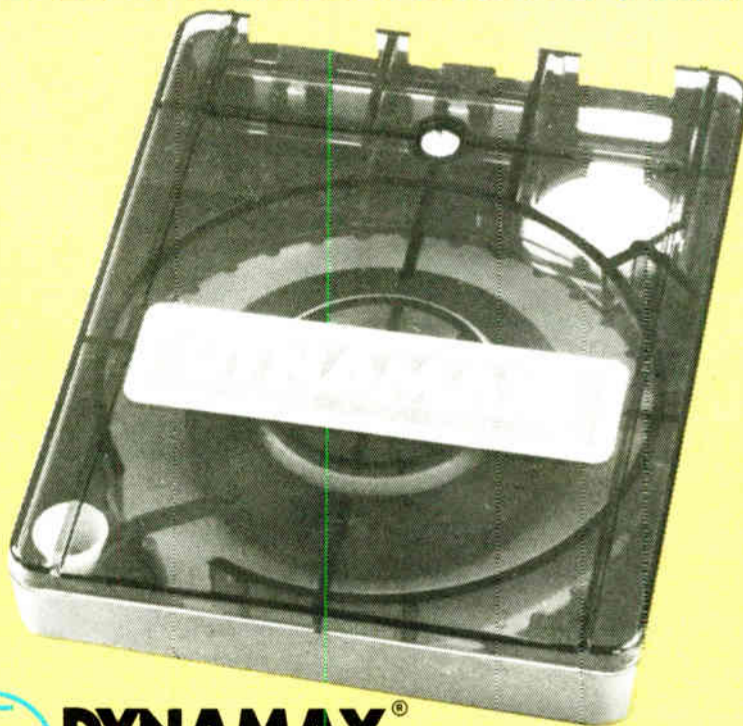
Topics ranged from "Circuit Concepts for High Performance Broadcast Audio" to a presentation of Walter Jung of "Op Amp Cookbook" fame of an update on the FMH signal improvement system.

Thomas Keller of Broadcast Technology Partners talked about the FMX system and there was also a demonstration of the Dyaxis Digital Audio Workstation.

In addition, attendees strolled the aisles of the Lansing Center and visited manufacturers, vendors and users at booths covering the entire spectrum of broadcast technology from transmitter hardware to electronic newsroom software.

(continued on page 3)

## DYNAMAX DELIVERS



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## NEWS BRIEFS

### AMers Still Get Preference

**Washington DC** The FCC issued a declaratory ruling clarifying that, regardless of channel type, preference for FM allotments will still be given to former AM daytimers which have been granted secondary status authorization to operate at night.

The action grants a request by Newsic Inc., licensee of daytime-

only WRWH-AM, Cleveland, GA, for clarification of issues on actions taken in 1987.

At that time, the FCC authorized nighttime operations on regional channels for former daytime-only stations, reduced when necessary to avoid interference, and imposed secondary-service status on the nighttime operations of former daytimers operating with less than 250 W nighttime power on those

channels.

The Commission, however, declined to address issues relating to the daytimer preference on FM allotments, concluding that those issues were beyond the scope of the proceeding.

Newsic asked the FCC to rule on whether former regional channel daytime-only stations which received nighttime authorization at a power level below 250 W will remain eligible, if they meet other established criteria for the special comparative credit granted in Docket 84-231 to former AM daytimers competing in comparative hear-

ings for new FMs.

In response, the Commission ruled that channel type was not a factor in determining eligibility for the daytimer preference when a daytimer subsequently receives a nighttime authorization.

The FCC concluded that former daytimers operating at night with an authorization of less than 250 W and not producing an effective field strength of 141 mV/m, or greater, at a distance of 1 kilometer from their transmitter sites, will be considered daytime-only licensees for purposes of determining eligibility for the daytimer preference,

regardless of the channel on which they operate.

### Short-Spaced FMs

**Washington DC** As of mid-February, the text of FCC action authorizing limited short-spaced FM stations by using directional antennas was expected "any day," according to an FCC official.

The staff had finished the report and order and was waiting on Commissioner James Quello to prepare a statement he had wanted to attach to the document. Quello dissented in part on the action that permits limited short-spacing of FM by using directional antennas.

The NAB has promised to file a petition for reconsideration due to its long-standing opposition to the move.

### Going Far East

**Washington DC** NAB Science and Technology VP Michael Rau was among a US delegation in Japan during February observing advanced television developments. But Rau also said he was going to work in appointments for some radio issues.

He said he would meet with representatives of the EIAJ, the Japanese version of the Electronic Industries Association, and representatives of Broadcast Technology Association about NRSC developments.

Now that the NRSC preemphasis standard is used voluntarily by some radio stations and a proceeding is before the FCC to make it mandatory, the industry is encouraging radio manufacturers to build AM radios capable of receiving the improved transmission.

Rau also said he would talk with manufacturers about a certification mark to recognize new and improved AM radios that incorporate NRSC and AM stereo.

# WHY DIDN'T SOMEONE THINK OF THIS BEFORE?

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# State Licensing the Focus of MAB Panel

by Geary Morrill

**Lansing MI** Is a Broadcast Engineer an Engineer? That question was addressed recently at a panel session at the 3rd Annual MAB/SBE #91 Conference held here 6-7 February.



John Ronayne moderated and John F.X. Browne; Harold Ball; Bob Von Buhler and E. Harold Munn joined in a lively discussion of licensing of engineers.

group with an offer to "bring the peace pipe to the table" on behalf of the Michigan SPE. He said "the MSPE is not at war with the SBE."

Ball also said that use of the term "engineer" was not the only thing that his organization was out to resolve, although he admitted that one of the long term goals is to dissuade the use of the term by individuals and firms except as permitted by state registration laws.

While results were inconclusive, some light was shed on a question that could affect every person engaged in the technical side of broadcasting.

The panel was moderated by John Ronayne III, of the law firm of Kasaboriski, Ronayne & Flaska, legal counsel for the Michigan Association of Broadcasters.

Harold Ball, Executive Director of the Michigan Society of Professional Engineers, opened his comments to the

He indicated that the National Society of Professional Engineers would use legal action where necessary to enforce its goals and is concerned especially about SBE's Professional Broadcast Engineering Certification program.

Ball said the organization doesn't have

as much concern with the full time employment of an engineer at a broadcast facility but indicated that the contract broadcast engineering picture was a grey area that "may require interpretation by the Attorney General."

## SBE's position

Robert Von Buhler, Vice President, Society of Broadcast Engineers/National, indicated that his concerns on this matter were prompted by "an alarm bell" from the National Association of Radio and Telecommunications Engineers (NARTE) that "PEs were putting the squeeze on Telecommunications Engineers all over the country."

Von Buhler said SBE National separates itself from association with NARTE on this matter while the society continues to investigate the issue.

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The MAB panel on state licensing drew attendee interest.

# MAB Show

(continued from page 1)

One of the hottest sessions at the seminars was a panel discussion entitled "Is a Broadcast Engineer an Engineer?" (See separate article, this issue).

Since it's still unclear how proposed legislation initiatives will affect thousands of broadcast engineers nationwide, there was great interest shown by all attendees.

The hit of the conference was a "Beer and Bull Session" held on Monday evening.

Here, attendees were able to grab subs and sandwiches (courtesy of Michigan Bell and GTE Michigan) and meet with presenters in informal groups to discuss presentations more in-depth, or to get answers for problems at their own facilities.

The topic tables were staffed by presenters from the management and technical sessions.

Plans for next year's joint conference include an expansion of broadcast software topics and software equipment exhibitors to showcase this highly important and rapidly expanding facet of the industry.

Additional information on next years conference can be obtained from Karole White at MAB (517) 484-7444 or Larry Estlack of SBE #91 at 517-484-7747.

—Geary Morrill

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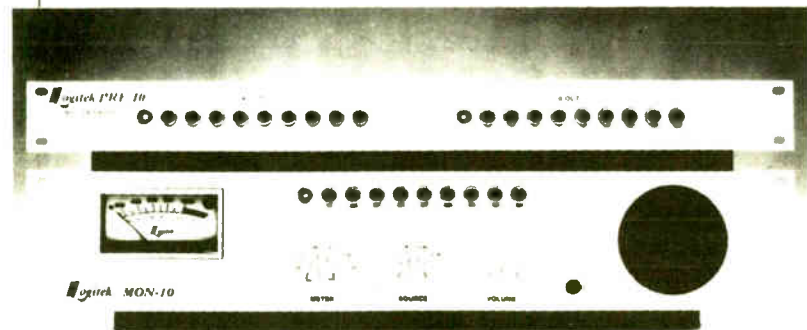


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# No Room At The Inn In Vegas

by Judith Gross

**Falls Church VA** Hate to be the one to break this to you, but if you're going to the NAB convention, which is late this year by the way (end of April), you may find you've been assigned to a room oh, let's say, out in Colorado somewhere.

No kidding, exhibitors are reporting a real room shortage, but it isn't NAB's fault. Seems the Las Vegas Convention and Visitors folks have been less than cooperative.

Apparently travel and wholesale people book large blocks of rooms and pay for them, regardless of whether or not they end up filling them with poor souls who wish to become even poorer by spending their time in the casinos and such.

NAB is telling convention-goers that they may have an easier time booking Vegas accommodations through their travel agents, rather than the association.

Stay tuned to upcoming issues of RW ... we'll keep you posted on the latest.

Oh, and you can probably forget about that suite at the Hilton, unless you're thinking of the Albuquerque Hilton.

Speaking of NAB, things might get a little tricky, now that there's a controversy brewing in the industry over FMX. Remember that NAB is a partner in Broadcast Technology Partners, which is promoting and marketing the noise reduction system for FM stations.

NAB is a minor partner through its "for-profit" subsidiary, NAB Technologies.

Now it already grates on the nerves of some industry entrepreneurs that NAB is trying to enter the marketplace with an interest in a product that many feel rightfully belongs firmly in the hands of private industry.

And let's not even worry about the fact that NAB's own weekly "newsletter" to stations only gave the BTP side of the

Bose/MIT controversy over FMX.

Now, at the NRSC's technical subgroup on FM, which is supposed to talk about technical issues relating to FM, BTP representatives were welcomed to give their criticism of the Bose study math, but neither Dr. Bose nor William Short, who worked on the study's calculations, were



invited in the interest of fairness.

No wonder the subgroup's attendees were reluctant to discuss this sticky wicket. In fact, even though the NRSC is a group convened by both the EIA and the NAB, the whole incident calls into question how independent the subgroup can be when its activities are heavily coordinated, and its meeting space is provided, by none other than NAB.

We said it before. What's needed to clear this whole mess up is a truly independent industry group to do its own research on the pros and cons of FMX. Otherwise, the spectre of AM stereo will come back to haunt us all.

☆☆☆

Just one more teeny-weeny little observation on this state licensing brouhaha. Why is it that a lot of the people calling

the whole thing a "tempest in a teapot" are already licensed PEs (nothing personal)?

It's clearly not a black and white issue, but it has caused a lot of concern, especially among contract engineers, so why do some prominent industry groups (not to mention any acronyms, but there are several) seem like they have to be dragged kicking and screaming into addressing this issue?

On another controversy, what's all this fuss over the fact that many, many radio stations were instrumental in helping defeat the Congressional pay raise?

Whether you like the end result or not, it was pretty dynamic that so many on-

in my life!"

Okay, now Henry Engineering is saving up for the prize for the 10,000th Matchbox customer. That lucky person will receive \$1,000. Okay, Hank, we're getting the hang of this. Let's see you divide by ten ...

☆☆☆

We told you, but you weren't listening.

We told you a few issues back that Radio World was changing its publication dates in anticipation of our new look. So how come so many of you called to find out if we were running late?

From here on in, just check the box on this page and you'll know when to expect your next issue. Still twice a month ... just a little more timely, that's all.

By now most of you have seen our first RW Annual, our directory issue chock-full of product and company info and glimpses into the future.

A couple of footnotes on my "Dubious Achievement Awards." First, I gave a real achievement to BTP for its work on FMX. Well, I'm still giving BTP an award, not so much for the technical aspects of the system, which are apparently still being debated.

But they keep the real achievement award for diligence in getting marketplace acceptance, getting receiver manufacturers support and also for the FMX logo, which I still think is nifty.

And I also noted that there weren't any really tasteless station promotions to give a dubious achievement award to this year.

But wait. I took a look at the real Dubious Achievement Awards, the ones that appear in Esquire magazine at the beginning of each year.

And lo and behold, here was one of their awards to Utah station KJQ, or rather, to Jenise Merrill, the Ogden woman who won a trip to California from the station.

To win it, according to Esquire, Merrill sat in a raft with two rats and three mice and let people throw chicken gizzards and creamed corn at her and got a bucket of liquid cow manure poured over her head.

The magazine gave its award to Merrill, but I'm giving a belated one of my own dubious achievement awards to both listener and station.

Hey, Jenise, California is not that far from Utah ...

A Groundhog Day party I went to across the Potomac in DC brought me face to face with folks from the transportation industry.

I became acquainted with one well-known fellow, a John Ingram who was apparently a prominent figure in the railroad industry under the Nixon administration.

When he heard about RW, he said, "Hey my brother used to be in radio." He was talking about none other than the Dan Ingram of 77-WABC of the 1960s. Used to? I guess Big Dan's been pretty quiet lately, Kimosabe.

But it just goes to show, I can't get away from the power of radio anywhere (not that I'd want to). And may its force be with you, too.

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.



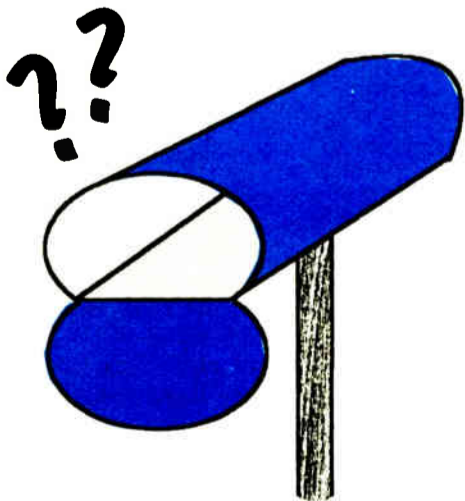
The 5000th Matchbox customer

air personalities got listeners rallied enough to send those tea bags in as protests. Ah, the force of radio ...

And the winner is ... Henry Engineering got its winner of the \$500 president Hank Landsberg decided to award to the 5000th Matchbox customer (guess \$5000 was a little too steep for you, huh Hank?).

Shown in the photo which Hank required as proof is Jim Tardi, who owns AGV Corporate Video in Floral Park, NY. Jim bought his Matchbox through Allied, and he says "Gee, I never won anything

## Where's My Radio World?



You may have noticed that we're arriving at different times during each month than you're used to.

Radio World has changed its publication dates so we can keep you up to date on the latest industry happenings.

We're still twice a month; but watch this space each issue so you know when to expect your next information-packed copy of RW.

And thanks for asking. It's nice to be wanted.

Look for your next RW March 22nd!

# Encourage Creative Production "Rats"

by Alan Peterson

**Syracuse NY** There are times when I wonder if Ty Ford and I were twin brothers separated at birth. He and I definitely speak the same language when it comes to contemporary radio production.

In his writings (*Production Rat Discovers MIDI* RW 15 January) you see a visionary who knows the potential of new recording and music technology as it applies to the broadcast environ.

I thought I saw it coming with the advent of the modular Moog units around 1968-69, but what's happening now exceeds everything I thought possible.

Are Ty and I alone? Heck no. I salute the gangs at WABB, Mobile, AL for pulling out all the steps and going full-blown MIDI; WTIC Hartford, CT, for a marvelous multitrack facility, KIIS-FM in Los Angeles for its Synclavier system.

Even my own WHEN Syracuse saw the future quite a few years back when the station shelled out the bucks for the quintessential Harmonizer, reverb tank and (gasp!) MiniMoog.

May I add this was done while all of these units were staples of recording studios only. Even today our producers turn out work which is second to nobody.

I'll tell you what would delight me more than a whole tide of Ty Fords, Al Petersons, Synclaviers et al descending on the production rooms of the USA (oops... make that "audio workstations of the USA"... better get used to that).

How about a tide of owners and GMs who demand, expect and welcome the innovations these new technologies bring? How about OMs and PDs who place the demands of "make me some-

thing that sounds like *this*" on their creative people?

## Why it isn't done

Ever hear of the NICORI principle? More than anything else, NICORI has kept new production tools away from the producers who desire (and need) them.

NICORI is my own acronym and stands for Nobody Is Capable Of Running It.

Case in point: the guys crosstown get the new MegaMutant PS-1000 Processing thingie which makes their production run sonic circles around your station.

You looked at it, you know you can afford it or at least trade with the music store that has it. So how come you haven't got one? Need I say it? Somebody along the line decided "Nobody here would know how to work the darn thing."

So you're stuck with the brochure for it, the producers are still flanging with their thumbs and the crosstown station is cranking out the greatest stuff you've ever heard.

Do I sound bitter? I'll admit the station I work for provides our production people with some great electronic toys (they're in the fifth paragraph).

We're set up so that what we don't own can be patched in line when the project demands it. I'm always bringing bits and pieces of my home studio into work just to get "that" sound.

Not everybody is as fortunate, and for those of you reading this who aren't my heart goes out to you.

You who crank out those spots and promos on gear that a hungry high school carrier-current station would junk. In fact, how many of those high school students have their own dresser-top "studio" with better production toys than you'll ever see? Especially those who are musically-inclined and work daily with the stuff?

Don't laugh; I gave such a kid a tour at a Massachusetts station I worked at. Rotten kid laughed at the gear and left.

## Advice for the future

PDs, OMs and GMs alike: please don't let the NICORI principle guide you. If you've got any musicians on your staff, ask them to bring in some of their gear.

New sounds, techniques and effects that can set you apart now from everybody else is available at amazingly low cost. A digital reverb with 64 different "rooms" costs hundreds less than the old one-sound spring-in-a-box special.

Patch a mic into a Yamaha SPX 90II or an Eventide UltraHarmonizer H3000B. Poke a button or two on an Ensoniq EPS. These are the tools you'll be a-wantin' heading into the 1990s.

Ty was being kind writing his story the way he did. The fact is you've got to hear these new tools and make a serious commitment to the sound you want and what your producers can give you. Forget NICORI; nobody can perform an angioplasty either, until they learn how.

I don't think my "long lost twin" Ty

(continued on page 12)

## GUEST EDITORIAL

The EPA's investigation of a company that sold PCB capacitors to a trusting engineer brings to light the confusion surrounding correct handling of this hazardous material.

Most station CEs and GMs are aware some action is necessary if the contaminant is present in transmitting equipment, but regulations vary from state to state.

Even the EPA's guidelines are occasionally murky, and rumors and word-of-mouth inaccuracies cloud the situation further.

In the past few months since labeling and/or disposal of PCBs have been required, several things have become clear. First, the EPA will fine stations when PCBs have been mishandled, as it did with Texas station KLBJ.

# Matter of Ethics

Another is that there is a chance some unscrupulous individual may take advantage of the confusion to turn a profit.

Now more than ever, stations need to rely on their technical staffs to come to the rescue. Full-

time and contract engineers should avail themselves of the information and resources that exist and become familiar with the regulations involving the handling of PCBs.

The EPA and the NAB especially have gone the extra mile in assembling information and are eager to advise stations on what needs to be done to label and dispose of the contaminant correctly.

The NAB also has suggestions for cost effective ways this can be accomplished, and local EPA offices can also help.

Engineers should put aside their stations' usual competitiveness and work together to create a safe environment for their communities.

An understanding of the regulations and some careful follow through are what's called for when it comes to taking care of PCBs.

It's more than just the law; it's also a matter of ethics.

—RW

## READERS FORUM

If you have comments for *Radio World*, call us at 800-336-3045 or send a letter to Readers' Forum (Radio World, Box 1214, Falls Church VA 22041 or MCI Mailbox #302-7776). All letters received become the property of Radio World, to be used at our discretion and as space permits.

### WLW info incorrect

Dear RW:

Since there is more radio history in the Mason, OH area than anywhere else in the United States (perhaps the world), I was dismayed to read a statement in your 1 January issue.

To wit: "We have all heard that WLW in Cincinnati was the first 500 kW powerhouse. Not so, says a friend of mine. The 500 kW was only an experimental license, used the call of W8XO and was used only during the experimental hours after midnight. If there is factual data to contradict this statement let it come." (*Old Timer*)

No one has ever had to question "experimental." WLW would still be 500,000 watts with a permanent license. How-

ever, when it comes to call letters and hours of operation, there is factual data to prove that from April 17, 1934 to March 1, 1939, WLW was authorized by the Federal Communications Commission to operate experimentally with 500 kW power during the regular broadcast day.

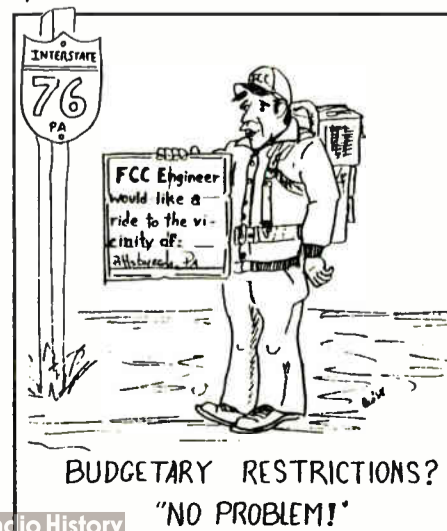
Evidence of an unimpeachable nature comes directly from the archives of the Federal Communications Commission. Page 25 of the FCC's first annual report for the fiscal year of 1935, states "on April 17, 1934, the Federal Radio Commission granted station WLW, Cincinnati, Ohio, which operates on the clear channel frequency of 700 kilocycles, special temporary experimental authority to increase power from 50 to 500 kilowatts during the broadcast hours of operation."

It is interesting to note that during 1936, the FCC ran its own survey in which it determined that WLW was the number one listened to station in 13 states and was the second most listened to radio station in six other states. Seventy-six newspapers from Texas to Connecticut carried complete WLW program listings.

Since interference levels were at an all time low, daytime listeners from Honolulu were not an uncommon occurrence. It was the powerhouse! With all of this unimpeachable documentary evidence. I do hope that you will see fit to clear the name of the greatest radio station that ever lived. (Still a dominant midwest force).

Dave Burns, National Marketing Director  
Allied Broadcast Equipment  
Richmond, IN

by Trenton Williams



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# The CD Single-Play Solution

## Denon DN-950F CD Cart Player

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— **Dick Byrd, C.E., WZGC, Atlanta, GA** "We switched to classic rock on January 3. Since then our 4 DN-950Fs have been running 24 hours a day without a problem. Response from the DJs has been very positive. The music sensing is very tight, and the end-of-message tone is very helpful. We set it for 20 seconds from the end, so it keeps us from getting fooled by all the false endings on those classic rock cuts."

— **Mac Wiley, C.E., WRFX, Charlotte, NC** "We're an AOR Classic Rock station, about 96% CD on the air. Since last October, we've had 2

CD Cart Players in our on-air room and one in each of our production rooms. Problems? We've hardly had any at all. I did have one chip fail, but Denon sent me replacements via overnight delivery. The unit was back in service the next day."

— **James Boyd, C.E., KMJK, Portland, OR** "We've had 3 CD Cart Players in our on-air control room for about a year, and we've had good luck with them. The operators find them very convenient, and the reliability has been better than the other players we tried. Denon's and Allied's support is excellent."

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# Company Sells PCB Capacitors

(continued from page 1)

substance is ingested or inhaled in a vapor. The vapor is most dangerous when it leaks out of an electronic component during a fire.

The EPA requires that leaking electronics parts containing PCBs be removed from radio stations by a hazardous materials handler and disposed of under EPA guidelines.

Stations are allowed to continue using non-leaking capacitors and transformers if they and the equipment are marked with a warning label. Stations also must notify local fire departments that PCB transformers are on the premises and keep a log of self-conducted quarterly inspections.

Capacitors with less than three pounds of PCBs are not subject to any of these warning conditions, except a requirement to label the equipment they are used in with the statement, "This equipment contains PCBs."

If they do leak, the capacitors should be disposed of according to EPA regulations.

## Better safe than sorry

The CE's problems with these PCB capacitors began in January.

Knowing the potential danger of PCBs, even though capacitors at his stations were not leaking, he decided to replace the old ones used in the power supplies.

In recalling his transaction with Universal Capacitor, the CE said he called the company and was told by the salesman that the company could get him non-PCB replacements for his GE capacitors. The salesman never stipulated whether they were new or used, the CE maintained.

The salesman did say "all the capacitors we sell are non-PCBs," the CE recalled.

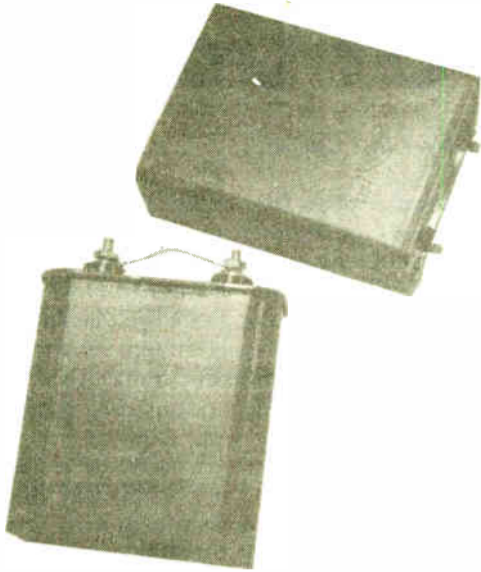
The CE said the salesman assured him the company had a good source for radio-compatible capacitors and that Universal Capacitor sold them to radio stations all the time. The CE added that the salesman even offered to establish a credit line.

## Suspicious replacements

After a few days, the CE took delivery of the capacitors and right away, his suspicion was aroused, he said. The capacitors looked like his old ones and the brand and serial numbers were very similar, he said.

The CE noted that the capacitors looked "banged up" like they had been moved several times, but the posts looked as if they had not been soldered, which indicated to him they were new.

Following his suspicion, the CE said he called the GE toll-free number to find



Top: Old capacitor containing PCBs recently sold to a station. Bottom: Similar capacitor, but with no PCBs.

out about the capacitors, since there were no labels indicating that they were non-PCB. Other capacitors he has since purchased from another company have

such labels, he added.

The CE said a GE spokesman told him the new capacitors, Cat. 22F17, 48F11-62-03, CP7B1FG1066K, were at least 20 years old and that Universal Capacitor did not have an exemption to sell them.

After confirming with GE that the new capacitors contained PCBs, the CE contacted the EPA.

## Wrong capacitors

The CE said he also called back Universal Capacitor and told "Mike" what he found out about the capacitors. He said Mike responded by accusing him of giving him the wrong number when ordering the capacitors.

The CE said he doubted the salesman's assertion because the capacitors' values, which he measured, were the correct ones for his power supplies.

Mike then promised to check into the situation and call the CE back, the CE said. He added that his dilemma at that point centered around uncertainty over

whether the capacitors could be shipped out of the station without violating EPA rules about PCBs. To his surprise, the CE subsequently found out that they could (see related story).

Two more weeks passed and the salesman finally called the CE, to tell him that Universal Capacitor would send a prepaid delivery service to pick up the PCB capacitors and take them off his hands.

The truck was sent, but the CE decided to hold on to the new capacitors until the confusion was cleared up with the EPA.

The CE said it is possible other CEs are being deceived if the company is selling PCB-filled capacitors as non-PCB capacitors.

Many radio station engineers and owners, he continued, are confused about what stations should do with non-leaking PCB-filled capacitors and transformers, and the confusion seems to be responsible for the problems he and others may have experienced.

For information from the Environmental Protection Agency, contact Lisa Nichols at 215-597-6666.

## PCB Rules Cause Confusion

by John Gatski

**Washington DC** The cancer-causing hazards of PCBs, polychlorinated biphenyls, have been publicized for more than ten years, but some radio station engineers and owners remain confused on just what to do with their old PCB-filled transformers or capacitors.

Actions have ranged from prompt removal of leaking and non-leaking PCB components to total disregard—due to uncertainty—for Environmental Protection Agency (EPA) procedures.

An inappropriate response by a station can mean clean-up costs of several thousand dollars for its owner or owners.

Although non-leaking, PCB-electrical components can continue to be

used if stations adhere to EPA guidelines, EPA and NAB officials said there is a moral imperative to rid stations of the potentially hazardous material to avoid future problems and perhaps an expensive clean-up.

"As soon as they (station owners) can, they should go through the procedures so they won't have to worry about the hazard anymore," said Ralph Justus, director of engineering/regulatory and international affairs for the NAB's Science & Technology department.

## Cost vs. hazard

Justus said that station owners have to weigh the economic aspects of purchasing new, non-PCB components and paying for disposal of the old ones before trouble develops, or contend with future liability costs if someone is harmed by a leak or a fire.

PCB components have been manufac-

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tured since the 1930s with a variety of trade names indicating their presence. If one of the following names is not on a capacitor or transformer it is still likely the component contains PCBs if manufactured prior to 1979. Components manufactured after 1979 must have a label indicating they are non-PCB.

(continued on page 14)

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## National Religious Broadcasters '89 Media Expo in DC

On display from Radio Systems was the Rs DAT, a digital audio tape player modified for broadcast use. ▼



Broadcast Electronics drew religious stationowners' interest at its busy booth. ▲

QEI showed its line of transmitters and Comrex featured its frequency extenders for telephone lines. ►



▼ Dataworld (far left) HM Electronics and Fidelipac (across aisle) were equipment vendors who shared the exhibit hall with more than 200 technical and non-technical exhibitors.



# Shift of Community Of License Favored

by Alan Carter

**Washington DC** Broadcasters and interest groups gave conditional support, with at least one noting opposition, to an FCC proposal that would allow FMs or TV stations to upgrade their facilities to a higher class, adjacent or co-channel frequency in a different community of license without facing competing applications.

The proposal, under docket MM 88-526, came from a petition filed by the Christian Voice of Central Ohio. The broadcaster sought the action when it unsuccessfully attempted to move its WCVZ-FM, Zanesville, OH, a short distance to South Zanesville to upgrade from Class A status to B-1 and avoid spacing constraints. Denied because rules would not allow a change without facing competing applications, the owner sought to have the rules re-examined.

In comments filed with the FCC, the NAB supported the idea as long as any change allows for "a fair, efficient and equitable distribution" of radio service, as required by the Communications Act, and the new allotment is mutually exclusive with the existing allotment.

### Guard against interference

"Permitting stations to upgrade their facilities when such upgrades will not

cause additional interference is an appropriate regulatory function and is clearly in the public interest," NAB stated.

Press Broadcasting also supported the proposal but was concerned that broadcasters seeking the change maintain service to their original communities of license.

Rather than tie any rule amendment to the allocations standard, the FCC should require the station to continue providing a minimum of a 60 dBu signal (or Grade A signal in the case of TV) to the community losing the allocation, Press argued.

"This would ensure that quality service will continue to be provided to the community losing the allocation, but would provide more flexibility to stations interested in upgrading facilities by a change in their city of license," Press stated.

### Maintain existing service

Cox Broadcasting addressed the same concern as Press, urging the FCC to implement some restraint by requiring licensees seeking an upgrade to maintain a given signal strength over the original community of license, even though a new community of license is selected.

"The Commission must act to prevent

(continued on page 12)

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# Digital Radio Offered Via Cable

By John Gatski

**New York NY** Although several radio services have failed more often than not on TV cable, several new digital entries, including Digital Music Network's CD/8, will soon be tested in some US markets.

Developed by International Cable Casting Technologies, Inc. (ICT), the CD/8 service will broadcast eight different channels of commercial-free, uninterrupted digital music of varying formats from classical to country.

The service will debut in Las Vegas this spring and the company hopes to expand to 30 cities.

It will include a pay-per-listen service for album listening, an optional video device that lists the title of the song and artist and home computer access to 64 services such as the Dow Jones stock ticker.

The key to the system, according to ICT, is the patented Digital Modulation technology. The Digital Music Channel will broadcast using broadcast satellite technology and digital compression, resulting in an undisturbed digital signal to the cable head ends.

## Radio: a cable premium

The cable companies would distribute the signal via a special tuner to the home subscribers, just like HBO or Showtime, who will pay \$7.95 per month service fee.

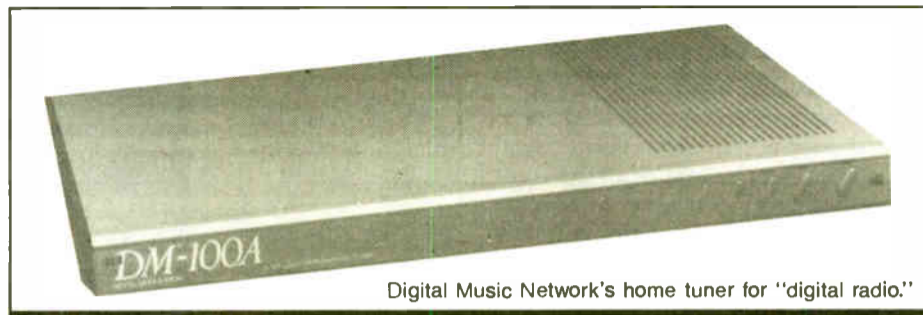
ICT contends that normal FM radio and cable TV sound is broadcast on FM, which limits frequency response (20 Hz-15,000 kHz), stereo separation and dynamic range, when compared to digital music.

Digital radio will sound as good as a CD player with a frequency response of 20 Hz-20 kHz, 100 dB of stereo separation, 100 dB SNR, according to the company's technical data.

Digital Modulation consists of an encoding/decoding process via compression to the satellite. The signal is then beamed to the cable headend, which

distributes it on a normal 6 MHz cable TV channel to the home.

The signal is input through the normal cable with a splitter taking the audio portion to the 16 bit, DM-100A special home tuner, which decodes the signal and converts it to listenable sound. The tuner must be purchased separately (no price



Digital Music Network's home tuner for "digital radio."

given) and will connect to any stereo with high output auxiliary jacks.

ICT technicians believe the digital signal to the satellite and to the home allows for virtually no signal degradation during the transmission.

The Digital Modulation system, ICT boasts, does not lose any of the original signal because all the digital information remains intact from the source at CD/8 to the cable subscriber's stereo.

With the CD/8 system there is no multipath or other interference that normal radio listeners face that can degrade standard FM signals, according to ICT.

Conventional radio signals, even when the source is CD or DAT, become analog as soon as they are transmitted, but the CD/8 signal remains digital until it is processed through the tuner where it is converted to analog.

## Other companies

Similar digital radio systems for cable are also getting ready for test in the market.

General Instrument's Jerold division is now testing Digital Cable Radio in Florida and California. Digital Radio Labs is testing a system known as the Digital Radio Channel in Los Angeles.

Digital Cable Radio's system was developed by Dolby Labs and uses an 18 bit encoding/decoding process.

These companies believe a market exists for better quality radio and digital is the way to achieve that quality.

Success in the market, however, is uncertain. Some audio-only services are

still offered by cable companies using analog technology, but others have failed.

Studioline, an audio service that ceased in 1986, was considered a success technically, but the \$200 price tag for the converter box was blamed for the service's lack of acceptance, according to company officials.

## Homes already wired

ICT Chairman of the Board Jerold Rubenstein, former chairman of ABC and United Artists records divisions,

said that the CD/8 system can be very successful because of the 4.5 million U.S. homes that are wired for cable.

An ITC survey said 61% of cable subscribers would like to have digital radio because commercial radio is more suited to car listening than home listening, company officials said.

ITC officials believe that commercial broadcasts of 15-30 minute blocks of music with a talking DJ and commercials may be all right for the car, but not what they perceive as the "picky" home listener who may be more quality conscious because of the advent of the CD.

## Not worth the money

Critics of the digital radio idea believe that most cable subscribers will not be able to tell the difference between current analog and digital audio on cable and that it would therefore not be worth the extra monthly charge and tuner cost.

Most industry watchers are taking a wait-and-see attitude toward cable-fed digital radio.

"It's hard to tell (if it will succeed)," NAB Staff Engineer Stan Salek said.

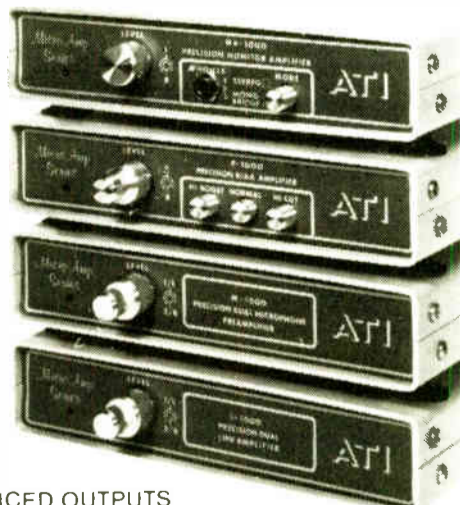
He said the technology is interesting, but the service may only appeal to die-hard audiophiles. The normal cable subscriber may not think the monthly charge is worth it, he added.

"I don't think I would pay an extra eight dollars a month, no matter how good the quality," he said.

For more information, contact Molly Seagrave at ICT, 212-983-3307.

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# Radio Suddenly Hot in Film, TV

by Alan Carter

**Hollywood CA** Noticed how popular radio is with the Hollywood crowd lately?

*Good Morning Vietnam*, which came out in 1987, seems to have started the trend, or at least showed the money-minded here that the medium would make them dollars.

Next came *Talk Radio*, and then, from nowhere, the wheelings and dealings of Harrison Ford, Melanie Griffith and Sissy Spacek in *Working Girl* involved buying a radio network.

It doesn't stop with the silver screen. Radio has popped up in several places on television this season.

*Midnight Caller* is a drama on NBC about ex-cop Jack Killian who became a late-night talk radio host at fictitious KJCM-FM in San Francisco. And over on CBS's *Almost Grown*, Norman Foley is program director on KDOG in Los Angeles.

So, what's all this radio-hype about? "TV's finally learning—they've finally heard where the action is," quipped RKO Radio President Jerry Lyman.

Emmis President Jeff Smulyan, himself the center of some unwanted attention last year when *Cosmopolitan* magazine named him one of the US's most eligible bachelors, was somewhat more serious. "I think the medium is finally

without it?" And each one has an idea on what the new-found attraction is all about.

Perhaps Hollywood has finally recognized the integral and intimate part radio plays in people's day-to-day lives.

Ninety-eight percent of all homes have radios, Walters noted. "Very definitely, radio has an impact on everyone's life."

"It's a very personal medium," Smulyan agreed.

"We've always said, in the busi-

ness, that radio plays an integral part of everyone's life," said Lyman. "I believe that radio is a subconscious medium."

DiLello said. "With an Oprah or a Donahue show, even a Barbara Walters' one-on-one—there's still that lack of intimacy you get from a voice coming out of a little box."

As with the radio executives, DiLello said the radio medium offers a unique forum not found elsewhere.

"I think it has to do with an intimacy between one person talking to another person that you do not get on television,"

DiLello said. "With an Oprah or a Donahue show, even a Barbara Walters' one-on-one—there's still that lack of intimacy you get from a voice coming out of a little box."

DiLello said he thought Oliver Stone, who directed *Talk Radio*, had a "telling

Looking to the (continued on page 12)



Eric Bogosian as controversial talk show host Barry Champlain in Oliver Stone's "Talk Radio."



Gary Cole plays ex-cop-turned-radio-talk show host Jack Killian and Wendy Kilbourne is station owner Devon King on NBC's "Midnight Caller."



In "Working Girl," Melanie Griffith and Harrison Ford play corporate wheeler-dealers about to buy a radio network.

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getting some notoriety."

Bud Walters, president of the Nashville-based Cromwell radio group, said today's society is very high-tech and he thinks the technology of radio fits the image Hollywood is looking to portray.

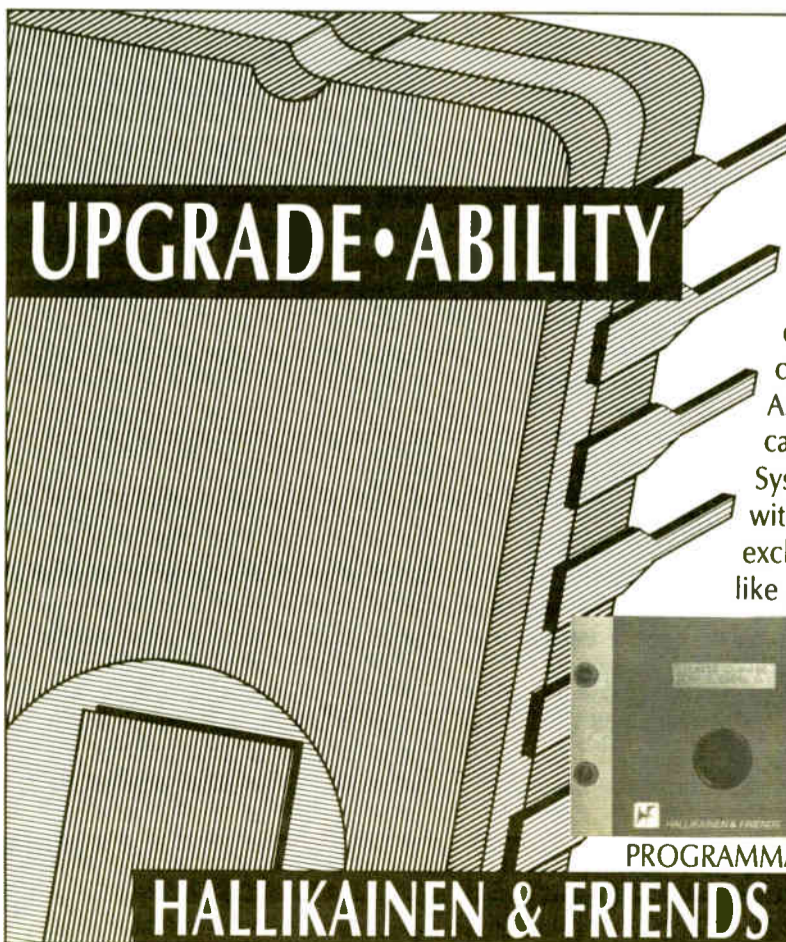
The three radio executives don't see any deep, philosophical meaning to explain the interest of film-makers and television producers in the medium they live.

But all three are active in a NAB-RAB Radio Futures awareness campaign to be launched at this year's NAB convention on the theme "Radio. What would life be

business side,

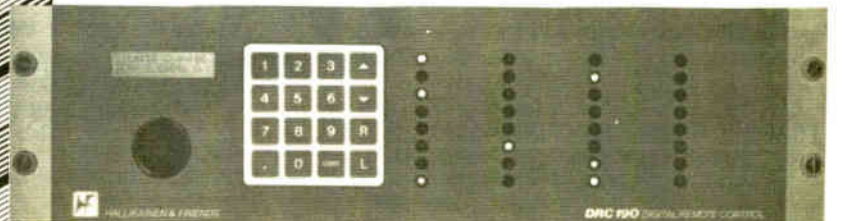
Smulyan noted that radio has received a lot more coverage because of the recent high-price sales. "I think Hollywood mirrors the rest of society," he said. "We get more press and turn up in a lot more places, and they start writing about us."

The creator and



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# Shift for FMs Supported

(continued from page 8) shifts of service towards larger markets at the expense of smaller existing communities of license," Cox wrote.

Strong opposition came from Great American Television and Radio Co., which argued that the proposal conflicted with a 1945 court ruling, *Ashbacker Radio Corp. v. FCC*, that requires competing applications to insure the most qualified applicant for that community is selected.

Great American, however,

suggested the proposal could be amended to correspond with procedures available to AMs in similar situations.

### Allow for competition

Great American suggested that when an existing licensee files a request for a change in the table that would be mutually exclusive with the licensee's own existing allotment, the Commission could issue a public notice proposing to adopt the proposed change.

Simultaneously, it could act to modify the existing station's license if no bona fide expressions of intent were received from parties stating they would file competing applications.

If no one filed a notice, the Commission could then process the application.

But if a party expressed interest in filing a competing application, the existing licensee could continue to pursue its proposal—in the face of opposition—or withdraw, Great

American explained.

In reply comments, the Christian Voice of Central Ohio argued that the proposal did not violate the *Ashbacker* ruling.

The broadcast owner addressed the court case, concluding that the Commission has found the case does not preclude upgrading in the course of an allocation rule making when an existing station seeks to improve its service either on its current channel or on an adjacent frequency.

For information on this rule making, contact Karl Kensinger at the FCC, 202-634-6530.

# Radio Is Now Hip

(continued from page 10)

comment on radio in the movie: *Talk Radio*—It's the last neighborhood left in America."

"That's a very intelligent take on what radio is, and what the new wave of talk show hosts mean to people," DiLello said.

OK. But are TV and the movies presenting radio true-to-life?

DiLello and others working on *Midnight Caller* have made every effort to make the show look as much like radio as they can.

DiLello visited with KGO-AM talk show host Michael Kransy in San Francisco, and set decorator Jim Poynter said the studio for KJCM-FM is old equipment rented from stations. The show bought new mics, the only "working" part of the set.

DiLello admitted the studio is more glamorous than a radio station. But hey, this is Hollywood.

Film makers also seem to be going out of their way to make the movies technically accurate. *Talk Radio* used working equipment from Pacific Recorders and Engineering and from Gentner Electronics.

The real radio executives didn't have much criticism of radio's portrayal.

Smulyan said *Working Girl* presented "an interesting analysis" of the Wall Street side of radio.

Lyman, too, said he finds the movies and TV to portray radio "more accurately" than in the past.

Walters referred to a scene in *Almost Grown* in which Foley gives his teen-age daughter several records and asked what she liked. He put her favorite on the station's playlist. "That might happen in some stations," Walters said, "and in others, it certainly doesn't."

Or does it?

# Creative

(continued from page 5)

would mind greatly if I paraphrase part of his article. Production people can and will have that spark of creative fun again. The line will form at the door and stretch to the coffee room just to use the gear.

Best of all, the returns to the station will be significant, the innovations priceless. The right tools for the '90s are here now, the right people are those creative geniuses laying in wait ... even as you read this.

Open up a rack space, jam in a magic black box, think of Ty and me and let 'em wait.

Al Peterson is *WHEN's* Production Manager, a synthesis/production specialist and incurable juggler. He can be reached at 315-457-6110.

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# MAB Panel Tackles Licensing

(continued from page 3)

SBE has delegated some of the investigative work on the issue to Dane Erickson of the firm of Hammett and Edison, who is a registered PE and member of the SBE Executive Board.

Erickson's findings concluded that "there is no crisis situation" and that the majority of SBE Engineers are "exempt from registration, based upon the exemption provided for employers and manufacturers."

Erickson saw no problems with the apparent "stepping up of enforcement" by the NSPE of state engineering registration requirements and pointed out that "it is not necessary to hold an engineering degree from an accredited institution to become a PE."

He noted that qualifying experience may substitute "when accompanied by successful completion of an eight hour engineering fundamentals examination and an eight hour PE test in any of the about 19 fields of specialization."

Von Buhler argued that employers and could hardly be considered the "general

areas, than the practice of building bridges, or highways or things of that type," said Munn.

He pointed out that many four-year colleges and universities have discontinued their active broadcast telecommunications programs and that puts the requirement for a four-year degree for PEs in a whole new light.

He also noted that while the MSPE has been in existence since 1946, the act that they are supporting that may affect broadcast engineers dates back

a bit further.

Browne added that he felt the problem with the state laws was one of terminology, and not of substance, and stated that he had been appointed to head up a committee of the Association of Federal Communications Consulting Engineers (AF-CCE) "to work on this very problem, because it is getting a lot of press."

Browne stated that the committee has not formed any association position on the matter at the moment, but expected that the issue could be resolved

satisfactorily.

Most participants in the question period which followed keyed in on the area of contract engineering and the terminology used and the liability issues that might occur with use of the term "engineering consultant."

In all, about 70 people were present for the discussion, which is not likely to be the last on the issue.

■ ■ ■

Geary Morril is DE for Midwest Family Stations.

**... the contract broadcast engineering picture was a grey area that "may require interpretation by the Attorney General."**

public, but as part of an educated, specialized industrial elite" sophisticated enough to pass judgement on the credentials of technical personnel.

He also indicated that a proposed policy statement from SBE would be under discussion at the upcoming meeting at the spring NAB convention.

**Difference in terms**

John F.X. Browne, PE, of John F.X. Browne Associates broadcast engineering consultants, said he didn't disagree with any of the statements of Von Buhler and added that GMs and others in the industry recognize the term "chief engineer" or "broadcast engineer" and don't confuse these with engineers in other disciplines.

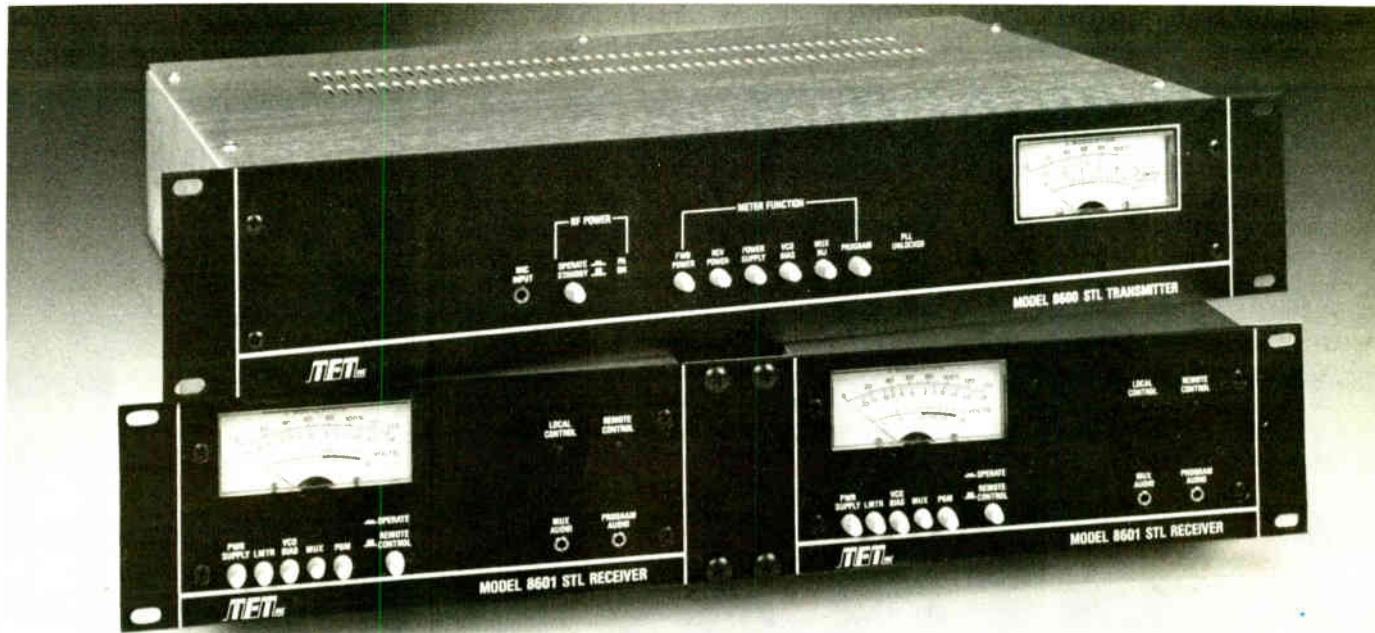
But he said that state agencies may not see the differentiation as clearly and they will ultimately make the decision on usage of the terminology.

Browne went on to state that there are "areas of broadcast engineering that do require professional engineering services ... and certification" and that state laws cover not only health and safety issues but also "welfare of the public—which means everybody."

He suggested that such welfare could be construed to encompass "economic welfare of a client who has sought PE expertise in the design of a broadcast station telecommunications facility and expects to get professional services" as well.

The final panelist, E. Harold Munn Jr., of E. Harold Munn Jr. & Associates, also broadcast engineering consultants, is not a PE. He said, in fact, that his training is in the field of physics.

"I don't claim to be an engineer, I'm a physicist ... and that's more closely aligned to telecommunications, in most



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Photo shows 8600 STL System (Model 8600 Transmitter) as a single link with redundant receivers (Model 8601 x 2)

# PCB Rules Confusing

(continued from page 7)

The following fluid trade names are known to contain PCBs, according to the NAB PCB Alert:

Apirolio, Aroclor, Asbestol, Askarel, Chlorextol, Chlorinol, Clophen, Clorphon, Diaclor, DK, Dykanol, EEC-18, Elemex, Eucarel, Fenclor, Hyvol, Inclor, Inerteen, Kanechlor, No-Flamol, Non-Flammable Liquid, Phenoclor, Pyralene, Pydraul, Pyranol, Pyroclor, Sal-T-Kul, Santotherm FR, Santovac, Solvol, and Therminol.

## What to do

In 1986, the NAB issued a PCB Alert, which contained suggestions to get rid

of PCBs in a cost-effective way and outlined the EPA regulations requiring labeling, reporting and disposal of PCB-filled components.

Among the recommendations, each non-leaking PCB large capacitor (with more than three pounds of PCBs) and transformer (with 500 parts per million or greater PCBs) still in use or stored for disposal must be labeled with a 6"x6" sticker indicating the presence of PCBs.

The equipment (transmitter, power supply, etc.) where the large transformer and any PCB capacitors are located also must be labeled with a sticker stating, "This equipment contains PCBs."

Small capacitors are not required to be

labeled, but the equipment must be labeled with a "This equipment contains PCBs" label and the equipment it's contained in must be located in a restricted access room that has floor and walls that would contain any PCB leak.

Labels can be ordered from Setton Name Plate Corp., P.O. Drawer FD-1331, New Haven, CT, 06505 or by calling 203-488-8059. Another company that produces the labels is Brady Signmark Division, 727 W. Glendale Ave., P.O. Box 571, Milwaukee, WI. The phone number is 414-961-2233.

## Notify fire department

Because of the highly cancerous potential of PCB vapor if burned, stations with any PCB transformers must register them with the local fire department and owners must report any fire involving

PCB equipment to the US Coast Guard National Spill Response Center by calling 800-424-8802 or 202-426-2675 in Washington DC.

Large PCB transformers must be inspected by station personnel every three months and a written log must be kept by the station, subject to inspection by the EPA.

No requirement exists for inspection of small or large capacitors, but the NAB suggests looking over each one whenever transmitter maintenance is completed.

If any PCB-filled component is found to be leaking, it must be contained and cleaned up, according to EPA regulations. Clean-up efforts should begin no later than 48 hours after discovery and disposal of the PCBs should be made by a licensed hazardous waste handler who will take it to a special chemical disposal area. PCBs are not to be discarded at municipal waste sites.

## Remove PCB components

Before old equipment can be discarded, it must be stripped of the PCB components and properly disposed. Don't throw small capacitors in the trash.

The major companies that are licensed for PCB disposal include: General Electric, 800-626-2001 Ext. 25, Westinghouse Electric, 412-937-7140, Environmental Services Co. at 501-223-4160 and Chemical Waste Management Inc., 312-218-1500.

Because it is expensive to dispose of PCBs properly, the NAB and stations that have carried out PCB disposal suggest finding out when waste handlers are making a "milk run," which is a schedule of stops at several stations that are getting rid of PCB components.

With regard to waste handlers, the NAB also suggests stations require the company chosen to handle all paperwork and permits, but keep a copy of paperwork and the contractor's licenses at the station.

For more information about PCBs and their removal/disposal, contact the EPA at 215-597-9904, Ralph Justus of the NAB at 202-429-5341 or Environmental Services Company at 501-223-4160.

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# FCC Hit By Early Retirements

by Alan Carter

**Washington DC** The impact of an early retirement deal offered FCC employees with at least 25 years federal government service undoubtedly was on the minds of agency officials as they waited to see who would leave next.

An early retirement option was one step the Commission took to try and prevent placing employees on unpaid leave as the agency deals with a budget shortfall.

As of mid-February, about 14 employees agencywide had accepted the retirement offer, according to Personnel Operations Branch Chief Michele Cooke. "I don't know how many more are out there."

Employees accepting the offer had until 28 February to give notice and pack.

Among those leaving in the Mass Media Bureau were Wilson LaFollette, assistant chief for international affairs with 29 years experience; Jonathan David, chief of the international negotiations group with 27 years and George Enuton, assistant chief for engineering in the FM Branch with 28 years, according to FCC officials.

At this point, the International Branch seems to be hit the hardest with both LaFollette and David leaving. Also resigning from international, but not under early retirement, is Bill Meintel, a senior staffer for software development.

LaFollette, 49, is joining the Washington consulting firm of Cohen, Dippell and Everest.

LaFollette said he considers the move the same as starting a second career. "After 29 years on the inside looking out, now I can be on the outside looking in," he said.

David said he and Meintel are forming an international consulting firm on legal and engineering representation and a separate software development firm, to be called Datel Corp., that will be located in Arlington.

Enuton said he will be doing consulting work on his own with a special em-

phasis on minority services in the application process.

Several FCC personnel officials noted that losing experienced employees is the downside of early retirement.

Cooke said the number of employees that have notified the Commission they are leaving is spread throughout various departments.

While acknowledging the International Branch will be affected the most, Cooke also said some of the employees retiring are in field activities where manpower levels are limited and the loss of one person will be significant.

Another personnel official, who asked not to be identified, said staff is brainstorming to deal with the losses. "Some

effects may be felt immediately, and some will not," the official said.

Consulting engineers who work closely with Commission activities expressed some concern about the immediate impact the loss of experienced personnel will have.

"We do fear there is going to be a gap in continuity," said Ron Rackley of du Treil, Lundin & Rackley. But he added that there is a normal progression of personnel in agencies such as the FCC. "It

(continued on page 19)

## Active Device Course To Be Offered in RW

**Annandale VA** We live in an era when the best tools a broadcast technician has are often a telephone with an equipment manufacturer's "800" assistance number taped to it, and a file of "air express" mailers.

Too often the basics of electronics have been forgotten, yet these principles are important for an understanding of what is going on in an electronic circuit as well as when creating circuits of your own design.

**Introduction to Active Devices** is a course offering a brief overview of how the basic active devices in electronics operate. A brief review of vacuum tubes will also be presented.

The course is excellent for the in-

dividual who plans to study further in a technical school or community college. It's also a good refresher program for individuals who have studied the basic material in the past.

The course will begin in the 12 April issue of **Radio World** and continue for 12 consecutive issues.

Northern Virginia Community College (NOVA) will offer 1.3 CEUs (continuing education units) for those who complete the class. An examination will be mailed to those who register for the program (see coupon, below).

The fee for this class is \$20. To register, fill out the registration form and mail it *directly to the college* (please do not mail to **Radio World**.)

The course has been prepared by Ed Montgomery, currently an electronics teacher at Thomas A. Edison High School in Fairfax County, VA. He has previously taught broadcast engineering at NOVA and worked as a broadcast engineer for several radio stations.

His last course for **RW** on fundamentals of AM broadcasting was a success. While not mandatory, Montgomery has suggested two possible reference sources for those who take this course.

One is the *Radio Amateur's Handbook* published by the American Radio Relay League and the other is *Electronic Principles and Applications* by Charles A. Shuler, published by McGraw-Hill.

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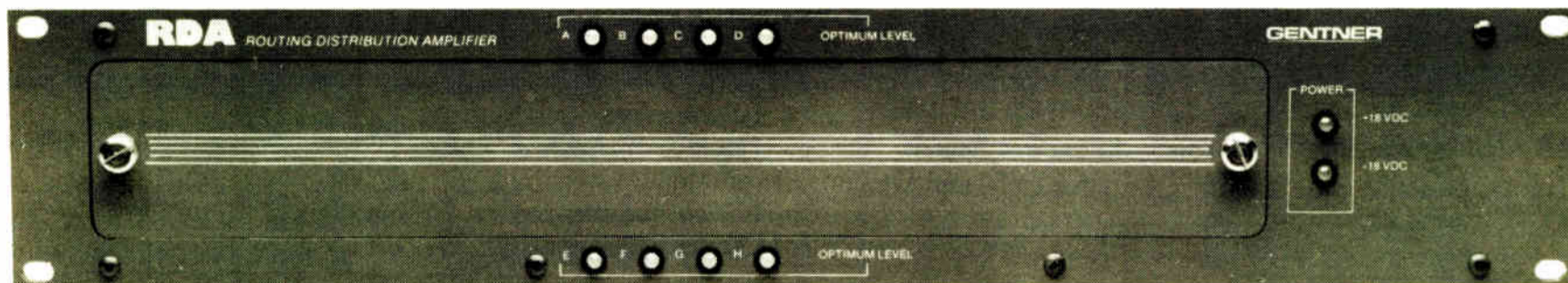
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Enclosed is my check payable to Northern Virginia Community College. I understand that enrollment may be limited and if the course is cancelled for any reason, my check will be refunded in full. For office use: \_\_\_\_\_ SA 91 \_\_\_\_\_ RU 97 \_\_\_\_\_ SD 91 \_\_\_\_\_ RU 98

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# Putting Radio Back On the Air in Haiti

by Serge Beaulieu and Sonda Singer Beaulieu

**Port-au-Prince HAITI** In the mountainous, mysterious, exotic, Caribbean country of Haiti, LS Radio Liberté, a 1-5 kW AM and FM authorized radio station was having technical difficulty reaching its audience in the capital city metropolitan area.

A new operation functioning under the aegis of the US-based Caribbean Network System, the station was also facing the normal start-up financial constraints.

Serge and Sonda Singer Beaulieu, members of the CNS Board of Directors, were unable to find qualified technical people to travel here.

Most of the US engineers contacted for their services responded negatively to the political situation in Haiti and were reluctant to come to the country.

The Radio Liberté transmitter was in

coordinated the mission along with Susan Barr of Murrells Inlet, South Carolina.

On Thursday, 17 November 1988, Bob and Buddy landed at Haiti's international airport in Port-au-Prince and were rushed by car to the Radio Liberté broadcast studios in the heart of the downtown commercial district.

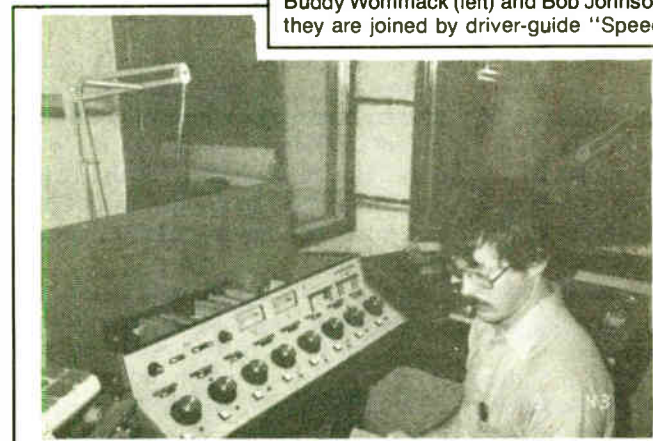
They spent most of their first night fixing a Continental console, which was damaged. An RCA console was found to be irreparable.

### Mountains to climb

The next day, Bob and Buddy drove up to the 2700 foot high tropical wind-swept mountain peak called "Boutilliers" to work on the FM and STL antennas,



Buddy Wommack (left) and Bob Johnson (right) aided Radio Liberte; they are joined by driver-guide "Speedy" (center).



Buddy Wommack, consulting engineer for Radio Liberte

which were having their own problems.

They hooked up the transmitter, which was showing a high SWR condition. The line voltage was extremely low and could not handle the load placed upon it. They realized that another voltage source had to be found. The engineers had to return

to the town to work on the STL unit.

On Saturday, negotiating once again the winding, scenic, mountain road, they returned to Boutilliers. They found that the amplifier had turned itself off because of a combination of high SWR and low line voltage.

Checking all connections in the coax line, they found that one of the connectors had been installed with some parts missing. Buddy Wommack decided they needed to buy a new coax to make the run from transmitter to antenna on a single cable.

This meant going back to town to make the necessary purchase. They also had to find a new electrical connection from another source.

After these snags were taken care of, standing once again on the mountain peak overlooking Port-au-Prince and its harbor, surrounded by a few grazing goats, some curious cows, a couple of strutting roosters and a dog or two, as well as more than 50 Haitian onlookers, Bob and Buddy turned the transmitter on.

Radio Liberté's FM signal was suddenly loud and clear all over the metropolitan capital city area, plus parts of the neighboring Dominican Republic.

Proud of their new "baby," Bob and Buddy were all smiles and Radio

(continued on page 35)

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# Industry Takes Sides On FMX

(continued from page 1)

get the problem corrected.

"It (the FMX problem at WBBM) has nothing to do with what Mr. Bose was talking about," Rucktenwald said.

He said the hiss and noise problems at WBBM are caused by the interaction between the FMX subcarrier and a 57 kHz data paging subcarrier also carried on the station's FM signal.

But Dr. William Short, one of the researchers in the Bose/MIT study said he doubted that WBBM would have problems with noise and distortion without FMX.

"They (subcarriers) would contribute significantly less to the problem than FMX would. Data paging subcarriers typically have 10% modulation while FMX adds 30 to 40% modulation, increasing the likelihood of noise and distortion," said Short.

Several stations in the past few years have reported noise problems—especially under multipath conditions when using FMX, but BTP said the problems have been fixed in the most current equipment. Some stations also have ceased broadcasting with FMX for various technical and non-technical reasons.

## Bose/MIT math flawed?

At an NRSC FM Subcommittee meeting, 15 February, BTP President Emil Torick presented a response to the Bose/MIT report, claiming the mathematical calculations made by Bose

were incorrect.

"Mr. Bose blew the math," said Rucktenwald. "He froze a time-varying function."

Because of the incorrect mathematics, all aspects of the test were flawed including the bench testing, he added.

Short said he had not seen the latest BTP response and was unsure what the company meant by the freezing of a time varying function. However, he said he stands by the math calculations of the Bose/MIT study.

Manufacturers who produce FMX equipment and companies interested in FMX equipment manufacture have said the Bose study has not changed their minds about continuing production.

"I'm not nearly as worried as when it was first going down. It was undertaken apparently to discredit FMX," said Jim Wood, president of Inovonics, currently the only manufacturer of FMX generators.

Woods said the negative research has not hurt sales for the Inovonics FMX generators and requests for generator demonstrations remain strong.

There are about 100 stations now broadcasting with FMX, according to BTP.

Although there has been speculation that Bose Corp. may have a deeper motive other than research for conducting the study, Wood said he was unaware of a competing project on which Bose Corp. may be working.

"It (the Bose/MIT report) is certainly

not anything that is going to affect our judgment," said Howard Mullinack, sales manager for Orban Associates, a company considering whether to manufacture FMX equipment.

"We are not convinced that the people undertaking the research were being objective," he said.

Orban will wait for more independent testing before making a manufacturing decision, he added.

Other companies plan to keep a close eye on the market in the aftermath of the Bose study.

"We are going to wait for the marketplace to decide" before Apex Inc. decides whether to manufacture FMX generators, company President Marvin Caesar said.

Nutmeg Broadcasting President Mike Rice, who prepared a financial impact report on equipping stations with FMX two years ago, said that the Bose/MIT study would have been more credible if it had tested at several stations instead of the station at MIT.

"It could be that Bose is right, but he should have taken a different route," he said.

The Bose/MIT test consisted of mathematical calculations with a multipath simulator and field testing at MIT's FM station. Bose and Short said the station was adequate to make accurate testing.

## Stick with FMX

Broadcasting companies operating FMX-equipped stations, such as CBS and Buckley Broadcasting, said their plans are to continue with FMX.

"I've listened to the thing (FMX broadcasts) very carefully and I haven't heard a problem," said Wayne Mulligan, VP of Engineering for Buckley Broadcasting.

He said five of the nine stations owned by the company are broadcasting with FMX, although none are classical or jazz stations.

According to the Bose/MIT report, the type of format can make a difference in the effectiveness and side effects of FMX.

The FMX quadrature disappears with highly-modulated, compressed FM signals, which are often found in popular format stations rather than classical or jazz formats, according to Bose.

Despite charges that the Bose Corp. is working on an FMX transmission system, company researchers deny the allegation.

Short denied that the Bose Corp. is

(continued on next page)

## From The ALLIED Technical Notebook

The Denon Cart Player® is the most popular machine in all of radio. Many ingenious methods have evolved to interface it with consoles of all types. Henry put them all in one box.

1. The Denon CD player uses 5 volt logic. Many consoles use 12 volts. Connecting the CD player directly to the console could cause lots of damage. LogiConverter solves this problem by isolating the console logic voltage from that of the Denon CD player. "LogiConverter provides double isolation. Opto-isolators on the inputs, and relays on the outputs."
2. Connecting the remote-control circuits of the Denon directly to the console will probably cause a ground loop, because the audio and control grounds will tie together in the console. LogiConverter prevents this from happening, to preserve S/N performance. "LogiConverter eliminates ground loops."
3. Many consoles use logic outputs for remote control. In many cases, a circuit goes "HI" (+12 v) for START. The Denon CD requires a logic LO. LogiConverter eliminates this problem.
4. Some consoles provide only a maintained closure for remote Start. The Denon CD needs a momentary. LogiConverter solves this problem, because it can convert maintained inputs to momentary outputs.
5. Many installations will require both Start and Stop from the console. Most consoles provide start-only outputs. LogiConverter will add the STOP function even if the console doesn't have it. "LogiConverter can be user programmed to add a STOP function even if the console has Start-only outputs."
6. Up to four CD players can be controlled by one LogiConverter, if Start-only operation is desired. (CD stops at end of track automatically.) If Start and Stop is desired, then two CD players can be controlled by one LogiConverter.



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# NAB Radio Finished

by Alan Carter

**Washington DC** After months of frustrating delays, the prototype for NAB's "ultimate radio" is finished.

"It's a fully working prototype," said NAB Science and Technology VP Michael Rau. Among the technical features of this special radio are AM stereo, the NRSC preemphasis standard and FMX for FM stereo extension.

NAB initially premiered the radio, designed by consultant Richard Sequerra, at Radio '88 last fall. But the radio was not finished, with neither the AM portion nor continuous tuning operating.

Rau said the recently finished receiver

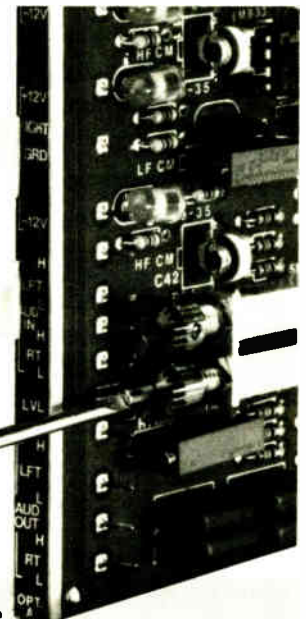
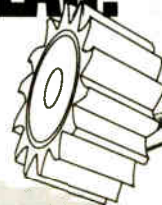
has C-QUAM AM stereo on a board replaceable with multi-system boards which allow for reception of multimode stereo or Kahn ISB stereo reception only. The multi-system boards use a chip developed by Sanyo, available as a sample but never put into general production.

Rau declined to elaborate if he would be searching for a manufacturer to build the radio on a trip to Japan in mid-February during which he would be meeting with representatives on various radio and TV issues. (See separate story in News Briefs.)

For more information contact NAB Science & Technology at 202-429-5346.

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# FMX Battle

(continued from previous page)

working on any potential competing transmission system.

"We definitely have no alternative system to offer," he said.

Short said Bose Corp.'s interest in FM is in receivers, not transmission.

The company collaborates with several automotive stereo manufacturers, such as Acura and Delco, and is looking into ways to improve reception and lower noise in the receivers under existing FM stereo broadcasts, but nothing further, Short explained.

Despite condemnation of the Bose/MIT report, other radio and audio experts concur with its findings.

Leonard Feldman, who conducts and publishes audio equipment test results for various publications including *Audio* magazine, said the Bose/MIT research looks solid.

"If the Bose math is correct, and I have no reason to doubt it, then it would seem that FMX raises problems in the multipath area," he said.

In a letter to Dr. Amar Bose, Ira Willett, a radio engineer and owner of Wilner Associates in Putney, VT, said the Bose/MIT research conclusions were correct about the degrading audio effects of subcarriers under multipath conditions.

"Much of their work confirms my own

observations over the years here in New England where rough terrain makes clean automotive FM reception nearly impossible," Wilner stated.

"I never liked the addition of SCAs and subcarriers up here. I have never been able to fully mitigate the damage done to FM reception by SCAs—especially the 67 kHz subcarrier," he said.

Wilner said that a client is planning to add FMX and he has bench tested the FMX generator that the station is planning to use.

"I was not impressed with the additional artifact that is visible in the traditional butterfly of a stereo composite signal, as viewed on an oscilloscope, with FMX enabled."

BTP said that following the 25 January Bose/MIT press briefing, Bose had made a reference to an unidentified radio com-

pany that "wanted this" research.

In responding, Bose said he was referring to a manufacturer that contacted him in 1981 about problems with subcarriers on FM. He pointed out that the conversation was several years before FMX was created.

Bose said he declined to release the name of the company, because he did not want to involve the company in any litigation that BTP might undertake.

Bose said BTP has already threatened legal action against several members of the research team, but Torick denied the charge.

In other FMX-related news, the FCC confirmed that Bose contacted the agency in December to alert officials about the research and whether the FCC has any guidelines or regulations with regard to FM reception.

Hank Van Deursen, of the FCC Mass Media Bureau, said he had a cordial discussion with Bose and informed him that the FCC had heard of problems with subcarriers, such as FMX, causing noise, but the agency had no regulations regarding the technology.

"I told him 'FMX complies with the way the rules were written,'" he said.

Van Deursen said he told Bose that in the eyes of the FCC, the marketplace decided which technologies succeed or fail.

For more information, contact Bose and Short at 508-879-7330, Emil Torick and Tom Rucktenwald at 203-622-2804, Jim Wood at 408-458-0552, Howard Mullinack at 415-957-1067, Marvin Caesar at 818-765-2212, Helene Blieberg at 212-975-3771, Mike Rice at 203-456-1111 and Wayne Mulligan at 203-661-4307.

# Retirements

(continued from page 9)

seems here that time has been forced a little."



Wally Johnson of Moffet Larson & Johnson said it will take time for the Commission to rebuild the personal relationships that LaFollette and David had established in international negotiations. "A lot depends on relationships built up over several meetings," Johnson said.

Johnson said the FCC has other employees in line for these jobs. But he added, "In the immediate future, it's going to hurt."

The Commission estimated about 170 employees were eligible to retire, based on the plan that is calculated on age and years with the federal government.

The FCC hoped to save between \$500,000 and \$600,000 or "a couple days" of furlough, Cooke said.

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# Make Something From Nothing

by John "Q" Shepler

**Rockford IL** How much does a microphone preamp cost? Quick, check your catalogs. \$70? \$150? \$500? You mean more than \$500?

Fact is, you can pay as much as you like. Several thousand dollars for a power amplifier? No problem. Somebody will sell you one for that price. Just hold out your money.

## Q-TIPS

Now, what if you don't have the money? What if "merger-mania" has dried up your budget? What if your station never had any money to begin with? What do you do when the preamps are \$500 or forget it?

Many people decide that they want something, find out the price, determine that they can't pay that price and forget the whole thing.

Perhaps they decided that what they really needed was one of those \$500 preamps. Actually, they needed something else. What they really needed was a certain function, not a \$500 preamp.

What's the difference? Well, if what you really need is a -55 dBm balanced 150 ohm signal, boosted to -10 dBm at 600 ohms with less than 0.1% distortion over a frequency band of 20 to 20,000 Hz, then all sorts of possibilities open up beyond forking over \$500.

You may want a new Crown amplifier or a Tektronix scope, but you'll settle for

something else. In fact, depending on how you define that something else, you may not have to pay anything at all.

For instance, build the function from what you already have and no money changes hands.

### Something for nothing

The control board has a main mic feeding a stereo input. All of the other inputs are high-level. You need a second mic, but swapping out the circuit boards costs a couple of hundred bucks.

You're running a pencil through your teeth with your feet propped up on the bench, trying to think of alternatives. Here are a few ideas.

You don't really need a stereo mic input for the announcer. One of those preamp cards is going to waste. Put the second card in another channel, and jumper the L and R channels on the pot input.

Careful! If you connect at the wrong place, you'll tie the mixing busses together and convert the board to mono. Perhaps you'll have to add series build-out resistors from the single preamp to the two mixing channels to preserve the board's separation.

Some boards have all channels driven with mic level amps. High-level inputs are handled with resistive voltage dividers on the cards. You can change the configuration by rearranging some jumpers. Check to see if this is true for this board.

Or, use an external preamp. A remote mic mixer not used for ball games anymore can drive a high-level input.

Maybe there's no mic preamp available, but you have a spare turntable

preamp. Clip the RIAA equalization and add an input transformer. Maybe you don't even need the transformer.

Say you have a high-quality 150 ohm to 10 K ohm transformer. Use this to drive an FET or 741 op-amp with a gain of  $\times 10$ .

Find a 101 electronics projects book at the library. Strip some parts out of a broken TV or radio and build a simple preamp.

Some stereos have a mic preamp. Swipe the receiver from the reception room and hide it under the console. Use the mic input and drive the board with

**Many people decide that they want something, find out the price, determine that they can't pay that price and forget the whole thing.**

one of the speaker channels. Replace the mic's XLR plug with a standard phone plug.

Or find somebody who has a board like yours. Offer to swap some other station equipment for a spare mic preamp card.

You could buy a junker board cheap or for trade. Strip it to get a preamp module and goodies for future projects.

Or, go out to the garage and find that old clunker of a tape deck that went south last year. Pull the electronics chassis and tap off the output of the mic preamp.

Go to a hamfest. Get some cheap parts or an already working mic preamp.

Stop by that old school they're tearing down and ask if you can have the PA amplifier.

Or finally, who needs a preamp? Connect another XLR connector in parallel with the main mic connector. Plug in the second mic when you want to use it.

Both the main and second mics will be on at the same time, but that's OK for interviews. A classier way to do this is

with a couple of switches to switch either or both mics into the board's only preamp.

### Are you sure they're the same?

Come on. That 20-year old PA amplifier that you just barely saved from the wrecking ball is no way going to compete with a shiny new \$500 preamp, is it? Maybe, maybe not.

Despite some rusty corners and a caved-in grill, the old amp might be pretty good. Even if it hums and hisses, a few new capacitors might make it sound great.

Actually, most electronic parts aren't inherently limited. A ceramic cap works just as well in a \$20 table radio as in a \$20,000 transmitter. A resistor is a resistor, as long as its value stays put. No, they were building high-quality audio and lab gear before you and I were born.

Many audio limitations are in the circuit designs. Some of these are for good reason. A PA amp may have RC circuits designed to roll off the high and low frequencies. This is so power isn't wasted on frequencies that the speaker can't pass.

Many PA systems are frequency limited simply so the sound is more intelligible. A clever engineer can change a few parts values and flatten the response beyond broadcast limits.

One major limitation of non-broadcast equipment occurs in transformers. High-quality transformers cost big bucks. There are several ways to deal with this.

Get a substitute high-quality transformer on the surplus market. Get rid of the transformer, even if you have to modify the circuit. Or, use as is.

Some stations do indeed use low overshoot wide bandwidth audio transformers at \$50 or \$100 a pop for phone feeds. If you need a good transformer, check around the station to see if one isn't already going to waste.

### Substitute brains for bucks

Some engineers have bad experiences building or modifying equipment. Usually this happens when you don't know what you really need or what the equipment you have will really do.

There is a psychological factor, too. (continued on page 32)

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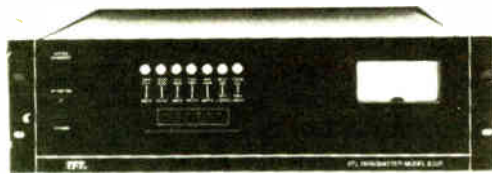
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Circle 16 on Reader Service Card

# A Review of Our Look at Rules

by Harold Hallikainen

**San Luis Obispo CA** Since this column began we've been discussing the various FCC rules and regulations that affect the day-to-day operation of the chief operator of radio broadcast stations.

Since we've covered many of the current requirements, I thought it would be a good next step to "go into the lab" and see what happens in the "real world."

In December, I filed a Freedom of Information Act request with the FCC. I requested a copy of all Official Notices of Violation, all Advisory Notices and all related correspondence from 1988.

I've been told by a Commission attorney that I should receive the requested information shortly. They say some documentation is being withheld to protect the anonymity of informers.

From these files, we'll develop "case studies" that will include what the inspector found, what the rules say and how the station responded.

## INSIGHT ON RULES

I hope this will give us a better understanding of the intent of the rules and how they are being enforced. Each station can learn from the experiences of other stations, without having to deal with its own FCC citations.

The identity of the stations will be in the documentation I'll receive, but I do not intend to reprint that information. We hope to learn from *what* happened, not to whom.

I really appreciate the effort the FCC Field Operations Bureau has gone through to gather this information.

Meanwhile, let's do a little review before we "head into the lab."

### Remote control

We started the series due to questions regarding FCC requirements when dial-up circuits are used for remote control.

This discussion went on for six months, and many readers still think these articles are about remote control only!

In this six-month period, we covered the FCC requirements for "sufficient" metering, control, accuracy and testing/calibration.

We found that sufficient metering was generally enough metering to determine power and pattern (if DA).

Sufficient control was open to argument (was "fail-safe" or "continuous control" required?). Since that time, the Commission has issued a clarification (call me for a copy).

The clarification allows dial-up operation if there is a way to insure the dial-up line is available for "the duty operator" (which is never defined in the rules; more than one duty operator is authorized at the transmitter or a remote control/ATS monitor point).

Dial-up operation is also authorized if the "duty operator" has a method to preempt any other dial-up line access or to shut down the transmitter.

Suggested means to meet this requirement include interruption of program audio, interruption of STL carrier/subcarrier, a separate radio link (such as a P-channel control/telemetry link) or a second dial-up line.

Sufficient accuracy was also open to

question, as the Commission eliminated the old "within 2% of local meter" requirement.

We introduced the concept of a "tightened window" on operating parameters. For example, if you can determine power within 2%, operate between 92 and 103% (indicated) of licensed power.

This should insure the actual power is within the 90 to 105% range. We then went on to show that with FCC authorized local metering accuracy (generally, 2% of full scale), it was not possible to operate within the tightened window (the lower limit was above the upper limit).

It will be interesting to see how the

Commission is actually enforcing these rules.

In addition, we discussed the limitations on "floating control points" (often the phone booth on the corner or perhaps a car phone).

At first, the Commission verbally disallowed floating control points. In Public Notice 88-194 (the "clarification") the Commission allowed control from any location as long as a designated operator is on duty at a fixed (and presumably FCC notified) control point.

### Network control

Next came a look at how the Commission has authorized some program net-

works to control the transmitters of the network subscribers.

These systems have generally used dial-up lines for routine telemetry and control with the satellite link providing the required alternate control path.

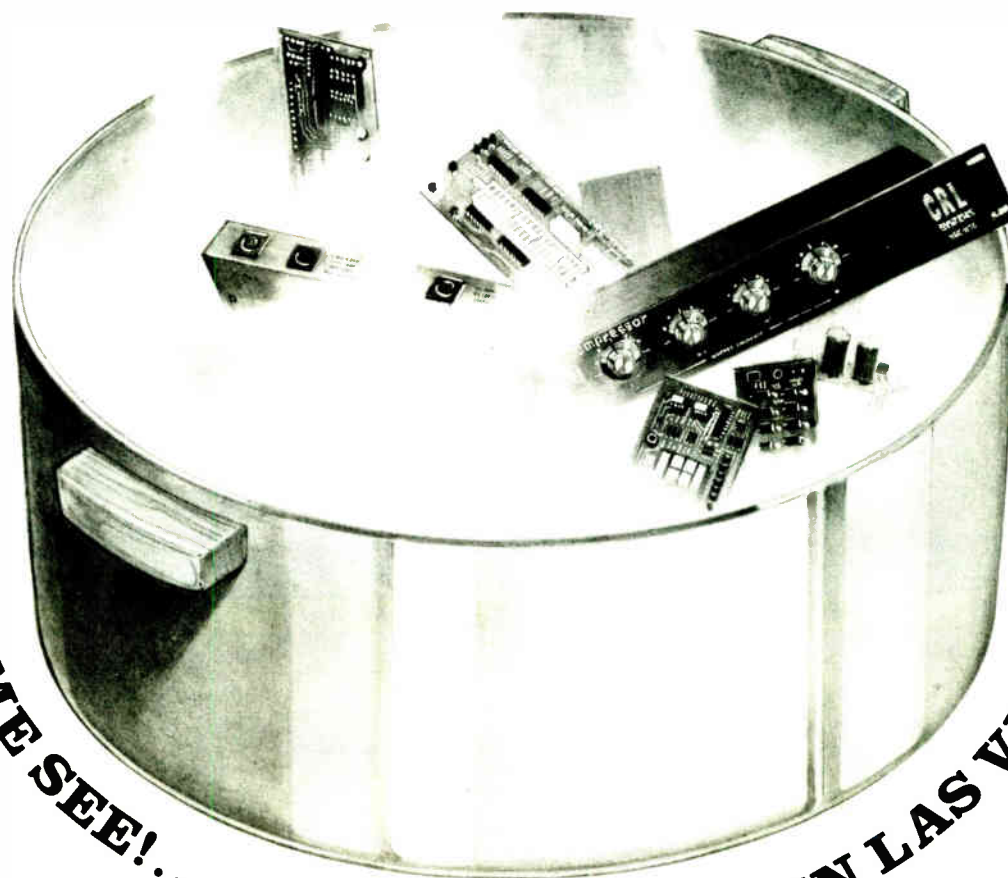
These network systems allow the local station to operate with no one at the local station (unattended, almost).

Generally, the stations have been given a waiver of a portion of the EBS monitoring requirements, since the network control point can generally not monitor the local CPCS station. Networks using such systems include Bible Broadcasting Network, Family Stations, Moody and Skylight.

From our discussion of the EBS requirements, I still get calls from stations

(continued on page 24)

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World Radio History

# Mic Placement Fundamentals

by Bruce Bartlett

**Elkhart IN** Once you've chosen a suitable microphone for the job at hand, where should you place it?

Microphone placement greatly affects the sound of a recording. Specifically, it affects the recorded sense of distance, the tone quality and the musical balance among instruments.

## LINE OUT

The number of mics required varies with the recording situation. Use just two (or a stereo mic) when you want to record an overall acoustic blend of instruments, for example, and room ambience, as shown in Figure 1.

Many ensembles can be recorded quite well this way. The technique is usually effective for classical orchestras, choirs, string quartets, pipe organs, small folk groups and vocal quartets.

On the other hand, pop music groups are usually recorded with multiple mics: one or more for each instrument or instrumental section.

You control the balance (relative loudness) at your mixer by adjusting the fader for each mic, as illustrated in Figure 2.

For greatest clarity in a multi-mic recording, follow the 3:1 rule: the distance between mics should be at least three times the mic-to-source distance.

For example, if your mics are one foot

stant with mic position.

But the closer you place a mic to a sound source, the higher the SPL is at the mic. The direct-sound level increases rapidly as the mic approaches the source.

Consequently, close mic placement picks up a high ratio of desired signal to undesired signal (ambience, leakage, and noise). The result is a tight, close-up sound with presence and very little background noise.

Although close miking has several benefits, you should place each mic only as close as necessary, not as close as pos-

sible. Miking too close can color the recorded tone quality of an instrument. Why does this occur?

Most instruments are designed to sound best at a distance (say, 1½ or more feet away). So, a flat response mic placed at that distance tends to pick up a natural or well-balanced timbre.

But when leakage or poor room acoustics forces you to mike in close, you emphasize the part of the instrument that the mic is near. The tone quality picked up very close may not reflect the tone quality of the entire instrument.

For example, the sound hole of an acoustic guitar strongly resonates at around 80 to 100 Hz. A mic placed close to the sound hole hears and emphasizes this low-frequency resonance, producing a bassy, boomy recorded timbre that does not exist at a greater miking distance.

To make the guitar sound more natural when miked close to the sound hole, you need to roll off the excess bass on your mixer, or use a mic with a bass rolloff in its frequency response.

With distant miking, you place the mic farther from the sound source than the source is big—say, 1½ feet or more away. Distant mic placement adds a live, loose, airy feeling to a recording.

(continued on page 29)



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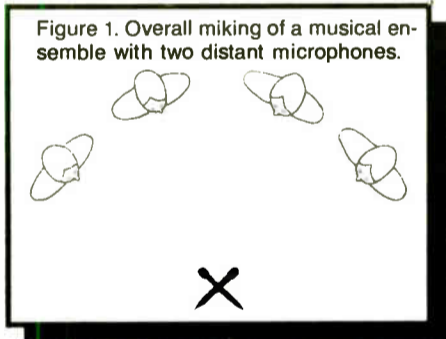


Figure 1. Overall miking of a musical ensemble with two distant microphones.

from their sound sources, the mics should be at least three feet apart to minimize phase interference between them.

Also, use as few mics as are necessary to get a good sound. Don't use two mics when one will do the job.

To achieve this, sometimes you can cover two or more sound sources with a single mic, as shown in Figure 3. A brass section of four players can be covered with just one mic on four players, or with one mic on every two players.

There's a disadvantage in picking up several sources with one mic. During mixdown, you can't adjust the balance among instruments recorded on the same track.

For a proper blend, the sound must be balanced acoustically in the studio while making the recording.

Suppose you're going to mike a musical instrument. How close do you put the mic? Let's consider the pros and cons of close and distant miking.

With close-miking you place the mic nearer the sound source than the source is big—say, a few inches away. If you put the mic close, it picks up very little room reverberation, leakage, and background noise.

The reason why is because the levels of reverberation, leakage, and background noise in a studio are fairly con-

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# A Second Look at Rules

(continued from page 21)

that do not have an EBS generator because they are not a participating station.

Every station (except class D FMs) must have an EBS generator. Every station must have an EBS receiver. Weekly tests are required.

## ATS revisited

We next went into a discussion of ATS. I believe very few stations are operating under ATS.

When the Commission first introduced the rules authorizing ATS, they were very complicated. Now they are very simple, but non-specific.

They require an ATS to monitor,

control and alarm non-specified parameters. In case deviation of a parameter can cause interference, the ATS is to shut the station down. This would seem to place a lot of parameters under ATS monitoring requirements.

Excessive deviation of power, modulation, carrier frequency, subcarrier frequencies, pattern and spurious radiations (harmonics and intermod) could cause interference. Is anyone monitoring all these continuously?

We then looked at the station log requirements. Although the Commission has reduced logging requirements, we noted that logging itself has not been eliminated.

On translators, the Commission has

made some rule changes regarding FM translators and may make more. We looked at the controversy regarding translators and the possibility of a Low Power FM Service, similar to LPTV.

## Operator requirements

As part of our look at operator requirements for broadcast stations, we reviewed the Communications Act of 1934 and its amendments.

Looking at the Communications Act, as amended, it almost appears that Congress was more interested in licensed operators supervising the programming than interference protection.

The Act was amended in 1976 to allow the Commission to waive the operator requirements on broadcast stations for those stations that are primarily engaged in rebroadcasting the signals of other

broadcast stations.

The Commission rules allow unattended operation of translators and boosters, no matter what the operating power.

Recent rule changes allow for high-power boosters, which are certainly capable of causing interference.

After this we reviewed the routine

**It will be interesting to see how the Commission is actually enforcing these rules.**

duty operator requirements (licensing and proper instruction) and the chief operator requirements.

We discussed the FCC's elimination of audio equipment performance measurements (which we used to call the audio proof).

We pointed out, however, that AM stations are required to make an annual spurious radiation (occupied bandwidth and harmonics) measurement.

AM and FM stations are required to make similar measurements on the installation of various pieces of equipment. The currently required measurements appear similar to what the FCC has proposed by proposing to adopt NRSC-2 without adopting NRSC-1.

Next on the agenda was a discussion of the NRSC proposals. We tried to tackle the thorny question of the Commission's "place" in the industry (standards setting or interference protection?).

Then finally, we discussed the various paperwork you should have available for the Commission. We covered both technical and non-technical areas.

I appreciate all the calls I've received on this series. Now that we've had our review of the rules we've been looking at, don't worry about passing a quiz.

I hope, however, that you'll find the "lab" work as enlightening as the "lecture."

...

Harold Hallikainen is president of Hallikainen & Friends, a broadcast equipment design, manufacture, sales and installation firm. He can be reached at 805-541-0200.

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# Backpacking Radio in Munich

by Dee McVicker

**Munich WEST GERMANY** When discussions turn to remote broadcasting, someone inevitably mentions the call letters WLUP. And then a story follows.

One story in particular sounds much like a Robert Ludlum spy novel in which the heroes (broadcast engineers, of course) send signals cross-Atlantic from a backpack wired for radio.

It is *Okttoberfest*, in the heart of tourist season in Munich, West Germany.

## OFFBEAT RADIO

Enter our first hero, an American engineer straddled with a 2.5 W transmitter, microphones and a portable three-channel mixer. He is wearing this apparatus on his back, in what is commonly known as a backpack.

Meanwhile back at the command post, which looks deceptively like a hotel with several antennas atop it, another hero is fidgeting with panels of equipment. He is Tom Knauss, WLUP's director of engineering.

In another part of the world, a board operator is conversing with Knauss. The board operator comments that the signal is received, and it sounds like it's coming from the studio down the hall.

"That kind of flexibility is what we had to create from an engineering standpoint," recalls Knauss. "To cover the entire city and broadcast from any location on a moment's notice."

Twenty-three large cartons of equipment, everything from transmitters and antennas to nuts and bolts, arrive in Munich to do just that.

Some of it, the lighter pieces, end up in a hiking backpack. Other pieces go to the command post and the rest could be found in any one of the city's church steeples.

Because the backpack is battery-operated and carrying only 2.5 W, a repeater site is necessary to bring the signal back to the command post five miles away. Packing any more power into an already heavy backpack would have meant constructing a monstrous battery supply.

Church steeples become excellent sites for repeater broadcasting. They are tall and the city has enough of them to keep up with the roving backpack.

Every day during the week-long remote, a new remote site is selected, two antennas are bolted in and propped up on church steeples to overlook the moving backpack.

One antenna receives the signal from the backpack and the other routes it to the command post.

At the command post, antennas

turned on rotor motors pick up the signal from the day's designated church steeple. Knauss has prepared route maps in advance, so that when the remote site is selected on a moment's notice he can set up almost immediately.

The remote signal then leaves the command post and after a short telephone hop to Frankfurt, is uplinked to an AT&T satellite and travels on to an ABC technical center in New York.

The trip from New York to WLUP is via SATCOM 1R, which the station is able to downlink on its satellite receiver. The remote signal path from backpack to Chicago is 15 kHz wideband.

But the live remote signal is not the only link to WLUP in Chicago. Knauss also needs a return feed from the station's studio. Another AT&T service provides this link: the telephone.

"We dialed direct back to Chicago and then hooked that into another transmitter and broadcast that at another frequency so that anywhere in Munich you could listen to what was going on in Chicago," says Knauss.

The idea, of course, is for the backpack remote to pick up the signal and return live programming in sync with what is going on back home. But they need to know more than what is going on over the air back home, they also need to coordinate the remote.

The director on-site in Munich is outfitted with a direct channel back to the board operator in Chicago. As he dodges the crowds in malls, squares and factories alongside the roaming backpack, he receives and sends instructions to the board operator in Chicago via a two-way radio.

The command post intercepts the two-way signals and sends and receives them over telephone circuit.

All of this might sound like American radio, but Knauss assures us it isn't. The remote frequencies, for instance, are a very foreign "460, almost 470 MHz." And there is also the small matter of acquiring the necessary permits.

Knauss started to lay the ground work

weeks in advance, when he arrived in West Germany with not much more in the way of German communication than his name. The Tourist Authority filled this communication gap until Knauss started talking radio. Then he was on his own.

"It got down to drawing pictures," Knauss reflects. "We had to use a nomenclature of international language symbols." After elaborate drawings and much hand waving, Knauss started to find his way around Munich.



The roof of the BMW car factory becomes the site of a repeater antenna. The Olympic tower (left) stands guard.

And Munich was getting to know Knauss as well. "Everybody in the town knew who we were, what we looked like and what we were doing," recalls Knauss, who found his way to the town's mayor, which then spurred press coverage and instant stardom.

It was this curious greeting from the press that, surprisingly, made the remote easier to conduct. "At that time the West German government was still strict with people doing any type of antenna work, having two-way radios or even recording," says Knauss.

"They have loosened up regulations since then, but at the time even the local police on the street had the authority to stop you if you had any kind of radio."

Knauss and his crew of remote broadcasters were not only listening to radio a continent away, they were making radio happen in a country where the Post Office regulated broadcasting.

The permits Knauss acquired for what



The field crew. Seated: German engineer Wolfgang Meyscheider and WLUP's Ken Lewin with backpack. Standing: talent Johnathan Brandmeier, newsman Buzz Kilman, operations director Greg Solk.

the government considered an elaborate broadcast with antennas looming down from steeples and a backpack on the move, were strictly regulated in power and frequency. Even that proved to be an advantage.

Says Knauss, "I found it easier to work in their country than our own. In the States, everybody has a two-way radio. The messenger guys have them, the truck drivers . . . You won't find that in Germany. We were able to operate interference free."

The only problem Knauss encountered with German regulation was the power restriction for the repeater stations. But instant stardom came to the rescue. Reveals Knauss, "Once the remote got under way, the Post Office seemed satisfied that we wouldn't do anything too outrageous."

(continued on page 26)

## ERRATA

The 8 February issue of *Radio World* carried an ATI advertisement containing an incorrect price. The ATI Vanguard Series Model BC8DS audio console currently sells for \$3,395, not \$3,195 as listed in the ad. *Radio World* sincerely regrets the error.

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# The Real Story On WLW's Long History

by George Riggins

**Long Beach CA** Open mouth and remove all doubt! Or is it foot-in-mouth disease? I thought I had good data on WLW, but it turns out I was only partially correct.

The best part of the goof-up was the tremendous number of phone calls I received with additional history on some of the early days of radio in these United States of America.

The first person to call and send a copy of the article appearing in BP&P (*Broadcast Programming and Production*, 1979, month not given) was Bill Frahm of KBOI, Boise, Idaho.

The article was authored by John D. Price. It was a two-parter, with the second part discussing the south-of-the-border stations built and operated by Dr. Brinkley and others.

I'll try to correct the errors and add additional history to "The Nations Station."

According to John Price, Powell Crosley Jr. purchased "The ABC's of Radio" for his son Powell III at the cost of 25¢. The next step was a \$200 receiver, and then a 20 W transmitter.

Young Crosley started playing records

and asking for listener reports. Such items as liners for tires, flag holders for radiator caps and "Little Shofers" for Model T Fords were being advertised.

These were products from the American Automobile Accessories Co. owned by Powell Crosley Jr. Soon another line was added: a ready-to-use crystal set. The receivers cost as little as \$9 without ear-phones.

During the summer of 1921, the Dept. of Commerce issued 8CR as a "special land station" with 20 W of power. The WLW call sign was issued in 1922

by the Federal Radio Commission. WLW was the 65th license radiotelephone station to go on the air.

It's interesting to note that with the 20 W, reports were received from Colorado, Maine, Michigan, Wisconsin and Connecticut. (I guess that now 20 W and \$5 will just about get you a good cup of coffee and a sweet roll at the local coffee shop!)

Showing good progress, WLW increased power to 100 W in January 1923 and to 1000 W in 1924. Time was shared with WMH and WSAI on 710 kc.

WSAI was also owned by Crosley Radio Co. and used for local programs and



service and located in Cincinnati.

The move to the present frequency of 700 kHz was made in 1927. Again, time was shared with WMAF, Dartmouth and KFBU, Laramie, WY.

The Dartmouth station operated summers only and soon disappeared. KFBU changed frequency, leaving WLW as a clear channel.

**I thought I had good data on WLW, but it turns out I was only partially correct.**

Power again was upped in 1925 to 5000 W with program tests starting at the new power in January. An order was placed for a 50 kW Western Electric transmitter in September, 1925.

The 50 kW plant went on the air 4 October 1928. The transmitter site was at Mason, OH with a Longwire antenna. The station was heard in Jacksonville, FL and Washington, DC.

The 500 kW transmitter was ordered from RCA in either December, 1932 or January, 1933 and installation began in early 1933 at Mason.

Regular programming was commenced at 9:02 PM on 2 May 1934. The license was provisional for six months. Crosley

managed to renew the license every six months until 1939. WLW returned to regular 50 kW power on 1 March 1939.

Yes, there were test periods between 1934 and 1939 when the call W8XO was used for experimental operation. But the regular call of WLW was used for normal programming at the super power.

The story does not end here. There were some additional tests made during World War II at the 500 kW power.

John Price either was unable to gather the definitive data to present the facts, or he saved the data for a later article. If and when the additional info is available, it will be presented.

Price lists many of the early personalities who started careers at WLW or gained additional experience there.

The list is much too long to do anything more than to mention one comment made to me by Jan, the daughter of the sound effects engineer of the station, about Red Skelton.

It seems that Jan's dad had a record cutting lathe at home and did some special recordings for Skelton and others.

Jan will only say that she learned why Red always had the audience in uproarious laughter when his programs went on the air. Jan says that Red had a very large repertoire of "good" jokes.

(continued on page 30)

## Remote With a Backpack

(continued from page 25)

Crossing international waters with a signal setting its sights on Chicago was where Knauss encountered most of his problems. The obstacle was not so much international regulation but capitalism.

Says Knauss, "We had an option to go from Frankfurt to London over a low quality circuit, and from London to New York over a poor-quality satellite channel." This route would have confined their signal to 3 kHz bandwidth and would have cost far more than a dedicated telephone feed.

Their other option, until they found AT&T, was to use what is generally considered video access satellite channels.

High-quality channels, it seemed, brought in big dollars from video en route but hardly justified the time or resource of transporting mere audio. "The people that had high quality wouldn't sell to us, and the people that would sell to us had low quality," claims Knauss.

Those difficulties have since been solved, but at the time the only semi-affordable access was a 50-country satellite network by AT&T.

"There are only two places where SATCOM 1R can be uplinked. One is New York and the other is Los Angeles," informs Knauss, who uses SATCOM 1R for most of the exotic remotes.

Which brings us to another story in the making. As Knauss recounts his travels and the technology for their Munich remote, he is at that very moment planning another remote adventure.

"This one," he begins, "will be a two-satellite hop from Maui. We'll have a company bring in the satellite transmission system over a barge and take it by trailer to a hotel ..."

■■■

Dee McVicker is a free-lance writer with a long record in equipment sales. Comments on articles and inquiries about her writing service can be taken at 602-899-8916.



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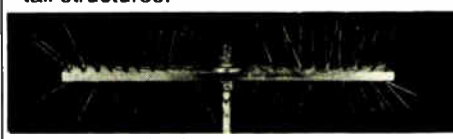
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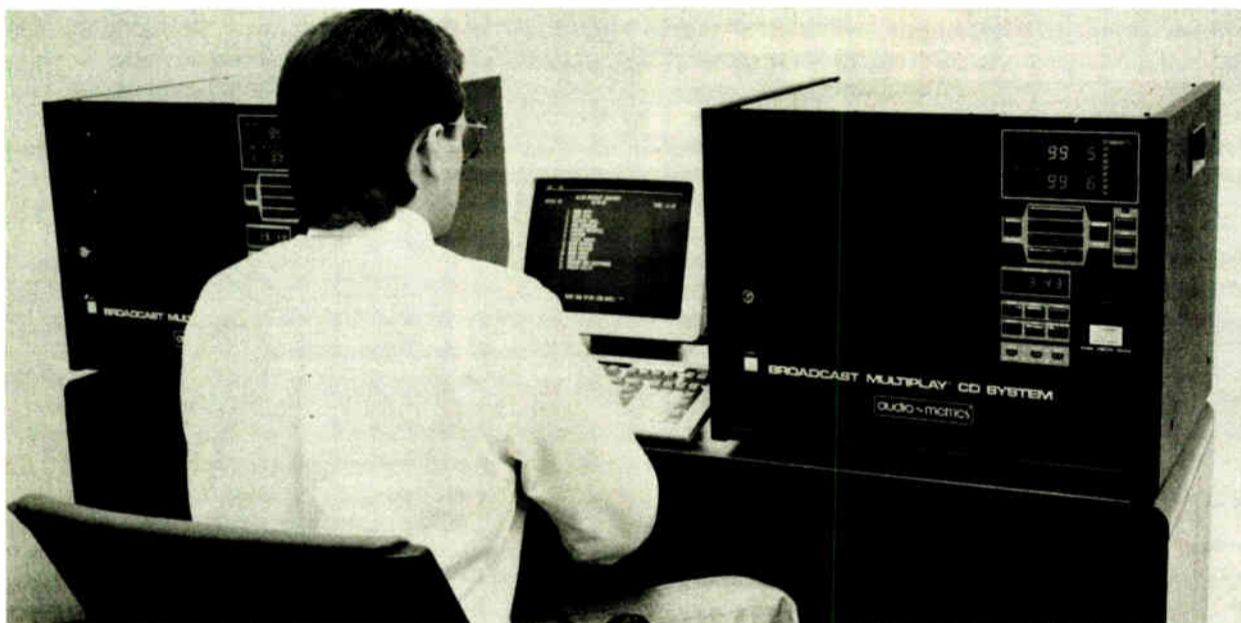
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they've taken care of the damage problem," Tom says. "The CDs are only handled when we rotate them. At the top of the hour, our operators pre-program nine cuts in each machine's memory. Then they just press the console "on" button, and cued-up music is on the air — the AMCDS-1000's multipin connector mates with the console's logic connector. Soon, we'll run the whole system from a PC — we've already written the software."

→ **WZOK FM, Rockford, IL** is the city's #1 CHR "and fully determined to stay there," according to CE Jack Lambiotte. They play "97.5% CDs" on a quartet of Audiometrics Multiplays. "We run our AMCDS-1000s with a live-assisted Sonomag automation system," Jack reports, "connected to the DB25 multipin connectors on the rear of the machines. That's been flawless. There's just a keyboard and monitor in the control room — it's a real "hands-free" operation. I can hear real improvements on the air. Our Multiplays track much better than the so-called professional CD player we had been using, and the sound quality is far superior."

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P.S. Check the mid-February *Radio World* Buyers Guide for more about the Audiometrics AMCDS-1000 Multiplay.

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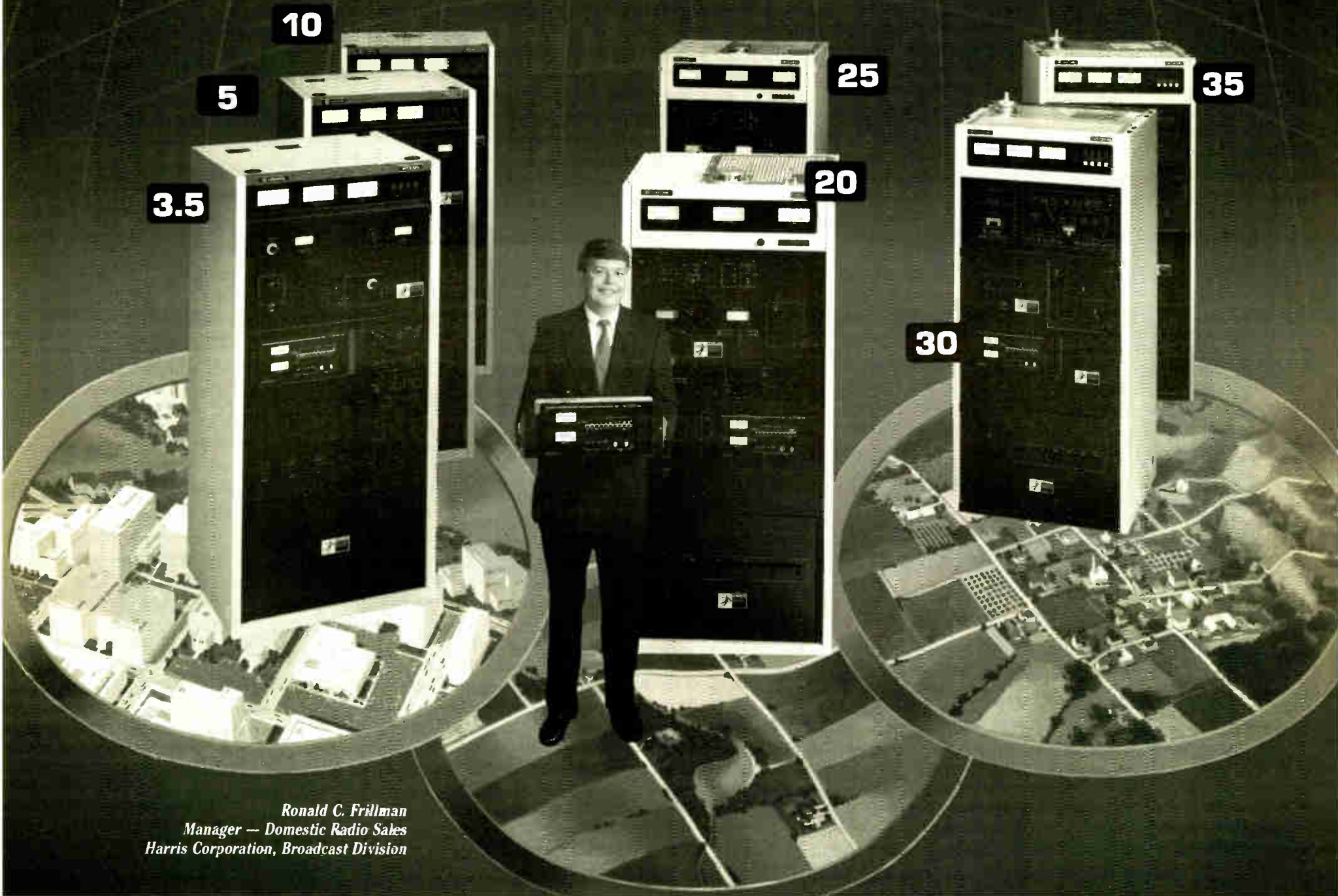
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# Miking the Correct Way

(continued from page 23)

This technique is often used when overdubbing strings and horns, and is sometimes applied to overdubbed vocals, electric-guitar solos, drums and pianos. Classical music is always recorded at a distance because concert-hall reverberation is a desirable part of the sound.

A natural tonal balance usually can be found at a miking distance equal to the size of the sound-radiating part of the instrument.

If the situation allows, place the mic as far from the instrument as the instrument is big. That way, the mic picks up all the sound-radiating parts of the instrument

you do this, the sound pressure level at each mic is high. Then you can turn down the mixer gain of each mic signal, which reduces leakage at the same time.

A musical instrument radiates different spectra in different directions and produces different spectra from different parts of the instrument.

Thus, you can partially control the recorded tone quality simply by changing the mic position relative to the instrument.

Other instruments show the same phenomenon. A trumpet radiates strong highs directly out of the bell, but does not project them to the sides. Thus, a recorded trumpet sounds bright when miked on-axis to the bell and sounds more natural or mellow when miked off to one side.

It pays to experiment with all sorts of mic positions until you find a sound you like. There is no one right way to place the mics because you place them to achieve your

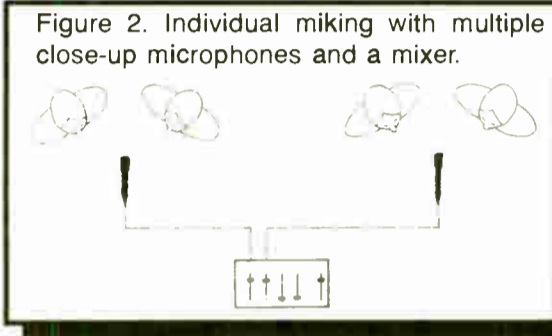


Figure 2. Individual miking with multiple close-up microphones and a mixer.

about equally.

Suppose the studio acoustics sound bad—the room reflections make the recorded instrument sound muddy. Distant miking picks up a lot of these bad-sounding reflections because the relative level of the direct sound decreases with distance.

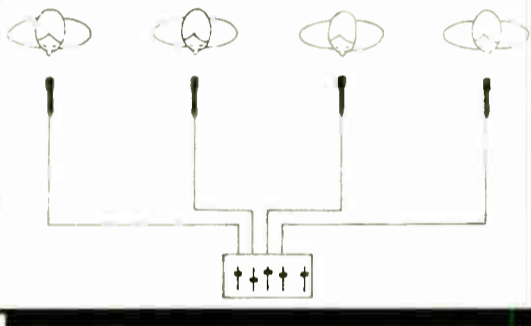
If you want a close-up, tight sound with presence, you can't get it with distant miking because of the high ratio of reverberation to direct sound in the recording.

Suppose you're close-miking several instruments simultaneously. Each mic picks up its own instrument with a close, clear sound quality.

Unfortunately, each mic also picks up leakage from distant instruments. That nice, tight sound you hear on each mic alone may degrade into a distant, muddy sound when all the mics are heard together, due to this leakage.

When miking many instruments at once, you can reduce leakage pickup by miking each instrument very closely. If

Figure 3. Multiple miking with several sources on each microphone.



desired tonal balance.

To determine a good starting mic position, try closing one ear with your finger. Listen to the instrument with the other ear and move around until you find a spot that sounds good. Put the mic there. Then make a recording and see if it sounds the same as what you heard live.

■ ■ ■

*Bruce Bartlett is a microphone project engineer and technical writer with Crown International. He can be reached at 219-294-8000.*

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# Standards for Digital Interface

by Mel Lambert

**Studio City CA** Last month's column on DAT timecode contained a small technical error.

For the new NHK/Matsushita/Sony format the timecode resolution is the same for both 44.1 and 48 kHz sampling frequencies. (I had stated, incorrectly, that the resolution was 20.8 microseconds at 48 kHz, and slightly less at 44.1.)

It appears that the timecode marker used in the proposed format is related to the count of 48 kHz clock periods for both 44.1 and 48 kHz sampling frequencies; in other words, the TC marker is equal to the sample count only in the 48 kHz mode. My apologies for the confusion.

In the beginning there was analog, and it was good. It could be noisy, distorted, weird-sounding but, by heavens, a tech could put it up a scope and see what the waveform was doing.

We could slap together an EQ circuit from three toothpicks and a length of zip cord and troubleshoot a remote using two rusty nails and a plastic comb.

Then came digital and it was better. Better sounding. Better flexibility. Better editing opportunities. Less down time. More glamor for the station. The list goes on. But it wasn't all good news.

In this month's column, I'd like to ponder one of the more anxiety-inducing "funnies" of digital systems: how to make them talk to one another digitally.

As we all know, analog interconnections are reasonably easy to sort out: balanced/unbalanced; low-Z/high-Z;

-10/+4dB; terminated/bridging—all of us have had years of experience in sorting out anomalies and learning what to do if we have a mismatch resulting in HF rolloff and/or distortion.

Digital should be easier, right? After all, it's gonna be 16-bit PCM, at a sampling frequency of 44.1 kHz or 48 kHz. This connector is labelled "Dig In" and this one "Dig Out." You know it's the same sampling frequency. No problem.

## DIGITAL DOMAIN

Nope, don't always work, does it? What we are overlooking, I'm afraid, is the rabid competitiveness between manufacturers of different systems, and the late arrival on the scene of those fearless warriors of interconnectivity.

We're talking about the standards making organizations, whose illustrious ranks include the AES (Audio Engineering Society) and the EBU (European Broadcasting Union) in addition to SMPTE (Society of Motion Picture and Television Engineers) and the good ol' NAB.

Cutting to the chase, what we have at the moment are around half-a-dozen or so reasonably well-established digital interface standards.

(By which we can assume that, although some of us might consider certain formats to be rather odd, they're being used on hardware, so we have to at least come to terms with their existence.)

In no particular order of priority, let's take a look at what we have.

### Sony's interface

SDIF-2 is a format developed and promoted by Sony Corporation ("SDIF" means Sony Digital Interface) and currently used on the firm's range of PCM processors and certain DASH reel-to-reel machines.

For compatibility reasons, it is also offered on several of the leading digital editing systems, including the AMS AudioFile and Lexicon Opus.

Three unbalanced BNC connectors are usually specified for connecting stereo program: one each for the digital bit-stream corresponding to left and right audio channels, plus a third that carries digital word clock pulses for synchronization purposes.

Word clock, if you didn't already realize, is of vital importance to digital systems; without it, the internal crystals can not be synced with external video sources and timecode synchronizers.

Input and output impedances for SDIF-2 are specified at 75 ohms, with TTL

interconnect levels.

It is here that some of the confusion and interface problems begin to develop. Many users are under the impression that S/P DIF (which stands for "Sony-Philips Digital Interface") is a low-level, unbalanced version of the "professional" AES/EBU interface.

Up to a (very reserved) point, they can be considered in that way. However, I would suggest that it benefits all broadcasters to forget for a moment anything they might already know about these connection schemes and take note of the following discussion.

### Pro and consumers

In chronological terms, these two digital interfaces were developed almost concurrently. Both the AES and EBU spent a long time developing the standard that is now ratified as AES3-1985, while Sony and Philips put together the specifications for consumer CD equipment.

Shortly afterwards, a large group of Japanese electronic manufacturers—known collectively as the DAT Conference—were at work on a multipage spec document that defined not only the tape dimensions and recording format for DAT, but also the means

(continued on page 35)

# The True Story of WLW

(continued from page 26)

A second article was sent by Jerry Burnham of KIIS AM and FM of Los Angeles. This article appeared in the November, 1967 issue of *Broadcast Engineering* magazine and was written by William E. Burke.

Burke's formal article was rather short, but long on photos with three pages devoted to pictures of the equipment with short explanations.

When WLW went on the air with the 500 kW, they used a Blaw Knox tower 708' high. The total height was 831' when the flag pole was in place.

The tower weighed 135 tons and was guyed with eight 1 7/8" cables anchored 375' from the base. The total exerted on the single ceramic insulator supporting the structure was reported to be 400 tons.

Burke also stated that at one time the antenna "was augmented by a directional antenna to protect CFRB, Toronto when WLW was using 500 kW at night."

The transmitter used 20 UV-866s. There were three PAs in parallel with four UV-866 tubes in each and the other eight were used in the two modulator sections.

The modulation transformers weighed 37,000 pounds each and appeared to be about 12' high.

The transmitters were in the basement, probably to keep them from falling through the floor. The three plate transformers, rectifier filter reactor and a modulation reactor were installed outside the building.

The installation included a distilled water plant for cooling water. The distilled water was cooled in a heat exchanger that was connected to a large spray fountain in front of the building.

By the way, the filaments on the UV-866s took DC which was supplied by motor generators. One picture shows a motor generator for 125 VDC "which was used for control circuits on the 500 kW transmitter."

A question was asked about whether other stations were on the same frequency as WLW. In a 1929 directory of American stations and in the December 1938 issue of *Radio Index*, WLW was the only station listed as being on 700 kcs.

Now, according to the 1988 edition of *Broadcasting/Cablevision Yearbook*, WLW shares the frequency with nine other stations in the US and two in Canada.

Next time I'll have more to say about Dr. Brinkley. I also have some comments and station calls from DXing books loaned to me by Bob Nicholas.

Bob grew up in St. Louis, MO and was an avid DXer in the late 1920s and well into the 1930s. Bob later worked at one of the St. Louis radio stations as an engineer for several years.

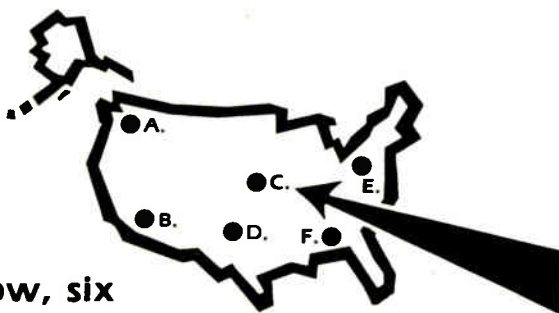
■ ■ ■

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

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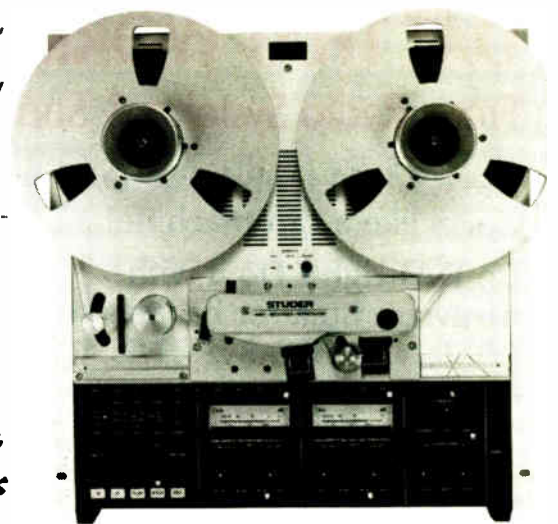
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# Get It For "Nothing"

(continued from page 20)

Anyone convinced that a shiny new console will make the station sparkle isn't going to expect much from the cobbled-up scrap heap mixer that is in the studio now.

You can stretch your few budget dollars a long, long way by being a little clever. This is how students and hobbyists operate. They're usually poverty-stricken, so they connive ways to get what they want for little or no money.

Start by deciding what is the most important feature of the equipment you need. If you need a response of 50 to 1000 Hz with less than a percent or two of distortion and an output noise of -55

or -60 to make a preamp that will sound just like what is already in the board, then work towards that goal.

It doesn't matter that the circuit is a couple of transistors clipped out of an old TV or that the circuit board is a cracked piece of perf board or even a thick piece of cardboard. If you can measure those specs, then you have succeeded. Sounding good counts. Ugly may not.

## Recognize success

Since we've decided to throw looks out the window, you need a way to determine if a circuit is good or bad. In the end your ears and the ears of the pro-

gram director and the air staff will decide if "Ugly-the-Wonder-Amp" stays or goes. However, you could use a little help getting to that point.

For audio work, you really need some trusty test equipment. The basics include an audio generator and a level meter/distortion analyzer.

The first station I chiefted at couldn't afford any test equipment. I wanted a B&K setup, the standard at the time, but couldn't swing the cost myself.

So, I invested a few dollars and some elbow grease in a Heathkit vacuum tube audio generator and distortion meter bought and built over a period of months. They still outperform some newer solid state equipment.

You may not want to or be able to spend even that much. If not, get some circuit books and build an oscillator and

THD meter out of junk parts.

You can check the calibration against another station's equipment or by being really polite to someone at a community college lab. Sometimes schools will even loan or sell cheaply their out-of-date donated equipment.

Once you have a voltmeter, oscillator and distortion meter that you can trust, the job gets more objective. The circuit either works or it doesn't. You play with it till it does and then leave it alone. It doesn't matter whether the parts are from an industrial supplier, Radio Shack or the junk box. If they work, they work!

## Some clever fixes

The same station that couldn't afford any test equipment certainly couldn't afford a mic compressor when that was all the rage.

We aspiring rock-jocks wanted one desperately, so I talked the owner out of 10 bucks or so for "spare parts." With that, I got some 741 op-amps, capacitors, resistors, an FET, a power transformer and a \$1.25 hobbyist magazine with plans for how to build a mic limiter.

I was almost out of money so instead of a BUD box, I bought a metal cake pan for the chassis. The compression just about sucked us into the microphone, but we got to play big-time on the cheap. I'm still getting asked what happened to that cake-pan limiter.

Another jock at the same station came up with a mic reverb for no money down. He swiped the springs and amp from his parent's electric organ. They didn't find out till long after we tired of speaking from a cave.

A couple of years later, I invented the Scotty-Watty Phone Box. Scotty, the morning man, needed a phone interface to do his talk show. So, I scrounged some used Opamp Labs modules, a hybrid transformer and a previously-punched rack chassis.

The CE donated some toroid coils from his ham radio-teletype setup. On the tenth attempt it started working. At that point, Scotty refused to let me take it back to the shop to clean up the rat's nest of wiring. The rat's nest was still there, working away, when I left the station.

■ ■ ■

John Shepler is an engineering manager, broadcast consultant, writer and regular RW columnist. He can be reached at 815-654-0145.



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World Radio History



# A Generator Model Can Save You Time

by Tom Osenkowsky

**Brookfield CT** When dealing with a new or modified DA system a well outlined setup procedure can save a lot of time and money.

If the new phasor and ATUs are not pretuned by the manufacturer, the first step is to set the phasor for the proper power distribution and relative phase angle.

For the sake of this discussion, we will consider the phasor as part of the "generator" model.

The phasor is responsible for delivering various currents at specified phase angles to the appropriate feedlines or towers. A DA system "map" is very helpful in determining "how much should be where." This is true for new as well as existing phasing systems.

Figure 1 shows a three tower DA system block diagram. Each component of each network serves a specific function and must be accounted for in the total system phasing.

Each transmission line has a certain phase shift as well. From the block diagram we can determine how much phase shift must be generated in the phasor itself.

Table 1 defines the parameters of the array. Given are the base values (not

the field or loop values). We begin by adjusting the power divider network which is the Ohm's Law shunt design in this case.

The most practical tool will be the station's antenna monitor. Using tower #1 as reference, connect the reference tower

port of the antenna monitor to the divider bus after turning off the transmitter and ing all components properly discharged.

Connect the remaining ports to the other two divider rollers. The loads should be disconnected at this time.

Drive the common point with low power from the exciter or external precision oscillator. Adjust the antenna monitor for a reference of 100. Now go to L2 and adjust it for a value of 0.780 on the monitor and 0.544 for L3.

These values were obtained by determining the current drawn by each of the transmission lines (50 ohms) given the power distribution in the table where  $I = \sqrt{\text{power} \div 50}$ .

With 7.246 amps for tower #1, the remaining two currents (5.655 and 3.94, respectively) are divided by 7.246 and thus the current ratios are obtained. Now reconnect the phase shift networks.

The power divider phase angles were determined given 26uH coils with a mutual coupling factor of 0.25 each.

## RF READER

Next, the reference port may be moved to the tower #2 phase network output and an impedance bridge placed at the phase #1 network input location.

Since the tower #2 phase network is a "zero degree" shifter, temporarily short out this L/C combination with a short clip lead. An OIB may be used with an FIM or other suitable null detector.

You will then adjust for a 50 ohm match to L1 with a  $-90^\circ$  phase angle reading on the monitor. The process is repeated for tower #3.

The zero degree shifter may be adjusted by removing the short and tuning its coil for a  $-90^\circ$  reading on tower #3, since we are looking for a resonant condition where  $XL=XC$  and the phase=0.

Our "generator" model is now complete. We have currents at each line which represent the required power duration and phase angles which are necessary to produce the licensed pat-

tern. For a better understanding of the algebra involved, I have shown in Table 2 the simple calculations used in this discussion. This particular array is interesting in that we have three different reference points.

Note that tower #1 actually has the most radiated power and conventionally would be used as the reference tower. Since we are using base sampling, the highest base current is present in tower #3 and thus it is the base ratio reference tower.

Further note that tower #3 has the least power, but also a very low drive point resistance. Next time we will set up the ATUs and energize the array at high power.

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

Table 1.			
Tower	Power	Drive Pt Z	Base Current/Phase
1	2625	64 + j22	6.4/-164
2	1599	29 + j50	7.39/74.4
3	776	12 + j10	8.1/0

Table 2. Phase distribution					
Tower	Divider	Network	Line	ATU	Total Phase
1	0	-90	-327	-80	-497
2	-27	0	-494	-97.2	-618.2
3	-42	-90	-473	-87.6	-692.6

Tower #1  $-692.6 - -497 = 195.6$ . ( $195.6 - 360 = -164.4$ )  
 Tower #2  $-692.6 - -618.2 = 74.4$   
 Tower #3 is phase reference.

# Splatter matters.

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

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

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# Desktop Audio Goes To School

by Frank Beacham

**Los Angeles CA** Within the exploding maze of new hardware and software in the desktop audio market, a small California manufacturer is marketing a relatively simple and inexpensive system to radio stations.

Dyaxis, a random-access audio workstation for use with a Macintosh personal computer, has begun to have an influence in radio station automation and will soon become a teaching tool at the University of California for the radio newsroom of the future.

The system, first introduced at the 1987 AES Convention, is manufactured by Integrated Media Systems (IMS) of Menlo Park, CA.

It is priced at between \$6,000 and \$35,000, depending on the amount of disk storage capability, says Gerry Kearby of IMS. More than 100 systems have been sold for a wide variety of applications.

## Rapid integration

The Dyaxis system is a good example of how new desktop audio technology—non-existent two years ago—is placing the radio broadcasting industry on the fast track to major technological change.

And it also is a good example of the many problems encountered in rapidly absorbing new computer-based technology into the broadcast workplace.

Among the wide range of systems now on the market, some costing more than \$300,000, Dyaxis is priced on the low side. It is a direct-to-disk, CD-quality audio system that provides random-access, two-track recording and playback; and multi-track, offline sound file assemble.

The manufacturers' application notes suggest the system for dialogue editing, sound effects work, commercial spot production and MIDI sampling and two-track recording.

Paul Schafer, developer of the first broadcast automation system 30 years

ago, saw a different application for the Dyaxis. Last NAB, Schafer showed the first production model of his Schafer Digital Automation system for radio stations.

The system, which provides storage capability of 80 hours of digital stereo sound, incorporates the Dyaxis and Sony's Betamax video recorder in its design.

The Schafer system can store up to five hours of program material on a single Beta tape in the PCM-F1 digital format with SMPTE time code.

A preprogrammed IBM-compatible computer controls the Dyaxis and the Beta machines (up to 32) causing the programming on the Beta tapes to be recorded on the Dyaxis hard disk just in advance of air time.

The Dyaxis disk is broadcast on the air and is continually updated by the computer and fed new material from the digital Beta tapes.

## College journalism

In another application for the Dyaxis, the Graduate School of Journalism at the University of California, Berkeley, purchased a system to train students to edit news spots and documentary programming on a digital random access system.

Journalism professor Bill Drummond, who has followed the progress of random access audio systems since Lucasfilm's now defunct EditDroid three years ago, convinced the university to purchase the system.

"Audio editing is one of the few things that computers can do that is clearly better than before," Drummond said. "As the cost continues to go down, I think it is reasonable to see these things in many news rooms around the country."

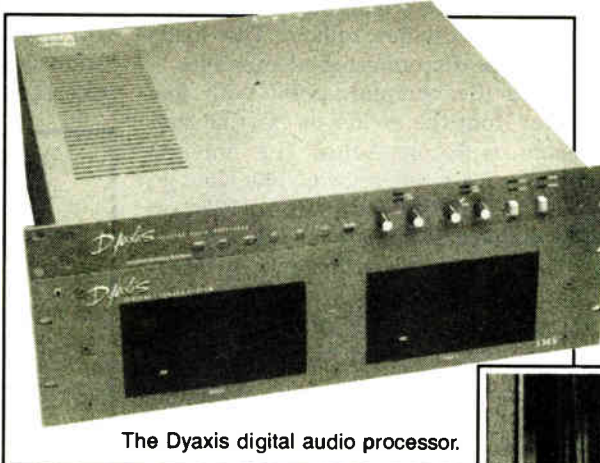
However, Drummond's initial experience with digital audio editing was not without problems. As a contributor of programming to National Public Radio, the professor decided to edit a news report, and later a documentary, on the Dyaxis.

"I didn't understand how to correctly record digital levels, things like that," he

said. "Digital is very different than analog. In digital there is no such thing as distortion. You go over and you get a click or a buzz."

Drummond blamed his problems on his own inexperience with digital audio coupled with poor documentation for the Dyaxis software.

"The documentation with Dyaxis is inadequate for anybody. It addresses none of these things," Drummond said. However, the professor said, Dyaxis and his local dealer compensated for the problems with excellent telephone support. "They walked me through some of the problems."



The Dyaxis digital audio processor.

As a result of the documentation problems, Drummond has delayed using the Dyaxis in classes and is writing a book for students on the operation of the Dyaxis and digital recording techniques.

Starting in the fall, students in his "Radio Reporting" class will use the new instruction book and produce a 30-minute radio news magazine each week with the Dyaxis.

Students will record material in the field on analog cassette, do rough cut analog edits on Otari or Tascam reel-to-reel decks and perform their final edit on the Dyaxis.

IMS's Kearby, a former college teacher himself, disagreed with Drummond's contention that Dyaxis documentation is poor and said he will offer the company's help in the writing of the manual for students.

## New software at NAB

More "user friendly and efficient software" is Paul Schafer's goal as his automation system undergoes some design improvements.

Recently purchased by the Texas-based Houston R&D, Schafer Digital will introduce the new software at the NAB show and give a free upgrade to all existing customers.

Twelve broadcast stations—including one in Holland that covers 15 countries—are currently about to go on the air with the Schafer system, he said.

However, two of Schafer's radio station customers told *Radio World* that due to software problems they won't put their systems on the air until the new software is released.

"I've seen the hardware work, and it works well," said John Kennedy, CE at WSSG in Boston. "But there are problems getting the software ironed out."

The station purchased Schafer's \$25,000 Digsat One system, designed for satellite affiliates.

Schafer's largest system, installed at Sacramento's KCTC, is also off the air due to software problems.

"I've seen enough and heard enough from other people to realize it has some glitches that need to be worked out," said KCTC Operations Manager Dean Cull. "We have a well-operating radio station, and I'm not in a hurry to make the transition until I'm comfortable."

When the \$60,000 Schafer System is operational, the station will access its entire music library from it.

## Looking ahead

Despite the problems, neither Kennedy nor Cull was critical of Schafer's company and both expressed optimism that once the software glitches are fixed the systems will enhance the quality of their stations.

Schafer promised the release of interim software fixes in mid-February that will make all systems operational.

"The software was not as good as it could be, but that problem will be resolved soon," Schafer said. He said a major installation in Amsterdam, Holland, has been operating successfully for



The Dyaxis digital desktop workstation

several months with the current software.

On the future impact of Desktop Audio technology, Professor Drummond asked a question: "What does this technology imply for the division of labor between producers and engineers?"

"I consider myself a producer, but I'm doing engineering work with this device. It merges functions. People on the engineering side are going to become more like producers and producers are going to have to become more like engineers."

"And one more thing, I'm not convinced the Dyaxis is faster than the old analog methods," Drummond added. "Because you have so much power to achieve perfection, you tend to try for it. In the old days I would get my actualities together, make my splices and go to the studio. I'd have a certain amount of studio time, take my chances and come out saying this is the best I can do under the circumstances."

"With the Dyaxis, there is no such thing as a final edit. You can always fool around with it and you tend to do it. You tend to spend more time with it."

For information from Integrated Media, call 415-326-7030; Schafer Design, 619-456-8000, and Bill Drummond, 415-642-5710.

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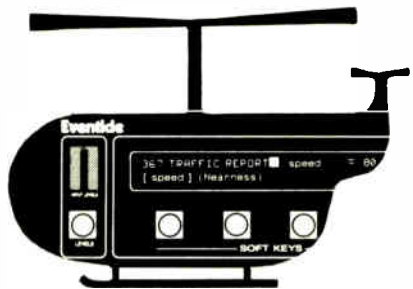
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# Many Digital Audio Interfaces

(continued from page 30)

whereby various kinds of consumer digital audio equipment will/will not talk to one another digitally.

Subsequently, the Electronic Industries Association of Japan (EIAJ) decided to define a ratified interface standard that would cover both professional and consumer applications. The AES/EBU format became known as the CP-340 Type I standard, while the DAT Conference format became the basis for CP-340 Type II.

Because, in the interim, several manufacturers developed equipment with the original CD digital interface

use of isolating transformers for digital transfer in every other respect; the AES format is identical to the EBU-implemented version.

CP-340 Type II makes use of the same 32-bit word format, but different electrical characteristics (unbalanced, 75 ohm, 500 mV levels), connector (female RCA-type phono connector, or similar) plus differences in the data carried in certain bit sequences too obscure to enter into here.

For all intents and purposes, a properly configured AES/EBU-format digital output will drive a CP-340 Type II-format digital input. The reverse will

Type II ins/outs, but you never know in this business. One anecdote, however, might serve as an example of the type of frustration that can ensue.

The Sony PCM-2500 professional DAT machine—and the consumer-grade DTC-1000 from which it is derived—carry PNO information in the digital bitstream from machine to machine, so that digital copies of DAT tapes made with 2500/1000 decks contain the same PNO/Start ID information.

Other brands of DAT machine, however, because they might implement CP-340 Type II interfaces—even though they are often labelled in the brochure as "S/P DIF" or even "CD/DAT Format"—do not necessarily recognize some of the information that Sony includes in the 32-bit data word and, as a result, ignore it!

In reality, the differences between the various consumer-type digital interfaces can be likened to the situation we currently face with video terminals.

Although every manufacturer has tacitly agreed on the definition of the 127 ASCII 7-bit codes, not every terminal has to implement them!

In other words, even though we have agreed on a common interface language, the methods in which they are used—and whether we offer them in all models—are up to each individual firm building such devices.

## Yet another interface

MADI, or Multichannel Audio Digital Interface, is a variant of CP-340 Type I that has been proposed and developed by Mitsubishi, Neve, Solid State Logic and Sony Broadcast.

It allows 56 channels of digital audio to be multiplexed on a single BNC-terminated cable over distances up to 150 feet.

Using an internal data structure identical to the AES/EBU-format, certain bits are reserved in the MADI format to identify channel number, left/right designation and other critical parameters.

Of possibly greater importance to users of large multichannel production consoles, multitracks and editing systems, MADI will nevertheless be of vital significance for broadcasters of the future to link together digital production centers and for cost-effective interconnecting of multichannel studio hardware.

## Proprietary info

Finally, the Japanese manufacturers, Mitsubishi Electric Corporation and Yamaha Corporation use proprietary digital interface schemes on certain of their products.

The Mitsubishi X-86 stereo and X-400/850/880 series multitrack decks feature a pair of Dub In and Dub Out multiway connectors that carry multichannel digital data, while the Yamaha DMP7/7D digital mixers and various effects processors come with BNC, 5-pin DIN, multiway and/or XL-type connectors that carry stereo or multichannel data between units.

Yamaha also manufactures a range of interface units that will very efficiently handle conversions between practically all of the currently used digital schemes.

The Model IF3 interface, for example, enables the output from four SDIF-2 digital pairs (a quartet of Sony PCM-1610/1630 digital audio processors, for example) to be connected directly to a DMP7D digital console.

All in all, with a little care and attention to some new details and an appreciation that not all hardware manufacturers interpret the standards in quite the same way, broadcasters can quickly come to terms with the ways of digital.

Next time: disk-based recorders and random-access editing systems in the broadcast environment.

■ ■ ■

*Mel Lambert has been intimately involved with the production industries on both sides of the Atlantic for the past decade and for seven years served as editor of Recording Engineer/Producer magazine. He is currently president of Media & Marketing, a consulting service for the professional audio industry and can be reached at 818-753-9510.*

## What we have at the moment are around half-a-dozen or so reasonably well-established digital interface standards.

format—also often referred to as the S/P DIF interface—an appendix to CP-340 was written to define the ways in which early and later versions of the consumer-grade interface might work with one another.

## For professionals

The AES/EBU or CP-340 Type I interface is intended to cover pro-audio applications, and specifies, among other parameters, the connector to be used (3-pin male/female XL-types), differential, 110 ohm impedance and 3-10 V signal levels, plus the data configuration, including standardized bits to be placed in the 32-bit digital "word."

This basic building block for CP-340 interfaces comprises a 4-bit synchronizing preamble plus channel ID, a 24-bit data word—with the first eight bits set to zero for current 16-bit PCM systems—followed by four special bits for parity checking and other uses.

In Europe, the EBU has specified the

never be true, however, simply because a Type II output has insufficient drive level to open up a Type I input.

More confusion exists, however, when we consider the S/P DIF interface featured on most consumer-grade DAT and CD players, in addition to several digital mixing consoles and effects units.

In basic terms, S/P DIF differs from CP-340 Type II in the definition and potential use of bits within the first byte of the digital data.

## Sorting out confusion

It all gets rather complicated, but the bottom line is that S/P DIF digital interfaces are proprietary to Sony and Philips equipment and, if featured on other hardware, you need to check with the manufacturer to discover how it has been implemented and whether it is intended to be compatible with CP-340 Type II interfaces.

In most cases, you will run into few problems mixing S/P DIF and CP-340

# Reviving Radio Liberté

(continued from page 17)

Liberté's FM, a new dimension in broadcasting in Haiti, made its professional sound quality debut.

An old Haitian voodoo priest who was watching the performance of the foreigners declared, "The spirit of the mountain was with them while they were working."

On Sunday, back downtown at the Radio Liberté AM transmitter site, Bob and Buddy checked out the distorted on-air sound coming over 1360.

They found that the 300' tower had been installed too far away from the transmitter, causing a power loss.

Since it was almost time for the two engineers to return to their US business, Buddy could only note that problem in his report. They had just enough time before leaving, however, to tune the AM transmitter and the AM Optimod.

## Job well done

The car radio emitted a brand new AM sound as Bob and Buddy took the airport road en route to the plane back to South Carolina.

At the airport, Bob and Buddy's driver, "Speedy," a well-known local personal-

ity, said, "This is the first time I saw two people come to Haiti and work during their entire visit, from arrival to departure. You are ruining the reputation of the island!"

Bob and Buddy had to promise they'd touch base at home and fly back as soon as possible. A small vial of Haitian earth was given to them to seal the agreement of a prompt return.

As the two were airborne, Serge Beaulieu was on the airwaves thanking them for their contribution in bringing LS Radio Liberté to full sound, and special thanks were extended to South Carolina for loaning Haiti its hometown men.

For Bob and Buddy's diligent work, Radio Liberté 94.1 FM and 1360 AM, played a country music simulcast all night long on November 20, the date of their departure.

■ ■ ■

*Serge and Sondra Beaulieu are on the board of the Caribbean Network System. Any experienced person interested in the position of Assistant Manager or Business Manager of Radio Liberté can contact Linda Baker, Traffic Manager, Caribbean Network System, 60 Brandon Avenue, Wayne, NJ 07470 at 201-894-8098.*

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# Broadcast Equipment Exchange

"Broadcast Equipment Exchange" accepts no responsibility for the condition of the equipment listed or for the specifics of transactions made between buyers and sellers.

## AMPLIFIERS

### Want to Sell

**BGW 75**, gd cond, \$200/BO. P Wolf, WCOO, 106 New Market Rd, Immokalee FL 33934. 813-574-5548.

**Stanton 310B** stereo phono preamp, like new, \$190; Radio Systems dist amp, 8 stereo out, 16 mono out, like new, \$300. D Clarke, 3682 N Sierra Way, San Bernardino CA 92405. 714-882-8103.

**KLH 35** stereo amplifier & tuner, less speakers, \$25. P Russell, Bowdoin College, AV Services Sills Hall, Brunswick ME 04011. 207-725-3066.

**KLH 35** stereo amplifier & tuner, less speakers, \$25. P Russell, Bowdoin College, AV Services Sills Hall, Brunswick ME 04011. 207-725-3066.

**Ramko SMA-1000E** monitor amp, \$75; Stanton phono 310, \$150 ea. Clark B, WFAS, Secor Rd, Hartsdale NY 10530. 914-693-2400.

**Spotmaster DA** amps, \$75 ea. B Roberts, ARP Studios, POB 325, Mt Pleasant SC 29465. 803-928-3663.

**McIntosh C26** preamplifier, solid state unit in mint cond, \$500; McIntosh MC2105, solid state power amplifier 105 watts per chnl, mint cond, \$600. W Konetsko, 135 A Victoria Cover, Greenville NC 27834. 919-355-3079.

### Want to Buy

**EICO HF89**, HF85 stereo amps; HH Scott 299D amps; GE AI-320 amps; CCA/QRIT ultimate turntable pre-amps, any cond. K Smith, RR 3 Box 483A, Gorham ME 04038. 207-929-6129.

**RCA amps** monitor or booster. B Davies, Virgo Prod, 5548 Elmer Ave, No Hollywood CA 91601. 818-761-9831.

## ANTENNAS & TOWERS

### Want to Sell

**Dielectric DCRH2** 2 bay on 98.3, 7 yrs old, \$1100; Altronic 5715 15 kW dummy load, water cooled, 1-5/8" flange, \$450. JA Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

**Guyed Utility type tower**, 200', 3 sided, tubular legs, galvanized, 18" face, painted, on the ground. H Greenberg, KMAS, POB 760, Shelton WA 98584. 206-426-1030.

**LNR 210' Starpoint** on ground, galv & painted, BO. J Schloss, KICD, 2600 Hiway Blvd, Spencer IA 51301. 712-262-1240.

### Reconditioned

**American 50-B Two Drum Hoists**. Specially set up for tower erection... \$8500 each, FOB: Suffolk, VA. We buy, sell and lease erection equipment. Also used guyed & S.S. towers in stock.  
**Call Southern Tower Service Co., Inc.**  
804-539-8365.

**Cablewave FCC 78 50J 155'** of 7/8" heliex, in two pieces of 75' ea, BO. M Black, WEOS, Hobart & William Smith College, Geneva NY 14456. 315-789-8970.

**Celwave power divider** 1, 3-1/8 input port by 8, 1" output ports (2), never used & capped, \$2500 plus shpg. B Roberts, ARP Studios, POB 325, Mt Pleasant SC 29465. 803-928-3663.

**Celwave 2-bay** tuned to 103.1, used less than 4 yrs, heaters included, \$1000. D Manca, WTOJ, 199 Wealtha Ave, Watertown NY 13601. 315-782-1240.

**ERI 2 bay**, tuned to 103.9, 3.5 yrs old, taken out of srvs 11/88, BO. R Eller, KBUS, 2775 NE Loop 286, Paris TX. 214-785-1068.

**ERI LPC-11** FM antenna, 106.7 MHz by low power w/radomes, max output 50 kW, max input 9.5 kW, make offer. J DeGroot, WKPK, POB 190, Gaylord MI 49735. 517-732-2474.

**Jampro 2 bay** 103.9 w/heaters, \$700. Clark B, WFAS, Secor Rd, Hartsdale NY 10530. 914-693-2400.

**Phelps-Dodge 12 bay**, 300', utility tower w/deciders tuned to 101.1; 250' 3-1/8" flex line avail approx 1 Mar 89; Harris SX-1A, fire damaged, repairable or many usable parts; also SX-1A spare parts kit; RCA BTA-500R AM xmtlr for parts. John or Mike, KMZU, 102 N Mason, Carrollton MO 64633. 816-542-0404.

**Phelps Dodge 2-bay** (2), avail now, \$1000 ea. D Brown, KMCD, 57-1/2 Court St, Fairfield IA 52556. 515-472-4191.

**Shively 1413-1**, 4-1/8" x 20" rigid coax line, 520' (26) sections, \$250 per section, gd cond. J Pollet, WRNO, 4539 I-10 Serv Rd, Metairie LA 70006. 504-889-2424.

**Dielectric coaxial switcher**, 3 ports, 1-5/8", 10 kW description, negotiable. C Harrison, Boise Viking Assoc., 5601 Cassia St, Boise ID 83706. 208-344-3511.

**Four Bay ERI FM-CP**, medium power, near Joplin MO, \$2500. B Dodge, WTUJ, POB 105FM, Hinsdale NH 03451. 603-336-5848.

**Phelps-Dodge 2-bay antenna** set up, tuned to 88.3 MHz FM, foam filled, BO. Pat Layman, WEAX, Stewart Hall, W Park St, Angola IN 46703. 219-665-3314.

**RCA 51.5 ohm solid transmission line**, 20' sections, sweep 1's. K Dick, WVVA, R460 By Pass, Bluefield WV 24701. 304-325-5487.

**Scully PR 450-U** (2), 4 yrs old, call. J Evans, KNTI, 75 Fourth, Lakeport CA 95453. 707-263-1551.

**Truscon solid rod guyed**, insulated steel tower, 300', 48" face w/60' top mounted pole. Galvanized & painted, lighting, \$13,000. B Glasser, WHBC, POB 9917, Canton OH 44711. 216-456-7166.

**Zenith 3 phase automatic transfer switch**, never used, rated 30 kW, \$500. K Dick, WVVA, R460 By Pass, Bluefield WV 24701. 304-325-5487.

### Want to Buy

**ERI circularly polarized G5C PM Series**, 4-6 bays, MCD power 96.7 MHz. J DeGroot, WKPK, POB 190, Gaylord MI 49735. 517-732-2474.

**Scala FM HDCA-5** or equiv antenna, tuned near mid-band, closer to 100.3 the better, buy or trade. B Harris, KMJI, 5350 S Roslyn #210, Englewood CO 80111. 303-741-5654.

**360' tower to support** 3 to 4 bay FM antenna & 3 to 40 LPTV chnl 6 antennas. D Jordan, WDTM, POB 3417, Jackson TN 38303. 901-668-1153.

**5 Bay FM antenna** at 91.5 MHz & 5 bay antenna at 88.3 MHz for educational FM. K Hill, WHCB, POB 2061, Bristol TN 37621. 615-878-6279.

**Phelps Dodge/Celwave CP1000-4** radome needed for FM antenna. M Black, WEOS, Hobart & William Smith College, Geneva NY 14456. 315-789-8970.

**10 Bay FM CP antenna** for 98.5 MHz, 20 kW deciders needed. B Dodge, WTUJ, POB 105FM, Hinsdale NH 03451. 603-336-5848.

## AUDIO PRODUCTION

### Want to Sell

**Nagra stereo IV-SL** x-tal, incl, WSGX, ATN-2 & leather case, mint cond, sale by original owner, \$7500. Julius, 718-961-4469.

**Harris (Audiotronics) M-90** stereo/audition/mono mixing console, \$3000; Harris/ITC 3 deck cart player, mono, \$600; ITC RP cart recorder, mono, \$400; MCI/Sony JH-110B R-R, \$3000; Gentner SP-4 telephone interface, \$375; in custom formica covered cabinet, sold separately or as package for \$6000. J McNally, KXBS, 9400 N Broadway, Oklahoma City OK 73113. 405-478-4499.

**Symetrix 528** mic processor, like new, \$600. D Clarke, 3662 N Sierra Way, San Bernardino CA 92405. 714-882-8103.

**Telex CS-90** Sportscaster headsets, 3 work, 1 for parts, all need new ear pads, all do work, \$100/all plus shpg. M Rockwell, WNBI, Box 309, Park Falls WI 54552. 715-762-3221.

**Allison Research Kepex 500** w/LX-100 power supply, \$150/BO. K Smith, RR 3 Box 483A, Gorham ME 04038. 207-929-6129.

**Ampex 350 electronics**, fair to gd cond, 4 chnl, \$150/all; Remote trailer, 16' w/quadr-eight console, A.C. distro & isolation transformer, 24 trk, ready, \$7600/bo; Ursa Major space station, digital reverb delay processor, vgc, \$300/BO. B Patruzzi, Rouse Street Prod, 804 Old Hickory Blvd E, Madison TN 37115. 615-868-8516.

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**E'entide H969** harmonizer, \$2250. G Spaniola, Seller 5nd St, 5014 Peekskill, Sterling Heights MI 48310.

**Rane ME-15** stereo graphic EQ, 2/3 octave, absolutely mint, \$250. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

**Shure M63** audio master EQ, companion to M67 remote broadcast mixer, fair cond, \$50. D Sites, 5809-K Cambridge Dr, Springfield VA 22152.

**Shure M68** microphone mixer, 6 chnl, \$75. M Skinner, Color County Bdctg, 341 So Bluff St, St George UT 84770. 801-673-1450.

**Shure M68** microphone mixer, 6 chnl, \$75. M Skinner, Color County Bdctg, 341 So Bluff St, St George UT 84770. 801-673-1450.

**Teac** 4 chnl mixing board, vgc, \$175. W Dougherty Jr, WLD Recrdg, Music Valley Rt 1, Mill Spring MO 63952. 314-998-2377.

**Texar Prisms** (2) w/manual, \$2500. S Karwan, KCMJ, 619-320-6818.

**Orban 245E** stereo synthesizer, BO. J Corcoran, KWWW, POB 638, Wenatchee WA 98801. 509-662-7135.

**Orban 8100A** Optimod in gd cond, \$3500. R Price, KWIK, Box 998, Pocatello ID 83204. 208-233-1133.

**Orban 245F** stereo synthesizers (2), brand new, unused, current model, \$250 ea. Call Steve 303-499-5533 after 6PM, MST.

### Want to Buy

## WANTED: PULTEC EQ'S

We will pay \$1,000 for almost any Pultec program EQ models EQP1/EQP1A/EQP1A3.  
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Also wanted: EQH2/EQH3/MEQ5/MAVEVC/MB1/ITI & SONTEC EQ's/ any tube or ribbon mics and limiting amps.

Call or write to:  
**Dan Alexander Audio**  
2944 San Pablo Ave  
Berkeley, CA 94702  
(415) 644-2363  
FAX: 415-644-1848

**Phase chaser**. D Brown, KMCD, 57-1/2 Court St, Fairfield IA 52556. 515-472-4191.

**Orban 8000A** & 8100 stereo processors wanted. Cash paid. Please call for quote. Jon Hall, Hall Electronics, POB 7732, Charlottesville VA 22906. 804-977-1100.

## AUTOMATION EQUIP.

### Want to Sell

**Gates SC-48** programmer (parts); (2) Gates motor driven faders; Gates time pulse gen. R McDaniel, KJRG, 209 Meridian, Newton KS 67114. 316-283-5150.

**SMC DPI**, (2) Revox decks, (2) Otari decks, (9) Carousels, (3) single play time announce, switcher, brain, sell all or by piece. B Hicks, KBAT, 3306 Andrews Hwy, Midland TX 79705. 915-697-7300.

**SMC ESP1** fully equipped, (4) Carousels, Instacart 24 tray, (4) R-R Revox, (2) dual cart players, delay recorder for network, excel cond. R Monroe, KKTX, Kilgore St, Kilgore TX. 214-984-2001.

**Broadcast Products & SMC AR-2000B** automation system, controller, (6) Carousels, power supply & tape reader. Includes clock & racks, working, \$3500. J McDonald, Wind River Group, Box 481, Broomfield CO 80020. 303-669-3442.

**IGM Go-Card 24**, 3 yrs old, 300 hrs, like new, all manuals & hardware, \$1000; Sono-Mag 24 tray Carousel, rebuilt 1985, less than 300 hrs use, vgc, \$700. M Crouch, WCHE, 119 W Market St, W Chester PA 19382. 215-692-3131.

**IGM Go-Card 24**, 3 yrs old, 300 hrs, like new, all manuals & hardware, \$1000; Sono-Mag 24 tray Carousel, rebuilt 1985, less than 300 hrs use, vgc, \$700. M Crouch, WCHE, 119 W Market St, W Chester PA 19382. 215-692-3131.

**Kohler automatic transfer switch**, solid state, 70 amp single phase. J Lackness, KRIA, 512-828-3737.

**SMC Mini-Pro System programmer**, 350RS Carousels, (2) RSC-100 Carousel programmers & (2) racks, excel cond, perfect for Satellite. J Bassett, 8787 San Pedro Way, Elk Grove CA 95624. 916-686-6613.

**SMC Mini-Pro System programmer**, 350RS Carousels, (2) RSC-100 Carousel programmers & (2) racks, excel cond, perfect for Satellite. J Bassett, 8787 San Pedro Way, Elk Grove CA 95624. 916-686-6613.

**Sono-Mag MSP1** automation control head, 2000 event random access, \$3000; Sono-Mag 450 (2) bi-directional mono Carousels, \$1600 ea. W Hanlon, WKFD, 19 Updyke Ave, N Kingstown RI 02852. 401-295-8808.

**Sono-Mag MSP1** automation control head, 2000 event random access, \$3000; Sono-Mag 450 (2) bi-directional mono Carousels, \$1600 ea. W Hanlon, WKFD, 19 Updyke Ave, N Kingstown RI 02852. 401-295-8808.

**Harris SC-90 controller**, numeric logging, console & power supply, SMC 250 RS Carousel w/interface, BO. B Glasser, WHBC, POB 9917, Canton OH 44711. 216-456-7166.

**IGM Basic A-R-R** cards. E Kazmark, KAPA, 2065 Ocean, Raymond WA 98577. 206-875-5551.

**Otari ARS-1000 R-R** playback decks (2) for automation systems, vgc, \$700 ea/BO. C Gustafson, WKZO, 590 W Maple, Kalamazoo MI 49008. 616-345-2101.

**SMC DS-20 switcher**; DP-2 Brain; PDC-3A clock; RAC-20 remote control; (3) TS-20 tone sensors; 250 Carousel w/random select adaptor; 350 Carousel; (4) 710 cart decks; (3) ITC 750 R-R decks; Scully 270 R-R deck. Darcey Christianson, KATE, 507-373-2338.

**SMC 450** mono bi-directional Carousel (2), \$1625 ea or \$3250/both; SMC MSP-1 2000 event automation control head (RAM), \$3200. W Hanlon, WKFD, 19 Updyke, N Kingstown RI 02852. 401-295-8808.

**SMC Mini-Pro controller**, (3) 350RS SMC Carousels, (2) RSC-100 Carousel programmers, (2) racks, excel cond, \$6200 FOB Yuma AZ. J Bassett, 699 S Avenue B, Yuma AZ 85364. 916-686-6613.

**Sono-Mag SMC TS-25** dual channel 25 Hz tone detector, brand new, BO. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

**Systemation including**: (9) Teac V530X cassette decks, Commodore 64 computer, monitor, printer, rack, \$8000. D Rose, KAAA, POB 3939, Kingman AZ 86402. 602-565-3664.

### Want to Buy

**Satellite automation system** in bold face & Carousels & instacarts. B Romeijn, KJNO, 3161 Channel Dr Ste 2, Juneau AK 99801. 907-586-3630.

**Satellite automation system** in bold face & Carousels & instacarts. B Romeijn, KJNO, 3161 Channel Dr Ste 2, Juneau AK 99801. 907-586-3630.

**Carousel 360**, need complete set of circuit cards. D Rose, KAAA, POB 3939, Kingman AZ 86402. 602-565-3664.

**SMC DP-1** automation brain wanted in working cond for spare parts. G Peterson, KIMM, POB 8205, Rapid City SD 57709. 605-348-1100.

**SMC MSP-12** satellite automation or similar set-up. C Young, WAYX, 1600 Carswell, Waycross GA 31501. 912-283-1230.

## CAMERAS (VIDEO)

### Want to Sell

**Hitachi-Shibaden FP-1500 U** w/control unit, needs work but works, w/schematics, \$500. N Metzger, 312-989-1101.

**Hitachi KP-C100** color chip w/16mm auto iris lens, \$425. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

**ITE H2** tripod head, excel cond, \$250. M Murphy, 11621 Valle Vista, Lakeside CA 92040. 619-561-2726.

**Sony HVC-2400** Tricon color camera, case, HVA-200 AC adapter, zoom lens, 25' extension cable, mint cond, \$600/BO. T Steele, Steele Comm, 1697 Broadway Rm 1404, NYNY 10019. 212-265-5563.

### Want to Buy

**Rear lens controls** for Fuji 14:1, 16:1 lens, both focus & zoom, Cannon 12:1 also. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

**Rear lens controls** for Fuji 14:1, 16:1 lens, both focus & zoom, Cannon 12:1 also. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

**Dumont camera chain** & related equipment; also old image orthicon & iconoscope tubes. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

**Manual for Sony DXC5000BP** color studio camera. S Shumate, WVIR, POB 769, Charlottesville VA 22902. 804-977-7082.

## CART MACHINES

### Want to Sell

**Gates Criterion mono PB & Tape** 600RP, mono RP, gd cond, both working, \$225/both. M Meyer, WWCK, 3217 Lapeer, Flint MI 48503. 313-744-1570.

**ITC PDQ Series**, (4) mono. C Mandel, KAMP, Box 1018, El Centro CA 92244. 619-352-2277.

**ITC 3 pack w/tones** & ITC splice finder, excel cond. J Kiefer, 904-787-6404.

**ITC 3D mono cart deck** (2), 1 w/record amp, 3-tone; Nidec 3D motor gd/used; Spotmaster 505B mono cart PB. M Sequin, WVMT, POB 6200, Colchester VT 05446. 802-655-1620.

**UMC Beaucart R/P** w/motorized head azimuth-stereo w/spare heads, \$1600. E Kain, WNOE, 529 Bienville, New Orleans LA 70130. 504-529-1212.

**AudiCord twin transfer record/play** mono, BO. R Meadows, Southeastern Sports Prod, 3216 Granleigh Dr, Tallahassee FL 32308. 904-893-7808.

**Gates Criterion 80 R/P**, new heads & motor, mono, perfect cond, \$600; Gates Criterion 80 rec amp, stereo, gd, \$300. P Morton, WRQL, POB 57, Rupert VT 05768. 802-394-7858.

**ITC SP** w/rack mount, \$800; ITC RP w/delay & all tones, \$1400; Gates Criterion, \$300 ea; Gates Criterion rec amps, \$200 ea. Clark B, WFAS, Secor Rd, Hartsdale NY 10530. 914-693-2400.

**ITC 3-D**, (2) ITC 3-D triple deck, mono, \$1500 ea; (2) ITC WRA record amps, \$550 ea, mono, all equipment in gd cond w/manuals & in service. D Doelitzsch, WDDO, One Broadcast Center, Marion IL 62959. 618-997-8123.

**RCA RT-7, BA-7**, several players & record amps & one 4 place cabinet for above, repairable cond, BO. R Meyers, Benchmark Comm Corp., 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

**Audiopak AA-4** (96) brand new, never out of case, 6.5 minutes, negotiable. C Harrison, Boise Viking Assoc., 5601 Cassia St, Boise ID 83706. 208-344-3511.

**ITC 99BRPSE**, excel cond, \$3500. T Gaiser, KUZZ, 3223 Sillect, Bakersfield CA 93308. 805-326-1011.

**Rapid Cue 1 R/P**, 2 P/B, make offer. L Houck, Rolin Recording, 210 Altgelt, San Antonio TX 78201. 512-736-5483.

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 WE 111-C repeat coils, excel cond, \$50 ea. J Martin Newman, Box 7703, Atlanta GA 30357. 404-876-8623.

Moseley PCL-101 discrete STL's (2), recent vintage, gd cond, \$2000 ea or \$3000/pr. P Morton, WRQL, POB 57, Rupert VT 05768. 802-394-7858.

Satellite reception system for Transtar Format 41. Includes Wegener 1601 mainframe & pwr supply, 1610-01 7.44, 1610 7.04 demodulators, 1608-23 RF, 1689-04 IF downconverters, 2046-07 comm & control module, (2) 1644-02 relay interfaces, Colorado Magnetics NS200B audio cart switcher & all instruction manuals. Used for just over 1 yr, make good offer. J Hansen, KDMG, 100 Court Ave, Ste 103, Des Moines IA 50309. 515-282-1033.

Equatorial/MPI, complete UPI satellite news setup including dish/LNA, controller & printer, gd cond, BO. G Peterson, KIMM, POB 8205, Rapid City SD 57709. 605-348-1100.

Harris 6528 satellite rcvrs, vgc, have approx 60, will make deal on package, \$1000 ea/BO. R Dietterich, WAMO, 411 7th Ave, Pgh PA 15219. 412-471-2181.

Modulation Assoc., analog satellite rcvr, make offer. J Evans, KNTI, 75 Fourth, Lakeport CA 95453. 707-263-1551.

Moseley SC88 subcarrier generators, 67 kHz, 185 KHz. Brand new, \$900; Moseley SC2, 185 KHz, brand new, \$900. J Evans, KNTI, 75 Fourth, Lakeport CA, 95453. 707-263-1551.

Moseley PCL 2B dual STL system, (2) xmtr, (2) rcvrs, you ship, \$2500/BO. R Dietterich, WAMO, 411 7th Ave, Pgh PA 15219. 412-471-2181.

Moseley PBR-30A 30 chnl rem ctrl w/2 studio terminals, working when removed, will work duplex or simplex, \$500 as is. C Gustafson, WKZO, 590 W Maple, Kalamazoo MI 49008. 616-345-2101.

Regency FM mobile radios, 25 watt, (4) \$75 ea. J Phillips, WZOM, 414 Washington, Defiance OH 43512. 419-782-6986.

Terracom TCM 601F microwave receiver, gd cond, w/case, \$2200; ITT/Federal MIL Spec. ptble microwave 12 line phone/telegram sys, gd cond, \$7800. M Murphy, 11621 Valle Vista Rd, Lakeside CA 92040. 619-561-2726.

**Want to Buy**

Comrex LXT or Gentner single line encoder. M Black, WEOS, Hobart & William Smith College, Geneva NY 14456. 315-789-8970.

Fairchild Dart 384, 7.5 kHz or 15 kHz audio chnl cards. T Hughes, KJDJ, 1160 Marsh, San Luis Obispo CA 93401. 805-541-3031.

Receiver to pick up ABC entertainment news. D Jordan, WDTM, POB 3417, Jackson TN 38303. 901-668-1153.

STL for video service. AACT Inc., 156 Lazelle Rd, Worthington OH 43085. 614-846-9234.

Telephone lines only. J Foust, WXEE, Box 1340, Welch WV 24801. 304-436-4191.

Ampex 400B remote control. C Wilson, Mongo Video, 13123 Moldridge Rd, Wheaton MD 20906. 301-949-1809.

Scientific-Atlanta digital audio terminal power supply. C Gustafson, WKZO, 590 W Maple, Kalamazoo MI 49008. 616-345-2101.

Stereo STL system. B Dodge, WTJ, POB 105FM, Hinsdale NH 03451. 603-336-5848.

**STATIONS**

**Want to Sell**

Wanted AM, AM-FM Combo or FM in VA, WVA, Maryland or PA if right down & terms. Reply in confidence, all replies will be answered. Brokers welcome. Write to: Radio World, POB 1214, Falls church VA 22041. Attn: 2-3-89RW.

Class A CP on edge of market \*52, great coverage potential, but lost xmtr site, will sell w/equip for my expenses. P Morton, WRQL, POB 57, Rupert VT 05768. 802-394-7858.

**FM CP's WANTED**

Clients seek CP's any size market. Small, medium, large. Will consider FM upgrades, too!

**Media Market Brokers**

Don Nahey  
1-404-323-8081

Combo AM 1 kW, FM Class A, 3 acres, au-to, retiring, priced to move fast, 3 bdrm hom avail. P Robillard, Robillard Comm, 1803 N 1st East St, Haynesville LA 71038. 318-624-0105.

Wanted AM, AM-FM Combo or FM in VA, WVA, MD or PA if right down & terms. Reply in confidence, all replies will be answered. Brokers welcome. Write to: Radio World, POB 1214, Falls church VA 22041. Attn: 2-3-89RW.

Will sell up to 45% of 10 kW AM under construction in Southwestern Montana. Station will serve Bozeman, Butte, Helena, Dillon & Livingston, plus Northeast Idaho & Yellowstone Natl Park. Also unopposed FM application for Class C now before FCC. Golden Empire Bdcg, POB 483, Belgrade MT 59714.

**Want to Buy**

Looking for AM, FM or CP in east for right price/terms. H Kozlowski, 703-631-0197.

Looking for AM, FM or CP in east for right price/terms. H Kozlowski, 703-631-0197.

**STEREO GENERATORS**

**Want to Sell**

Harris MS 15R, stereo gen, overshoot, base-band limiter, \$400/BO. P Wolf, WCOO, 106 New Market Rd, Immokalee FL 33934. 813-574-5548.

Collins 786W-1 plug in SCA generator for Collins 310Z-1B, 310Z-2, & Continental 510R-1 exciter, \$500. S Keating, 17029 Devonshire #150, Northridge CA 91325. 818-363-6064.

CRL stereo generator, excel cond, \$900; BE stereo generator, gd cond, \$500. P Morton, WRQL, POB 57, Rupert VT 05768. 802-394-7858.

Wilkinson SG1E stereo generator. E Kazmark, KAPA, 2065 Ocean, Raymond WA 98577. 206-875-5551.

**Want to Buy**

Gates M-6146 for use with 6095 exciter. K Smith, RRR 3 Box 483A, Gorham ME 04038. 207-929-6129.

**SWITCHERS (VIDEO)**

**Want to Sell**

CDL VSP-860 switcher, 20 inputs, 2ME, BKGD, 24 patterns, joystick, cable, Cox Chromakeyer, \$3500/BO. Steve, Box 10673, Denver CO 80210. 303-399-6444.

Panasonic AS-6100, 10 input, effects bank, DSK, w/AS-1000 sync gen & AS-2000 chromakeyer, \$1200. Aldon Video, 424 Commerce Ln, Berlin NJ 08009. 609-768-2439.

**TAPES, CARTS REELS**

**Want to Sell**

NAB reels, 10.5" metal 1/4", all in gd cond, 1-10, \$1.50 ea, 11-100, \$1.25 ea, 100+, \$1 ea. Falk Recd Svcs, 7914 Fegenbush Ln, Louisville KY 40228. 502-239-1010.

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Aristocarts, approx 1000 w/AC format music, for programming or refurbishing. M Forrester, KYGL, 500 L St Ste 200, Anchorage AK 99501. 907-272-5945.

Carts (2000-2500), various lengths & makes, make offer. D Hartman, KLFE, 992 Inland Ctr Dr, San Bernardino CA 92408. 714-885-6555.

Complete 50-60 & 70-80 music library on cart, most in stereo. C Mandel, KAMP, Box 1018, El Centro CA 92244. 619-352-2277.

Fidelipac Master Cart, approx 500 carts, various lengths, excel cond, \$3.25 ea. P Tinkle, WCMT, POB 318, Martine TN 38237. 901-587-9526.

Fidelipac Mastercart II carts (500), gd cond, w/stereo music, \$1 ea/BO. P Wolf, WCOO, 106 New Market Rd, Immokalee FL 33934. 813-574-5548.

Marathon carts (300+), 40s, 70s, 100s, etc. \$250 for lot, plus shpg. C Osgood, WBNC, POB 2008, Conway NH 03818. 603-447-5988.

Records, 45s & 33s, mint cond, covering big band, swing, jazz, R&B, rock, blues, country, large collection, from 1920s to present. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

A-2 or AA-3 carts. Sell or trade for other equipment needs. JB Salizat, POB 3246, Laredo TX 79041. 512-722-6832.

Ampex & 3M used 2" & 1" tapes on 13" & 10.5" reels, \$20 ea; 3M bdcq quality video tape, \$10 ea. N Metzger, 312-989-1101.

Capitol HOLN (60) pancake 3600' hubs of HOLN A-3 cart recording tape, sold in any quantity, \$15/hub or BO. J Emmel, WWAX, POB 750, Olyphant PA 18447. 717-489-0005.

Fidelipac CTR124. J Lackness, KRIA. 512-828-3737.

Fidelipac master carts, (1000), 3.5 minutes, \$60 ea. add \$3 per 100 carts. D Peluso, KFM Radio, Las Vegas. 702-732-7753.

IGM Good Music Series, 30 14" reels 7.5 ips 2T stereo, gd music, \$30 per reel, delivered. F Anderson, 3801 Fifth Ave So, Great Falls MI 59405. 406-452-2810.

NAB reels, 10.5" metal 1/4", all in gd cond, 1-10, \$1.50 ea, 11-100, \$1.25 ea, 100+, \$1 ea. Falk Recd Svcs, 7914 Fegenbush Ln, Louisville KY 40228. 502-239-1010.

Several hundred 34" U-matic cassettes used w/new boxes, ready for new tape reload, BO. R Meyers, Benchmark Comm Corp, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

3M used 1" tape, 206 (6) full on reels, 208 (2) full, one on reel, other on hub, Ampex 406, partial on hub, \$10/roll or entire lot for \$75. E Helvey, POB 1357, Winchester VA 22601. 703-877-1191.

3M 1/2" tape, 206 (12) full, (2) partial hubs, 208 (1) full hub, Ampex 406 (1) full hub, \$5 per hub; (2) 1/2" metal 10" reels, \$3 ea. Entire lot, \$75. E Helvey, POB 1357, Winchester VA 22601. 703-877-1191.

ABCO Mdl 500 lazy susan cart rack, holds 500 carts, 6' high, 21" in diameter, gd cond, (2), \$400 ea. E Swanson, WZTR, 520 W Capitol, Milwaukee WI 53212. 414-964-8300.

Ampex, Maxwell brands, one lot of 59 KCA type video cassettes, BO. E Meier, Rt 4 Box 98, Washington NC 27889. 919-946-2461.

Capitol, Fidelipac, various lengths & recorded songs, \$1 ea. R Price, KWIK, Box 998, Pocatello ID 83204. 208-233-1133.

IGM pre-recorded tape, 30 reels 14 in 2 tr stereo, big band music, \$30 per reel in US. F Anderson, 3801 Fifth Ave South, Great Falls MT 59405. 406-452-2810.

Record collection, 45 RPM, Neil Diamond, Supremes, Beach Boys, etc. 1960-1980, approx. 500 records, make offer. C Zalewski, Eds Comm Svcs, POB 92, Johnson City NY 13790. 607-798-7111.

**Want to Buy**

AA4 carts, large selection needed. D Brown, KMCD, 57-1/2 Count St, Fairfield IA 52556. 515-472-4191.

Cart tapes needed, large quantity, any quality, preferably cheap. J Smith, WRDV, POB 2012, Warminster PA 18974.

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TAPES . . . WTB

Thesaurus, World & Associated 12" transcriptions by various instrumental artists. J Leon, Leon Recdg Std, POB 51, Jackson Hghts NY 11372. 800-221-0605 or 718-383-7212.

**TAX DEDUCTIBLE EQUIPMENT**

Eng student desiring donation of old bdct equip (anything)in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Christian Boarding School, (9-12) w/sat rcvr seeks VCRs/VTRs & related equipment for record, edit & download to 1/2" VHS or edu pgming. J Mann, Campion Academy SW, 42nd & Academy Dr, Loveland CO 80537. 303-667-5592.

Christian Boarding School, (9-12) w/sat rcvr seeks VCRs/VTRs & related equipment for record, edit & download to 1/2" VHS or edu pgming. J Mann, Campion Academy SW, 42nd & Academy Dr, Loveland CO 80537. 303-667-5592.

Church & Christian school desire sound reinforcement & audiovisual/video prod equip in working cond, tax deductible donations preferred. A Allegra, Calvary Baptist Church, 1380 Valley Forge Rd, Lansdale PA 19446. 215-368-4444.

College station needs donation or R-R, cart machines & other equipment. M Black, WEOS, Hobart & William Smith College, Geneva NY 14456. 315-789-8970.

Donation of equip to church, 34 editing recorders, playback units, audio & video. JB Salazar, ICS, POB 3246, Laredo TX 78044. 512-722-5832.

Eng student desiring donation of old bdct equip (anything)in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Full Gospel Business Men's Fellowship is seeking tax deductible donations of all types of new or used audio & video equipment for a LPTV station. D Susong, 1939 Hill Trail Dr, Morristown TN 37814. 615-587-3915.

SCA Subcarrier receivers, any cond, for non-profit radio reading service. T Vernon, Assn for the Blind, 1800 N 2nd St, Harrisburg PA 17102. 717-238-2531.

R-R 10-1/2", 2 chnl stereo recorder needed & 16mm film sound projector for purposes of religious education. J Acuna, Cruzada, POB 760273, OKC OK 73176. 405-631-5877.

**TEST EQUIPMENT**

**Want to Sell**

Amber 3501 portable audio measuring system. Balanced input, IMD, options. Internal battery, balanced output available, excel cond, must sell, \$1800/BO. R Streeter, AMS Inc, Box 6677, Ft Wayne IN 46896. 219-447-5635.

HP 200CD, audio osc, as new, w/manual, \$100. J Martin Newman, Box 7703, Atlanta GA 30357. 404-876-8623.

RCA WX2D field strength meter w/book, \$500. J Heck, Gallup Bldg, 401 E Coal, Gallup NM 87301. 505-863-4444.

Tek 520A vector & 1480R wfm test equip, \$1500 ea. Steve, Box 10673, Denver CO 80210. 303-399-6444.

Telemet 4504A1, synchronous detector, gd cond, \$300; Telemet 4501, TV demodulator, presently chnl 2, gd cond, \$300; Telemet 3705 envelope measurement set, gd cond, \$200. Aldon Video, 424 Commerce Ln, Berlin NJ 08009. 609-768-2439.

## EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers, write Radio World, PO Box 1214, Falls Church, VA 22041, Attn: \_\_\_\_\_

**POSITIONS WANTED**

DJ looking for work in LA, exper, Vietnam vet, any job in radio. R Nabor, 2342 Harwood St, LA CA 90031. 213-223-2799.

Exper GM seeking work in FL/SE area, ambitious, willing to relocate, team-player. Write: GM, POB 1401, Elfers FL 34680.

20 year veteran career broadcaster, 12 yrs small market general management experience seeking growth opportunity. Resume & qualifications upon request to: Radio World, POB 1214, Falls Church VA 220041. Attn: 2-2-89RW.

20 year veteran career broadcaster, 12 yrs small market general management experience seeking growth opportunity. Resume & qualifications upon request to: Radio World, POB 1214, Falls Church VA 220041. Attn: 2-2-89RW.

20 year veteran career broadcaster, 12 yrs small market general management experience seeking growth opportunity. Resume & qualifications upon request to: Radio World, POB 1214, Falls Church VA 220041. Attn: 2-2-89RW.

20 yr veteran chief seeks small market. Wizard with satellite, automation, processing, & can make old equipment sing. Can pull air shift, will relocate. 802-394-7858.

Attention owners & GM's. Cut costs down to the bone w/m as O.M./P.D. My CHR format will make you number one. FM's only. Fox Hunter, 619-322-8855.

CE w/20 yrs exper in radio seeking position. Familiar w/DA's, installation of transmitters & studios. A people person, F White, POB 1825, Marathon FL 33050.

Electronic Tech Ham Radio, FCC lic/satellite TV installer for down link, needs position w/radio or TV station in NYC. M Saint-Cyr, 527 Maple St, Brooklyn NY 11225. 718-604-1617.

Experienced CE seeks new opportunities, hands-on exper in all phases of FM & AM directional FCC general & SBE sr certification. 804-276-4597.

Experienced technician at DA-38 tower AM-FM station seeks employment in heartland. J Scherer, Rt 1, Bell City MO 63735. 314-733-4398.

Radio Engineering position wanted by 26 yr old. Has experience & schooling, neat, professional habits, contract work considered, prefer Wisconsin. Chuck, 715-423-6763.

Bdct school grad, single female, seeks announcing, audio/video prod position, gen ph., some exper, will relocate. Linda, POB 1025, Cedar Rapids IA 52406.

Broadcaster, etc., Vietnam vet, American Forces Radio, native american Indian, needs work. 10 yrs exper. Ralph Nabor, 2342 Harwood St, LA CA 90031. 213-223-2799.

Central FL DJ, successful entrepreneur, over 10 yrs exper all facets of bdct, seeks employment near Mt Vernon MO. Reply #70 713 Rose St, Auburndale FL 33823.

CHR-UC air personality or music director seeking employment in AM & FM markets. Willing to relocate. For resume & aircheck contact James Torres, 3933 Main, E Chicago IN 46312. 219-397-4261.

Director of Engineering for one of Americas top rated, best sounding radio stations, is looking. Hands on, very strong audio & RF, 18 yrs exper. NARTE, SBE & FCC. Reply to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 3-89-4RW.

Engineer, 22 yrs exper all phases AM/FM bdct engineering including extensive station construction, seeks position as station or group CE or manufacturers sales representative. Patrick Shirley, POB 292, Mumfords NY 14511. 716-538-2976.

Engineer, 24 yrs exper, NARTE, SBE, FCC general, all phases of radio, seeks position with radio group or medium market combo. Prefer S.E., excel references. Write to Radio World, POB 1214, Falls Church VA 22041. Attn: 3-89-1RW.

FT contract engineer (AM/FM) seeking position for TX, OK, ARK, LA area, SBE certified/bdct eng AAS degree. B Gaddis, 1302 E 1st St, Mt Pleasant TX 75455. 214-572-9322.

Talented, versatile announcer, 11 yrs exper, looking for work. CW format, NW NC, SW VA preferred. R Wisbon, Rte 1, Box 545, Yadkinville NC 27055. 919-679-2379.

**HELP WANTED**

Nationwide Communications is seeking qual CE for 1st class combo in Las Vegas. Exp in high power FM, directional AM, C-Quam, RPU, STL, studio maint, automation, IBM computers and budgets necessary. Send resume to Box 14805 Las Vegas, NV 89114. EOE.

CE for Boston FM sta. Excel trblshng, construc, & people skills reqd. Reply to RW, POB 1214, Falls Church VA 22041. Attn: 3-89-5RW.

Engineers Dream! Tampa Bay AM/FM needs hand on tech. Gen +5 yrs. Mild climate, advance potential, new facilities. Send resume to: Ron Woodridge, WHVE/WTKN, 11300 4th St N#318, St Petersburg FL 33716. EOE.

Radio Engineer for AM/FM combo, great opportunity for advancement within growing group, must have knowledge of directional antenna systems, midwest location, EOE, M/F encouraged to apply. Reply to: Radio World, POB 1214, Falls Church VA 22041. Attn: 3-89-2RW.

Radio Technician needed: experienced in digital, data & microprocessor based systems; AM/FM stereo audio chains & composite STL; directional antenna & PDM maintenance. Responsibilities include: install & maintain broadcast equipment, design & construct audio, control & RF systems. Resumes only to: Norm Avery, WBZ Radio, 1170 Soldiers Field Rd, Boston MA 02134.

Small, rapidly growing tower installation & maint. firm, seeks a crew chief w/3-4 yrs exper. With knowledge of broadcast & communications industry. Benefits, 916-638-8833.

Assistant Engineer for 100KW FM & 50 KW AM in South. experience preferred. An EOE. Please send resume to: RW, POB 1214, Falls Church VA 22041. Attn: Box 2-1-89RW.

Engineer needed yesterday. Can you put a Harris System 90 together blindfolded? Beautiful area of No. California. Send resume to KNTI, 75 Fourth St, Lakeport CA 95453. 707-263-1551.

Experienced broadcast technician needed for small market group 2AM, 2FM excellent opportunity. Reply to D.A. Thurston, Berk. Broadcasting, POB 707, N Adams MA 01247. 413-663-6567.

Top Dallas Radio Station seeks CE, 5 yr minimum experience. Strong xmitter background & studio maintenance. EOE. Send resume to Max Sitero, TK Communications, 3000 S W 50th Ave, Ft Lauderdale FL 33314.

TV Asst Chief, electronics training & extensive broadcast experience required. Resume & salary requirements to CE, WVIR TV, POB 769, Charlottesville VA 22902. 804-977-7082.

The new V103, WVAZ is seeking a maintenance eng with a proven proficiency in the repair & maint of bdct equip. In particular, the person will be able to diagnose & repair, to the component level, xmtrs & related RF & microwave equip, bdct consoles, both the mechanical & electronic areas of tape cartridge machines, R-R tape decks, turntables, CD players & other types of equipment. In addition, the engineer will have knowledge in the construction of studios, design & fabrication of audio switching or other related electronic circuits. This is a union position. Send complete history to Sid Schneider, Operations Manager, WVAZ Radio, 408 S Oak Park Ave, Oak Park IL 60302. No phone calls. An EOE.

**The Christian Science Monitor**  
Radio operations Department  
Has immediate openings for on-air/production and Master Control engineers. Responsibilities include story and show assembly, on-air drive shifts, and satellite reception and transmission. Knowledge of Pacific Recorders, AMX and BMX consoles are a plus. Our domestic programming includes Monitoradio Daily edition and Weekend edition. Our international, 500Kw shortwave programming includes the World Service of The Christian Science Monitor, and the Herald of Christian Science. If you're interested in applying, please contact The First Church of Christ, Scientist, Personnel Department, A130, 175 Huntington Ave., Boston, MA 02115, or call 1-800-225-7090, Ext. 3860. We are an Equal Opportunity Employer.

**San Antonio AM/FM Radio Stations Seeking Technical Assistant**  
Formal basic electronics training and two years radio broadcasting experience required. SBE Certification helpful. Immediate opening, position expected to be filled by April 1, 1989. No phone calls please. Mail resume and description of your capabilities to Chief Engineer, KKYX/KCYX (Y100 FM), 8401 Datapoint Drive, Suite 900, San Antonio, Texas 78229. Competitive salary and benefits. New City is an Equal Opportunity Employer.



### TEST... WTS

Yaesu YC-355D freq counter, \$100. E Kain, WNOE, 529 Bienville, New Orleans LA 70130. 504-529-1212.

Coaxial dynamics 81001-A power meter, new, w/external input, 1-5/8 flange, elements from 100W to 5 kW, never used, \$500; London instruments deviation meter, calib mod monitors, check STL & Marti deviation, etc, tunes to 1 GHz, \$800; HP 330D, fair, \$50; Digimax D-1200 freq ctr, \$250. P Morton, WRQL, POB 57, Rupert VT 05768. 802-394-7858.

Coaxial dynamics 81001-A power meter, new, w/external input, 1-5/8 flange, elements from 100W to 5 kW, never used, \$500; London instruments deviation meter, calib mod monitors, check STL & Marti deviation, etc, tunes to 1 GHz, \$800; HP 330D, fair, \$50; Digimax D-1200 freq ctr, \$250. P Morton, WRQL, POB 57, Rupert VT 05768. 802-394-7858.

General Radio 1606B RF bridge w/accessories, manual & carrying case, \$1500/firm. S.T. Carter II, Cartronics, POB 3177, Indialantic FL 32903. 407-727-3015.

Harris 994-7023-001 stereo gain set, new cond, \$700/BO; B&W 410 distortion analyzer, new cond, \$400/BO. S Dalich, Box 8091, Greenville NC 27835. 919-355-6543.

RCA WX-2C (Potomac FIM-120-E) Am field intensity meter, excel physical & electronic cond w/manual, \$400 or consider trade for Revox A-77 or Sparta 5-mixer stereo remote console w/power supply. D Sites, 5809-K Cambridge Dr, Springfield VA 22152.

Tektronix 491 spectrum analyzer, \$1500; Tektronix 492 spectrum analyzer, clean, repairable, \$7800; General Avionix USM-117C solid state portable oscilloscope, excel cond, w/plug-in, book, probes, \$125. M Murphy, 11621 Valle Vista Rd, Lakeside CA 92040. 619-561-2726.

Data-Vue PS940A CRT or used PS940A w/good CRT. F Anderson, 3801 Fifth Ave South, Great Falls MT 59405. 406-452-2810.

Matec 1204 synchronizer & exponential generator, \$45 plus UPS. J Baltar, Maine Reel, 67 Green, Augusta ME 04330. 207-623-1941.

Potomac AM19 antenna monitor, 2 tower, 2 ref, \$1300. T Gaiser, KAFY, 1527 19th St #300, Bakersfield CA 93301. 805-324-4411.

Signal Corps BC-221-AA frequency meter, BO. D Ibel, KICD, 2600 N Highway, Spencer IA 51301. 712-262-1240.

Tektronix 454 oscilloscope, 19" rack model dual trace, DC to 150 MHz, w/manual, excel cond, recent calibration, \$725. S T Carter II, Cartronics, POB 3177, Indialantic FL 32903. 407-727-3015.

Wavecheck/SSI 3000/SSI service monitor, gd cond, \$2500. M Murphy, 11621 Valle Vista, Lakeside CA 92040. 619-561-2726.

### Want to Buy

20 kW air cooled dummy load in good cond. R Kerbawy, WTNJ, Box 1127, Beckley WV 25802. 304-877-5592.

HP 1820A/1840A 250 MHz vertical amp/time base for 180 Series scope; HP 3200B RF signal generator; HP 1802A, 100 MHz vertical amp for 180 Series scope; RF sweep generator. R Lankton, WDUV, 2600 1st St West, Bradenton FL 34205. 813-749-1420.

### TRANSMITTERS

#### Want to Sell

AM xmtrs including: GE 50kW, Collins 21-E 5kW, Gates BC-5E, Raytheon, RCA BTA-5T 1kW, Gates BC-1J, BC-1G, BC-1F, RCA BTA-1R, and many others, warranted. Jerry 315-488-1269.

AM xmtrs including: GE 50kW, Collins 21-E 5kW, Gates BC-5E, Raytheon, RCA BTA-5T 1kW, Gates BC-1J, BC-1G, BC-1F, RCA BTA-1R, and many others, warranted. Jerry 315-488-1269.

Continental 315F 5 kW AM, some spares, all docs, excel cond, clean & ready to ship, 1410 kHz, BO. R Sullivan, WPOP, 345 E Cedar, Newtonington CT 06111. 203-666-1411.



High performance at affordable prices.

10, 20, 30 and 80 W excitors. 100, 250, 500, 1000 W solid state amplifiers.

All front panel programmable, broadband.

1000, 2000, 3000, and 5000 W tube amplifiers.

2 and 20 W STLs.

24 Hr. technical support on call.

**Bext, Inc.**

739 Fifth Avenue.

San Diego, CA 92101

619-239-8462

Telex 229882LJMUR

Gates BC1F, excel cond, now in service, \$2500. C Ratliffe, WADE, 1 Radro St, Wadesboro NC 28170. 704-694-2175.

Harris XTS-1 & XTM-1 AM stereo exciter & AM stereo mod monitor, \$3500. E Kain, WNOE, 529 Bienville, New Orleans LA 70130. 504-529-1212.

Harris TE3 exciter, w/SCA, stereo & (2) matched parts, output xistors for RF amp, \$700. W Clark, RR2 Box 151, Pittsfield IL 62363. 217-285-6234.

Marti RPT40 transmitter, BO. T Storck, KTRF, Thief River Falls MN. 800-426-1003.

### ARMSTRONG TRANSMITTER CO.

Syracuse, NY  
Phone: (315) 488-1269  
Re-Manufacturers of Radio Transmitters

- Used & Rebuilt Units in Stock
- All AM/FM Power Levels
- Reasonable Rates—90 Day Warranty
- PCB Replacement, Re-Tuning & Installation Available
- Trade-Ins Accepted

Visit Our Showroom See Before You Buy

Parts for RCA BTF20E1, sold as package, \$5000/BO. J Schloss, KICD, 2600 Hiway Blvd, Spencer IA 51301. 712-262-1240.

AM xmtrs including: GE 50 kW, Collins 21-E 5 kW, Gates BC-5E, Raytheon, RCA BTA-5T 1 kW, Gates BC-1J, BC-1G, BC-1F, RCA BTA-1R, and many others, warranted. Jerry, 315-488-1269.

BTF-1E, 1 kW FM RCA xmt; BTE-10C FM RCA exciter; RCA BFA-4-A, 4 bay antenna; RCA BTS-1A, stereo subcarrier generator; Collins 26U-2 FM stereo limiter, \$5000 takes it all. P Knies, WBDC, POB 330, Huntington IN 47542. 812-683-4144.



STOP WASTING YOUR TIME CALL BERNARD GELMAN ASSOCIATES FOR ALL YOUR EQUIPMENT NEEDS NEW OR USED (813) 646-4101

BTF-1E, 1 kW FM RCA xmt; BTE-10C FM RCA exciter; RCA BFA-4-A, 4 bay antenna; RCA BTS-1A, stereo subcarrier generator; Collins 26U-2 FM stereo limiter, \$5000 takes it all. P Knies, WBDC, POB 330, Huntington IN 47542. 812-683-4144.

CCA FM 10000, refurbished before our purchase 1.5 yrs age, never used since purchase, now less exciter, first \$7500 takes it. J Nicholson, Central Coast Bldg, POB 666, Lincoln City OR 97367. 503-996-6800.

Dielectric 620-0675 3db hybrid combiner/splitter. Has 4, 3-1/8" flanged ports, never used in perfect cond, \$1800 plus shpg; 3 port RF patch bay 3-1/8" flanged, \$150 plus shpg. B Roberts, ARP Studios, POB 325, Mt Pleasant SC 29485. 803-928-3663.

FM xmtrs including: GE 3kW, Harris 5H, 5G, 5B 5kW, 10kW, Collins 830, CCA 10,000DDS, RCA BTF10-D, 20-25kW CCA 25000DDS, Harris FM 20K, 1kW, Collins 1000D, Gates FM-1B, FM-1-C, others. Jerry 315-488-1269.

FM xmtrs including: GE 3kW, Harris 5H, 5G, 5B 5kW, 10kW, Collins 830, CCA 10,000DDS, RCA BTF10-D, 20-25kW CCA 25000DDS, Harris FM 20K, 1kW, Collins 1000D, Gates FM-1B, FM-1-C, others. Jerry 315-488-1269.

Gates FM-1B xmtrs (2), 1 hardly used, the other so-so, w/brand new The-1 exciter, or w/TE-1 exciter, stereo gen & SCA gen, many spare parts, new & spare tubes, sell all or part, call; Collins 250 W, AM for standby, \$400. P Morton, WRQL, POB 57, Rupert VT 05768. 802-394-7858.

QEI 695 3.5 kW FM xmt, 3.5 yrs old, taken out of srvs 11/88, BO. R Eiler, KBUS, 2775 NE Loop 286, Paris TX. 214-785-1068.

RCA BTA 5F 5 kW AM excel cond, electronically & physically, in storage ready for immed shipment, includes all floor layouts, manuals, all tubes necessary for operation, \$10,000 plus loading & shpg. G Heidenfeldt, 2880 W Lake Rd, Wilson NY 14172. 716-751-6187.

RCA modulation transformer for BTA 5F xmt, new, in original crate, \$600 plus shpg. G Heidenfeldt, 2880 W Lake Rd, Wilson NY 14172. 716-751-6187.

RCA 100X AM xmt for parts, transformers, chokes, capacitors, some vacuum, relays, breaker switches, meters, a large supply of 200 watt wirewound resistors & misc. R Elm, WJWC, 1120 E McCuen St, Duluth MN 55808. 218-626-2738.

RCA BTA 50 F 50 kW AM, excel operating cond, recently removed from service, in storage for immed shipment. Includes all tubes, schematics, floor plans, many extras, electrostatic air filter, solid state rectifiers, magnaphone lightning protection etc. \$18,000 plus loading & shpg. G Heidenfeldt, 2880 W Lake Rd, Wilson NY 14172. 716-751-6187.

Tepco/Bob Jones J317-M 10 watt FM translator, used 1 month, new cond, \$1500. F Shields, Shields Comm, POB 351, Hunt TX 78024. 512-895-1230.

Bauer 707 AM 1 kW, 970 kHz, gd cond, \$4000. T Gaiser, KAFY, 1527 19th St #300, Bakersfield CA 93301. 805-324-4411.

Collins 830F-1B 10 kW xmt w/310Z-1 exciter on 97.3 MHz, make offer. C Langley, WHSL, POB 5307, Wilmington NC 28406. 919-763-6363.

CSI T1A, 1 kW, gd cond, 1980, on air, avail 3/89, \$6800. M McAnnally, WEKC, POB 1071, Williamsburg KY 40769. 606-549-3000.

Harris FM 2.5K, excel cond. G Spicer, Mid-American Gospel Radio, 1 Paradise Plaza, 1430 Olive St, St Louis MO 63103. 314-241-8442.

Harris FM-20H3/FM-20K w/MX-15 exciter, spare tubes & parts, used as main until 1/89. J Andrews, WSRS, Box 961, Worcester MA 01602. 508-757-9696.

ITA AM5000A 5 kW AM, gd cond, manual & spares, 1050 kHz, BO; Gates BC-1E, 1 kW AM, 1050 kHz, complete or as parts, manual & spares, BO. D Brintnall, KBUF, Box 798, Garden City KS 67846. 316-276-2366.

RCA BTA-250M, vgc, tuned to high end of dial, all PCB removed, you ship, \$1500/BO. R Dietterich, WAMO, 411 7th Ave, Pgh PA 15219. 412-471-2181.

SMX 40 solid state exciter, digital, field adjustable, 1/2 price. J Phillips, WZOM, 313 Washington, Defiance OH 43512. 419-782-6986.

### Want to Buy

3 kW FM, FM mod monitor & FM stereo monitor. R Hughes, 205-456-1362.

3.5-5 kW FM to operate on 93.9 MHz, prefer grounded grid final. D Jordan, WDTM, POB 3417, Jackson TN 38303. 901-668-1153.

FM xmt, 20 kW, gd cond, w/manual, CCA, Harris, Continental or Collins. A Chambers, WAWZ, Box 37, Weston Canal Rd, Zarephath NJ 08890. 201-469-0991.

FM xmt, 20 kW, gd cond, w/manual, CCA, Harris, Continental or Collins. A Chambers, WAWZ, Box 37, Weston Canal Rd, Zarephath NJ 08890. 201-469-0991.

Gates BFE-10C for a Gates BFE-10C FM xmt. Shawn Zurbrick, KOSA, 1211 N Whitaker Odessa TX 79760. 915-337-8301.

Harris or other late mdl AM xmt, 1.000 watt, must be less than 10 yrs old, gd shape. P Salois, KPCR, POB 1, Bowling Green MO 63334. 314-324-2263.

UHF band, 100 watt, 1 kW, 10 kW. AACT Inc, 156 Lazelle Rd, Wontington OH 43085. 614-846-9234.

1-1.5 kW FM needed. Non-profit organization can give a tax write-off. Pat Layman, WEAX Stewart Hall, W Park St, Angola IN 46703. 219-665-3314.

FM exciter, 10 to 15 W, must meet specs, prefer not over 5 yrs old, reasonably priced. R Kerbawy, WTNJ, Box 1127, Beckley WV 25802. 304-877-5592.

### TUBES

#### Want to Sell

Tubes, 4-250A, some new, some gd used, some unknown. John or Mike, KMZU, 102 N Mason, Carrolton MO 84633. 816-542-0404.

### REBUILT ELECTRON TUBES

- Partial List: 6623, 23791, TH150, 6425F, 5604, 6696, 6697, 5681, 5682, 5671, 7804, 3CX10, 000H3, 3CX20, 000H3, 4CS5000A, 4CX35, 000C

### Vacuum Tube Industries, Inc.

1-800-528-5014  
508-584-4500

EIMAC 3CX1500A7 1500 watt triode, 1987 date code, new in box, \$550. Lauren Libby, Colorado Educational Bcdts, 6166 Del Paz Dr, Colorado Springs CO. 719-593-9861.

833A, \$100; 813, \$40; 845, \$770; 6146B, \$12; 807, \$5.95. New Production 6 month/2000 hr warranty. Stanton 500 AL stylus-generic \$3.95, original \$7.95; 500 cartridge E or AL needle, \$12.95; Shure M-44C cartridge, \$21; generic stylus, \$3.95; original \$11.95 MTS EC cartridge, \$9.95. We ship prepay/COD/Amex. Triode Electronics, Chicago IL 60618. 312-871-7459. Fax: 312-871-7938.

833A, \$100; 813, \$40; 845, \$770; 6146B, \$12; 807, \$5.95. New Production 6 month/2000 hr warranty. Stanton 500 AL stylus-generic \$3.95, original \$7.95; 500 cartridge E or AL needle, \$12.95; Shure M-44C cartridge, \$21; generic stylus, \$3.95; original \$11.95 MTS EC cartridge, \$9.95. We ship prepay/COD/Amex. Triode Electronics, Chicago IL 60618. 312-871-7459. Fax: 312-871-7938.

EIMAC 4CX-15000 (2), near new cond, \$800 ea. L Peters, 2211 Rolling Hills, Lancaster TX 75146. 214-223-3786.

### Want to Buy

### ELECTRON TUBES

- Partial List: 6623, 23791, TH150, 6425F, 5604, 6696, 6697, 5681, 5682, 5671, 7804, 3CX10, 000H3, 3CX20, 000H3, 4CS5000A, 4CX35, 000C

### Vacuum Tube Industries, Inc.

1-800-528-5014  
508-584-4500

EF86 tubes (10-12), for Gates console, new or used. S Budd, WRPS, 34 Goddard, Rockland MA 02370. 617-871-0724.

We buy electron tubes. Contact us if you any for sale.

### PATH

507 Superior Ave.  
Newport Beach CA 92663  
714-722-6733

### TURNTABLES

#### Want to Sell

Empire TTs (5) & Sparta TT, \$200 all/BO. R McDaniel, KJRG, 209 Meridian, Newton KS 67114. 316-263-5150.

Russco Cue-Master, gd cond, w/arm & cartridge, \$100. R Hardy, Richardy Prod, 3239 S 90th E Ave, Tulsa OK 74145. 918-627-2937.

Russco Cue Master (2) w/Micro-Trak tonearms, plus spare tonearm, \$400/all. J Edman, 7732 Tampa Way, Shreveport LA 71105. 318-797-3211.

Technics SP-25, w/base, tonearm & 2 stylis, \$600. D Clarke, 3682 N Sierra Way, San Bernardino CA 92405. 714-882-8103.

Technics SL1200MKII, brand new, \$375. G Ingram, KIXC, POB 29, Quanah TX 79252. 817-663-6363.

Fairchild 641 stereo disk mastering system, 602 conax, 643 Beta amp, 842 cutter (stereo), 644 power amp, 845 power supply, 740 3 speed var. pitch lathe, \$5000/BO. T Boddie, Boddie Recdg, 12202 Union Ave, Cleveland OH 44105. 216-752-3440.

Gates Solid Statesman turntable pre-amp, in operating cond, w/manual, \$50 plus shpg. G Heidenfeldt, 2880 W Lake Rd, Wilson NY 14172. 716-751-6187.

Harris/Gates 1970 mdl, \$75; Gates Mdl M-5693 AM mod mon, gd cond, \$100; Rust Mdl 14C-3 AM RF amp, \$30, fir to gd cond. Emery, WOFK/Camillus NY 13219. 315-487-2393.

Technics SP-15 turntable w/base, dust cover & Audio Technica tonearm in vgc, \$450. B Roberts, ARP Studios, POB 325, Mt Pleasant SC 29465. 803-928-3663.

RCA MI-11870 (2) 16" universal pick-up arms. D Ibel, KICD, 2600 N Highway Blvd, Spencer IA 51301. 712-262-1240.

Russco Cue Master 3 speed turntables (2) in consolette w/4 channel mixer complete w/tonearms (2), \$375 plus shpg. B Kidd, Airwaves Media Sales, POB 976, Rayville LA 71269. 318-728-4574.

Scully disk mastering lathe, variable pitch, suction turntable, microscope, 33-45 speeds, excel cond, stereo cutterheads avail. \$2500 plus shpg. T Steele, Steele Comm, 1697 Broadway Rm 1404, NY NY 10019. 212-265-5563.

#### Want to Buy

Gray 303 12" tone arms (2) in gd cond, no junk. M Rockwell, WNB, Box 309, Park Falls WI 54552. 715-782-3221.

Gray 212 12" tonearm or equiv. J Schloss, KICD, 2600 Hiway Blvd, Spencer IA 51301. 712-262-1240.

## ACTION-GRAM

### EMPLOYMENT SECTION:

**Help Wanted:** Any company or station can run "Help Wanted" ads at the flat rate of \$25 per listing per month (25 words max). Payment must accompany insert; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$2. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for display rates.

**Positions Wanted:** Any individual can run a "Position Wanted" ad, FREE of charge (25 words max.), and it will appear in the following 3 issues of Radio World. Contact information will be provided, but if a box number is required, there is a \$2 fee which must be paid with the listing (there will be no invoicing). Responses will be forwarded to the listee, unopened.

Check as appropriate:

- Help Wanted  With Box Number  
 Positions Wanted  Without Box Number

Text (25 words maximum): \_\_\_\_\_

Name \_\_\_\_\_ Title \_\_\_\_\_  
Company/Station \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
Telephone \_\_\_\_\_

Mail to:  
**BROADCAST EQUIPMENT EXCHANGE**  
PO Box 1214, Falls Church, VA 22041

# TRANSCOM CORP.

Fine Used AM & FM Transmitters and Also New Equipment  
For the best deals on Celwave products, Andrew cable, Shively & Comark antennas.

- 1983 CSI 25,000E kW FM
- 1973 RCA BTS 20E1, 20 kW FM
- 1978 Collins 820F, 10 kW AM
- 1966 Collins 21E, 5 kW AM
- 1970 CCA AM 10,000D, 10 kW AM
- 1976 CCA AM 50,000D, 50 kW AM

201 Old York Rd.  
York Plaza Ste 207  
Jenkintown PA 19046  
215-884-0888

Telex No. 910-240-3856 (TRANSCOM CORP. UQ)  
FAX No. 215-884-0738

### TURNTABLES . . . WTB

CCA/QRK ultimate turntable preamplifiers, stereo/mono, any cond. K Smith, RR 3 Box 483A, Gorham ME 04038. 207-929-6129.

### TV FILM EQUIP.

#### Want to Sell

Elmo 16mm CLTC 24-fps projector for transferring films to video. Synchronous motor. 5-bladed shutter, easy channel loading system, optical or magnetic sound, 12.5mm lens. Perfect cond, \$750; Sony VCR-4 Uniplerex, \$120; will sell separately or \$800 for both. W Watrous, Watrous Prod, 745 S Orange Ave, Sarasota FL 34236. 813-366-3316.

#### Want to Buy

Kodak VP-1 super 8 film-video player. D Dewese, WJYM, 6761 Fremont Pike, Ferrysburg OH 43551. 419-874-7956.

### VIDEO PRODUCTION EQUIPMENT

#### Want to Sell

Hotronc AD51-TFS frame sync/TBC, \$4000; Prime Image TBC+, \$2750; Lenco TBC-450, \$2500. H.M. Dyer Electronics, 2982 Wixom Rd, Milford MI 48042. 313-685-2560.

Quanta Q7, character gen, \$900; Tek 1470, sync gen, \$1000; Conrac DZB-15, high res, B/W mon, \$200; RCA TG-6 sync gen, \$200; EECO MTG, time code gen, new, \$600. Aldon Video, 424 Commerce Ln, Berlin NJ 08009. 609-768-2439.

ITE P-6 pedestals w/H-2 cam heads, new cond, counterbalance pedestals w/cam heads, \$6000 for both. D Thranhardt, 1491 Silver Lake Dr, Norcross GA 30093. 404-381-7632.

Panasonic AG-A600 remote controllers (5) w/search dial, new, \$10 ea; Panasonic NV C80 extension cables (7), \$5 ea; Comprehensive Video E8P, E8P-50 50' EIAJ 8 pin to EIAJ 8 pin video cables (3), \$5 ea. P Russell, Bowdoin College, AV Services Sills Hall, Brunswick ME 04011. 207-725-3066.

Quantal DPE-5000 Plus 2 chnl DVE w/rotation & perspective, 3 sets control panels & switch over, \$10,000. D Thranhardt, 1491 Silver Lake Dr, Norcross GA 30093. 404-381-7632.

Vital VIX114A/4 3 M/E prod switcher w/24", rotary & spin wipes, auto transitions, 3 CKs 1 enc. CK edgers in all keys, \$7000. D Thranhardt, 1491 Silver Lake Dr, Norcross GA 30093. 404-381-7632.

Audio Video Engineering HSC-1 video hum stop coil, eliminates video ground loops, vgc, BQ G Peterson, KIMM, POB 8205, Rapid City SD 57709. 605-348-1100.

### VIDEO TAPE RECORDERS

#### Want to Sell

Ampex VPR-5800 1" VTR, needs some work, \$200. N Metzger, 312-989-1101.

Sony VO-4800 portable 3/4" VCR, vgc w/AC & two batteries, \$1250; JVC KY-2700 3 hand matched saticon tube color camera w/12:1 servo zoom, AC, battery & hard case, vgc, \$2600; Anton Bauer Super D-14F 4 Nicad 14.4V batteries, belt & charger/case, excel cond, \$900. S Vanderberg, Hugh Morris Prod, POB 232, Jenison MI 49429. 616-895-3105.

JVC 8200, 8250, RM-88, used in news editing, about 3000 hrs/machine, \$1000 ea. K Dick, WVVA, R460 By Pass, Bluefield WV 24701. 304-325-5487.

JVC 6650U, brand new, \$3000. D Miller, Airborne Audio Prod, 12037 Hemlock, Overland Park KS 66213. 913-492-8822.

NEC 3/4" time lapse, \$450 plus UPS. J Baltar, Maine Reel, 67 Green, Augusta ME 04330. 207-623-1941.

Sony VP-2000 & Panasonic NV 2110M, \$95 ea/postpaid. L Graziplene, Grailen Research & Development, 3532 N Main, N Java NY 14113. 716-535-7251.

**WORLD VIDEO STANDARDS CONVERSION**  
 Digital PAL/SECAM/NTSC. Chroma, Luminance, Error Correction given careful set-up for broadcast quality at budget price. VHS/BETA/3/4" 7mm. \$45/hr. Quantity discount.

**TK VIDEO**  
 12300 Coppola Drive,  
 Potomac, MD 20854  
 301-762-2786

Sony SLM-1000, pair of Beta off-line editing decks, bi-super high band, pre-roll editing, hi-fi stereo, \$2450. C Wilson, Mongo Video, 13123 Moldridge Rd, Wheaton MD 20906. 301-949-1809.

#### Want to Buy

Need charger/AC supply & good used batteries for Panasonic NV 9400; also camera cable for Sony, will consider buying complete system. Patrick, Video Velocity, Box K, 500 Fandango Pass, Virginia City NV 89440. 702-847-9847.

## Equipment Listings

Radio World's Broadcast Equipment Exchange provides a FREE listing service for all broadcast and pro-sound end users. Simply send your listings to us, following the example below. Please indicate in which category you would like your listing to appear. Mail your listings to the address below. Thank you.

Please print and include all information:

Contact Name: \_\_\_\_\_  
 Title \_\_\_\_\_  
 Company/Station \_\_\_\_\_  
 Address: \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Phone Number: \_\_\_\_\_

I would like to receive or continue receiving Radio World FREE each month.  YES  NO

Signature \_\_\_\_\_ Date \_\_\_\_\_  
Please circle only one entry for each category.

#### I. Type of Firm

- D. Combination AM/FM station
- A. Commercial AM station
- B. Commercial FM station
- C. Educational FM station
- E. Network/group owner
- F. Recording studio
- G. TV station/teleprod facility
- H. Consultant/ind engineer
- I. Mfg, distributor or dealer
- J. Other (specify) \_\_\_\_\_

#### II. Job Function

- A. Ownership
- B. General management
- C. Engineering
- D. Programming/production
- E. News operations
- F. Other (specify) \_\_\_\_\_

Brokers, dealers, manufacturers and other organizations who are not legitimate end users can participate in the Broadcast Equipment Exchange on a *paid* basis. Listings are available on a \$25/25 word basis. Call 1-800-336-3045 for details and complete display rates.

WTS:  WTB:  Category: \_\_\_\_\_  
 Make: \_\_\_\_\_ Model #: \_\_\_\_\_  
 Brief Description: \_\_\_\_\_  
 \_\_\_\_\_  
 Price: \_\_\_\_\_

WTS:  WTB:  Category: \_\_\_\_\_  
 Make: \_\_\_\_\_ Model #: \_\_\_\_\_  
 Brief Description: \_\_\_\_\_  
 \_\_\_\_\_  
 Price: \_\_\_\_\_

WTS:  WTB:  Category: \_\_\_\_\_  
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WTS:  WTB:  Category: \_\_\_\_\_  
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WTS:  WTB:  Category: \_\_\_\_\_  
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 Price: \_\_\_\_\_

WTS:  WTB:  Category: \_\_\_\_\_  
 Make: \_\_\_\_\_ Model #: \_\_\_\_\_  
 Brief Description: \_\_\_\_\_  
 \_\_\_\_\_  
 Price: \_\_\_\_\_

**Broadcast Equipment Exchange**  
 PO Box 1214  
 Falls Church VA 22041

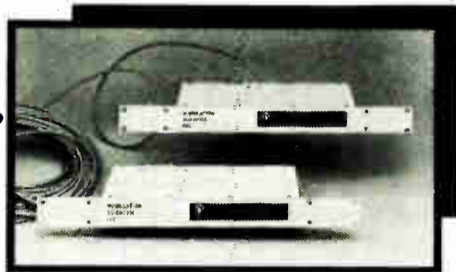
# ACTION-GRAWI

# Any of these problems sound familiar? Get to know Modulation Sciences' composite baseband solutions.

## Solutions

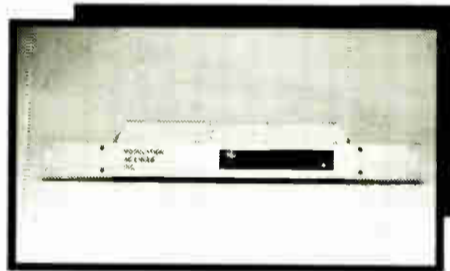
### Problems

- Transmitter noise, heat, RF field interference and physical location make the transmitter room a poor place to locate the stereo generator and audio processing. Necessary and critical adjustments are inconvenient at best; nearly impossible at worst!
- Lossy, expensive, hard-to-install 950 MHz semi-rigid coax is often impractical to run from the studio to the STL antenna on the roof.
- Fire codes won't let you run PVC jacketed coax through the ceiling, except in very expensive metal conduits.
- Long composite runs at the transmitter or studio pick up ground loop hum.
- You need to drive multiple exciters without composite level changes and switching or relay hassles.
- The station has two stereo generators and two transmitters. You want a simple way to matrix-switch them without requiring complex backloading.
- It's a pain to use your spectrum analyzer and other test gear to make composite measurements because of the hassles of interrupting the air feed to connect them.
- The PD, the CE and the GM all want to monitor and measure the station's quality. But buying three modulation monitors is out of the question.
- Keeping tabs on the competition's signal quality is important, but it's inconvenient and expensive to do.
- Lots of boxes use composite baseband—the STL, stereo and SCA generators and more. You need an easy, economical way to test their performance, and directly measure composite baseband signals.
- The station has an old modulation monitor gathering dust. You don't trust the readings, but can't it still be useful?



**Modulation Sciences' CLD-2501/2 Composite Driver/Receiver**

- ✓ Lets you put your stereo generators and audio processing where they belong—at the studio.
- ✓ Supports up to 3000 ft. (or two miles, on special order) of flexible, inexpensive, twinax cable – standard or PTFE-jacketed for plenum runs.
- ✓ Fully balanced against hum and noise pickup.
- ✓ 100 dB of immunity to ground-loop related noise and hum.
- ✓ Exceptional stereo separation and SNR performance.
- ✓ One driver can supply two independent receivers (each up to 3000 feet away in different directions) with composite stereo baseband audio and all SCA's.
- ✓ Works with 78 ohm twinax (Belden 9463) twinax for indoor service and 150 ohm twinax (Belden 9182) for outside or direct burial.



**Modulation Sciences' CLD-2504 Composite Distribution Amplifier**

- ✓ Makes distribution of composite baseband signals as easy as distributing audio.
- ✓ 1 composite input, 4 composite outputs.
- ✓ Unity gain with > 50 dB isolation between outputs.
- ✓ High impedance 50Ω input, low impedance outputs.
- ✓ BNC connectors on input and all outputs.
- ✓ Basic performance specs similar to Composite Line Driver.



**Modulation Sciences' FM ModMinder™**

- ✓ Provides all essential measurement functions of a high-quality modulation monitor when fed by any composite baseband audio source.
- ✓ Works with any wideband source of demodulated FM—even consumer tuners or stereo receivers.
- ✓ Displays total modulation percentage, overmodulation peaks, stereo & SCA subcarrier status, subcarrier injection level, allowable increase in modulation—all for about half the cost of a modulation monitor.
- ✓ If you have an old modulation monitor—even one that reads unreliably—that oldie's demodulator section can drive ModMinder. You get unbeatable accuracy at a \$3000 savings over the cost of a new modulation monitor.
- ✓ Plug-in cards adapt ModMinder to measure SCA sub-carriers on non-standard frequencies.

**W**hether you have these audio distribution or measurement problems, or some unique puzzles of your own, Modulation Sciences has the convenient, cost-effective composite tools to help you solve them. Any further questions? Of course—so call 800-826-2603 Toll-Free for complete information and specifications on Modulation Sciences' Composite Problem Solvers.

**modulation sciences, inc.**

115 Myrtle Avenue • Brooklyn, New York 11201 • Tel 718-625-7333 • Toll Free 800-826-2603



# Kiss 102

October 17, 1988

Mr. Gary Snow, President  
Wheatstone Corporation  
6720 V.I.P. Parkway  
Syracuse, NY 13211

Dear Gary;

I just wanted to drop you a line and let you know how much we appreciate all of the last minute help with the installation of our A-500 console back in July.

Thanks to you and your staff, we were on the air with the new facility on time and without a single glitch. The A-500 console is a winner!

Our staff enjoys the ease of use of the console, and I enjoyed the ease of installation. Everyone here enjoys our improved audio performance. We would recommend the console to anyone.

By the way, our SP-6 has been installed now for a few weeks and we are taking advantage of it's great features and performance. The SP-6 is a wonderful piece of equipment. Again, the installation was easy, and the SP-6's straightforward layout and design make the functions easily accessible and understandable to operations personnel.

You stood by your promise that Wheatstone is a service-oriented company...and then some. Thanks again, Gary, for providing an outstanding product with service to match.

Sincerely,

*Alan Lane*  
Alan Lane  
Chief Engineer

WCKZ  
Bassley Broadcast Group  
704-342-4102

 Wheatstone® Corporation

6720 V.I.P. Parkway, Syracuse, N.Y. 13211 (315-455-7740)