

Class A Boost a "Tradeoff"

by Charles Taylor

Washington DC Class A FM stations will be able to boost their power to 6 kW, but many of them will have to file an application instead of enjoying the blanket increase hoped for by a New Jersey grass roots group.

Effecting a tradeoff between the desires of Class A broadcasters and the opposing concerns of higher-power broadcasters, the FCC ruled in mid-July to selectively allow Class A FM stations to boost their maximum effective radiated power from 3000 W to 6000 W.

The anticipated ruling, contained in docket MM 88-375, initially will affect about 500 of the nation's 2000 Class A's. Hundreds more will be able to apply for an upgrade on a case-by-case basis. About 100 Class A's are eliminated from any power hike by the ruling.

The FCC action also revised the separation distance between Class A stations and other FMs, in an effort to maintain protection for all FM classes.

Class A broadcasters had rallied strongly for an across-the-board upgrade, but the Commission took heed of commenters who claimed such a ruling

would lead to increased interference and detriment to the FM band.

"This is a classic case of tradeoff, trading off the matter of providing an increase in service against undue interference," FCC Chairman Dennis Patrick said.

The Commission will compute a list of affected stations, to be released in November. The power increase will be initiated 1 December, and stations will be required to file FCC Form 302 within 10 days of increasing station power.

Those dates, said FCC Mass Media Bureau Chief Alex Felker, allow time for the

upgrade of nearly 150 Class A stations affected by a March FCC ruling creating a new C3 station class. Those stations will be authorized to transmit using up to 25,000 W with an antenna height above average terrain of 328'.

The ruling also might affect the February Report and Order issued by the Commission allowing short-spaced FM stations by the use of directional antennas.

The Commission noted then that applications accepted for the use of the antennas should be based on the pre-

(continued on page 9)

Race is On for SBE

by Alan Carter

Indianapolis IN The usual uncontested Society of Broadcast Engineers (SBE) presidential election will be a race this year with KXKL-AM/FM Engineering Director Paul Montoya mounting a grassroots campaign against *Broadcast Engineering* Radio Technical Editor Brad Dick.

Montoya said he would file a petition before the 1 August deadline. "We haven't had a horse race in a number of years, so I think it's time we go ahead and put this thing together," he said.

Montoya said he is challenging Dick, nominated by the SBE nominating committee, because Dick is not a "working engineer" and because of his association with the news media.

The election is conducted by mail, with ballots scheduled to go out by the end of August returned by the end of September. The results will be announced 5 October at the annual membership meeting during the SBE national convention in Kansas City, MO.

Dick said neither his status as an engineer nor his job at *BE* were issues to

(continued on page 13)



Construction crews hoist the top of the experimental tower.

NAB's AM Antenna Project Underway

by Judith Gross

Beltsville MD The tower was in place, and construction of the horizontal radiator and ground system was about to start on the NAB's AM antenna project here in midsummer.

Workers from L and R, sister company of LDL which is donating its services in the construction, had the 295' tower hoisted and in place after initial delays caused by wet ground after an exceptionally rainy June, according to Kelly Williams, NAB staff engineer.

The next step in the long-awaited process, and the start of testing, Williams said, awaits the return of the antenna's designer, consultant Ogden Prestholdt, from his home in Florida.

The construction was expected to be completed and testing expected to start within a few weeks.

Once the tower is built, NAB will begin testing a four-wire elevated ground system designed by Al Christman and

Roger Radcliffe of Ohio University.

Although not originally part of the antenna project, the system was tested through NEC modeling by Radcliffe and Christman and results said it could be as efficient, if not more efficient than the standard 120-wire ground system, Williams said.

A signal ground

"It creates a signal ground instead of a physical ground," said Williams. "It creates a ground plane but does not require connection to the earth."

Once the four-wire system is tested, a full 120-wire ground system will be put in and tested, and the two will be compared, Williams explained.

"Building a facility just to test a ground system would be extravagant," said Williams. "But the only way you can tell if one works is to build it and test it." Williams said the NAB's antenna project offered the perfect opportunity

(continued on page 9)

DYNAMAX WITH MAXTRAX

"At K101-FM, San Francisco, we replaced vintage Tomcats with DYNAMAX cart machines set up for Maxtrax. The overwhelming majority of our station personnel preferred the sound of DYNAMAX equipment."

Jack Kulp
Afternoon Drive Personality

For more information, contact Fidelipac Corporation.



Fidelipac Corporation □ P.O. Box 808, Moorestown, NJ 08057 □ U.S.A.
609-235-3900 □ TELEX 710-897-0254 □ FAX 609-235-7779
Dynamax is a registered trademark of Fidelipac Corporation.

NEWS BRIEFS

FM Simulcasting

Atlanta GA NewCity Communications is simulcasting its two Atlanta FMs, WYAY and WYAI, stations the group is allowed to hold under new liberal duopoly rules.

This is the second radio group to announce FM simulcasting. The RadioActive Group is simulcasting WACS-FM and WNYJ-FM, both in the Albany,

Schenectady, Troy market in New York.

NewCity, however, is specializing each station's broadcast by a quick draw on the cart machines. Messages intended for both stations are fed to both transmitters from a dual cart and those for a single station to the designated transmitter from a split cart.

Groups can hold two or more stations in the same band based

on new overlap restrictions to the 3.16 mV/m contour for FM and to 5 mV/m for AM.

NAB Calls for '90 Papers

Washington DC The NAB is accepting proposals for technical papers for the engineering conference at the 1990 convention, 30 March-3 April in Atlanta.

A one-page abstract on the proposed subject should be sent no later than 13 October to: Engineering Conference Committee, Science and Technology Department, National Association of Broadcasters, 1771 N St. NW, Washington,

DC, 20036-2891.

For information, call NAB Science and Technology, 202-429-5346.

Radio '89 Coming Together

New Orleans LA Some 127 exhibitors, about a third of them technical equipment firms, have signed up so far for the Radio '89 convention, planned here 13-16 September at the New Orleans Convention Center.

To date, 35,000 square feet have been sold. Engineering sessions begin 12 September.

Also, finalists for the Crystal Radio Awards for excellence in

local achievements were announced.

They are KTAR, Phoenix; KNCO, Grass Valley, CA; KVVQ, Hesperia, CA; KABC, Los Angeles; KLOS, Los Angeles; KTRB, Modesto, CA; KIOI, San Francisco; WILM, Wilmington, DE; WDBO, Orlando, FL; WGST, Atlanta; WSB, Atlanta; WLBK/WDEK, De Kalb, IL; WTLC, Indianapolis; WKQQ, Lexington, KY; WUMB, Boston; WCZY, Detroit; WDBC, Escanaba, MI; WJON, St. Cloud, MN; KFEQ, St. Joseph, MO; KBOZ, Bozeman, MT; KSEN, Shelby, MT; WFNC, Fayetteville, NC, and WPTF, Raleigh, NC.

Also, KRVN, Lexington, NE; WOKQ, Dover, NH; WTSN, Dover, NH; WCTC, New Brunswick, NJ; WYRK, Buffalo, NY; WWSC/WYLR, Glens Falls, NY; WSYR/WYYY, Syracuse, NY; WRRM, Cincinnati; WSTV, Steubenville, OH; KRMG, Tulsa, OK; WPEN, Bala Cynwyd, PA; WESB/WBRR, Bradford, PA; WULS, Philadelphia; WTAE, Pittsburgh; WCHX, Yeagertown, PA; WSBA/WARM, York, PA; WSM, Nashville, TN; KWES, Odessa, TX; KTBB/KNUE, Tyler, TX; KRSP, Salt Lake City; WKVT, Brattleboro, VT, and WCUB, Manitowoc, WI.

In other Radio '89 news, NAB named new awards recognizing outstanding stations and personalities in radio the Marconi Radio Awards.

Awards will be presented for format, station of the year, air personality or team, network/syndicated personality and legendary station.

In a contest naming the awards, NAB received 41 entries suggesting Marconi. But KOMA-AM PD Michael Bettelli of Seattle, WA, was the first one received and won free registration and transportation to the convention.

WHY DIDN'T SOMEONE THINK OF THIS BEFORE?

A FAST-PACED PRODUCTION CONSOLE

THE WHEATSTONE SP-6 AUDIO CONSOLE lets production people quickly accomplish 8 and 16-track work, yet easily handle routine transfers and dubbing operations. With its unique track monitor section it can facilitate simultaneous stereo mixdown during the multitrack bed session — almost halving typical production time cycles. Input channels are laid out just like an air console, with machine starts below the channel fader, so staff familiar with on-air consoles can quickly become comfortable in the production environment.

For those interested in more advanced techniques, the SP-6 employs a powerful talent monitor section designed to rapidly call up live mic and track combinations, making difficult punch-ins a breeze. Standard SP-6 input channel equalizers are more comprehensive than

those supplied as optional items on competing products, allowing much greater creative freedom. Input channel auxiliary send sections are designed to be the most versatile in the industry, providing 4 different auxiliary buses to allow digital delay, reverb, talent foldback, and mix-minus feeds. Stereo input channels can provide either mono or stereo effects sends. Even more, the SP-6 has 4 auxiliary effects return inputs that allow effects to be recorded onto the multitrack or sent to the monitor buses.

The SP-6 provides independent headphone, control room and studio monitor feeds, as well as stereo cue/solo. Control room and studio mute and tally functions are independently dipswitch selectable on individual input channels. Additional studio modules may be ordered to accommodate larger, multi-studio installations. The SP-6 may be configured with any combination of mono and stereo input modules, in mainframe sizes ranging from 16 to 32 or more inputs. The console is available in either an 8-track production format or a 4 stereo subgroup TV master control configuration. So why not profit from Wheatstone's experience and reputation? Call us today and learn more.



Wheatstone Corporation

8780 V.L.P. Parkway, Syracuse, NY 13211

TEL 315-455-7740 FAX 315-454-8104

Circle 4 On Reader Service Card

World Radio History

INDEX

Transistor Circuit Connection	
by Ed Montgomery	24
Adding Drums to a MIDI Studio	
by Bruce Bartlett	26
Why Some Circuit Boards Die	
by John Shepler	30
Dr. Brinkley's Story	
by George Riggins	32
A Bit of Channel Status Data	
by Mel Lambert	34
Corky Culver Swings on a Star	
by Peter Hunn	37
Becoming More of a "People" Person	
by David Hebert	43
Ambassadors of Shortwave	
by Dee McVicker	44

Bose Proposes Tests of FMX

by John Gatski

Framingham MA Bose Corp. President Dr. Amar Bose and engineer Dr. William Short have proposed listening tests radio engineers can conduct to help them make up their own minds on whether FMX works or not.

The proposal is part of Bose Corp.'s self-proclaimed "final word" on its FMX study questioning the technology. (See related story this issue.)

The first suggestion Bose and Short made is let someone who has no opinion one way or another about FMX evaluate the system.

They also suggest using a car radio and giving the person evaluating the system the ability to make an A/B comparison by instantly switching the transmitter between FMX and FM stereo.

Another step involves monitoring the left and right channels on an X-Y scope to be sure that the particular FMX receiver does not revert to mono or "blend."

Depending on the FMX receiver circuitry, it can blend to mono, negating FMX's claimed benefit, according to Bose. If the receiver does blend, the evaluator should switch the receiver to FM mono for comparative purposes.

According to the Bose Corp., the scope must be used to determine whether the receiver reverts to mono,

not the stereo light.

Bose suggested using high dynamic range material such as classical recordings, especially concertos in which artifacts can be heard on the solos.

Bose recommended conducting three tests.

Test 1: While broadcasting and receiving in FM, move the car to the edge of numerous multipath locations until distortion is just becoming audible. While receiving FM, switch the transmitter back and forth between FM and FMX.

According to Bose, the distortion will increase using FMX and the tester may hear artifacts such as volume variation and unstable stereo imaging.

Test 2: Repeat test 1, but instead switch the transmitter and receiver simultaneously between FM and FMX. Be sure to use the same antenna and receiver for both modes. The results should be more pronounced when transmitting in FMX under multipath conditions, Bose claimed.

Test 3: Drive the car through urban, suburban and rural areas that are flat and hilly to make comparative tests: FM to FM and FMX to FMX. Again, artifacts should be evident with FMX, Bose contended.

Broadcast Technology Partners representatives, promoters and developers of FMX, have said that if the receiver is equipped with all recom-

(continued on page 8)

Listen for Yourself, FMX Detractors Say

by John Gatski

Framingham MA The authors of a Bose Corp. study critical of FMX stereo extension are sticking by their research and suggest that radio engineers conduct their own listening tests to determine the effectiveness of the technology.

In a letter to the industry news media, Bose Corp. Board Chairman Dr. Amar Bose and Dr. William Short, a company engineer, also said there is little left to say about the subject and noted that they will let the research speak for itself.

"Please consider our future lack of response ... not as indifference or discourtesy," the two wrote, "but simply as the reaction of two people who have nothing more to offer on this topic and who are zealously looking forward to the peace and quiet of their own research."

In light of the concern over the Bose test, the corporation offered a three-step testing procedure that is an easy way for stations to make listening evaluations of FMX vs. FM stereo and/or mono, according to Short. (See related story this issue.)

"We just felt that people were perform-

ing the easy listening tests instead of the correct listening tests," Short said of the company's motivation to draw up the guidelines.

The suggested tests also are in response to complaints that the Bose report was too complicated to understand.

The test guidelines include utilizing a listener in a car who can control instantaneous switching of FM/FMX transmissions. The driver, according to the test guidelines, should drive along multipath routes and signal null routes to make a comparative test.

Reputation on the line

According to a recent Bose Corp. statement, if tests show that FMX provides wider stereo coverage and less noise and distortion than FM in multipath, "it will reflect poorly upon our research skills."

"If, on the other hand, our study is correct, it will reflect poorly upon the integrity of any party, which, having access to this information, encourages the public to spend money to replace existing FM receivers with equipment of lower performance," the statement added.

(continued on page 8)

Havin' A Heat Wave?



The **Informer** calibrated thermometers come in two models ideal for every radio station. The **Informer II** has a large LED readout, high and low memories with reset, and range from -40 to +120 degrees. An AA battery powers the unit for up to one year, and the 50 foot probe line and triple sealed sensor mean you stay cozy while giving the forecast.

To measure temperature in transmitter buildings, Bradley has designed the **Informer TX** just for you. The unit provides an output of 10 millivolts per degree (100°F equals one volt) and is perfect to interface with your remote control. Users need to supply 5 to 12 volts for operation.

Informer II \$54.95
Informer TX \$48.95

Special Offer! Mention you saw this ad in **Radio World**, and save **\$10.00** on the purchase of any two **Informers**. Offer valid all summer.



**BRADLEY
 BROADCAST
 SALES**

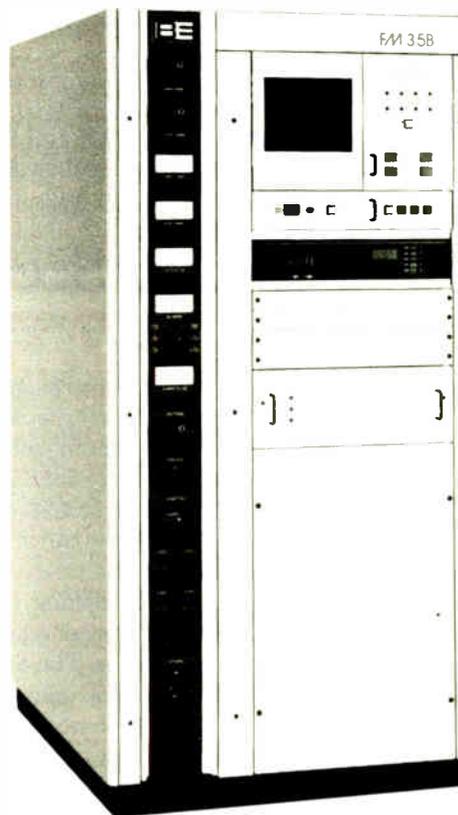
8101 Cessna Avenue
 Gaithersburg, Maryland 20879-4177

800-732-7665 / 301-948-0650
 Fax: 301-330-7198

Where Service and Engineering Make The Difference

Digital Quality Transmission

Broadcast Electronics' FM 3.5B 3500 Watt FM Transmitter



- **Guaranteed** 85 dB S/N.
- **New World Standard** FX 50 Exciter.
- **Built-in** synchronous AM noise test facility.
- **Patented** folded half-wave coaxial cavity eliminates plate blocking capacitor and sliding contacts.
- **Self contained** solid state broadband IPA in slide out drawer.
- **Complete** emergency RF patching.
- **Automatic** power control that maintains constant output power with proportional VSWR foldback protection.
- **Eight** individual meters.
- **Optional** microprocessor video display system (MVDS) with diagnostics.
- **Optional** PC Remote Control from MVDS.

The Model FM-3.5B single tube FM transmitter is the first choice for stations seeking the ultimate in audio performance.



4100 N. 24th ST., P.O. BOX 3606, QUINCY, IL 62305, (217) 224-9600, TELEX: 250142, FAX: (217) 224-9607

Thoughts Wander To Wonder

by Judith Gross

Falls Church VA CBS's *Sixty Minutes* curmudgeon **Andy Rooney** allegedly begins his soliloquy with "Did you ever wonder why . . . ?"

During these hot summer days, sitting in the cool shade of the transmitter building listening to the RF crackle, it's a great time to contemplate the deep mysteries of the world of radio.

It's a good time to ask "why?" For instance . . .

Why the SBE cut the exhibit hours at its national convention in half, from 20 hours over three days last year, to a mere 10 hours over two days this year.

Why its officers somehow feel this will entice more engineers to attend, or more exhibitors to feel it's worth their while to spend significant time and money to set up and staff a booth.

Why those exhibitors already signed up aren't asking the same question.

I wonder why the SBE thinks a "shop" or "lab" coat full of snacks will replace lunch for engineering attendees on Friday, and why they think the image of the shop-worn engineer is a positive one in a world where many engineers are striving to be taken more seriously as part of management.

What's it going to be, put on a suit, or schlep around in your shop clothes?

And why did they include the proceedings, the special dinner, et al in one lump sum with the price of the seminars, instead of breaking it down and giving attendees a choice as they have in the past?

☆☆☆

I wonder . . . why the Radio Futures Committee didn't just let stations create their own "Radio: What Would Life Be Without It?" promotions according to their own formats in the first place, as they've decided to do now.

Now those PDs who have no idea who **Richie Havens** is, don't take to the beau-

tiful baritone of **James Earl Jones** or don't like dead air can play **Donna Summers** *On the Radio* or **Sam Cooke's** *Having a Party* ("So listen, Mr. DJ, etc. . .") or some other snappy radio-related tune.

And why the GM who sold the 30 seconds of silence at a record profit for his market thought he was doing listeners a favor by "saving" them from dead air.

And why one member of the NAB Board didn't have his own stations air the promotion.

☆☆☆

I wonder why the NAB, which has bent over backwards to skirt the potential litigious issues involved in the AM stereo standards war has not shown the same caution with the NRSC FM subgroup on composite clipping.



Why has its NRSC embraced a report which clearly espouses only one side of the composite clipping issue (seeking to "embarrass" composite clipping off the air) and not encouraged participation by other points of view, risking interference to the marketplace's (individual stations') right to decide the issue for themselves?

I also wonder why the NAB has shown undue interest in the "legality" of the new FM ModMinder from Modulation Sciences when calls to the FCC from other concerned parties have yielded informal opinions that the product, if used as its designer intended, is perfectly legal.

And why there could be any question about that in their minds when it's simply a more accurate way to let stations measure modulation, allowing them in fact to turn off their heavy processing

and be just as loud—legally.

Why make things difficult for a company that's aiming at the same goal of your NRSC FM subgroups, namely, **healthier FM signals?**

☆☆☆

And, did you ever wonder why a well-educated communications lawyer would think it believable that a plane could fly flawlessly on automatic, with an unconscious pilot for 800 miles before heading into the briny deep, sinking, and leaving the now-conscious pilot alive but with a gunshot wound to the stomach, all without a credible explanation.

And why haven't more AM stations converted to stereo, when the trend towards one system is now crystal clear?

Why so many AM station owners think there aren't any AM stereo radios out there when any new Chrysler car you get into has them and about two dozen companies are making them and . . .

When Motorola even has a new microchip which will allow receiver manufacturers to easily develop a convenient "walkman" type AM stereo radio and when . . .

There is still a company like **Target Tuning** (Moonachie, New Jersey) able to turn out frequency-locked AM stereo walkman-type radios for stations smart enough to order them for their listeners and . . .

Why the "ch" in Moonachie is pronounced like a "k."

Why for the closing entertainment at **Radio '89**, the NAB has signed up three comedy acts: Mack & Jamie, John Candy and Jeff Altman.

The show is hosted by Dick Clark, whose name is synonymous with "Rock 'n' Roll." Where are the oldies?

☆☆☆

But enough wondering. Here it is, early August. You're already looking towards the fall. What's on the agenda?

That's right, **trade shows**. So how about a handy rundown?

First there's **Radio '89**, New Orleans, 12-16 September, looking to be bigger and better than in past years because radio, more and more, is feeling the squeeze at the NAB's spring show.

There'll be new products at this one, stay tuned.

IEEE will have its Annual Broadcast Symposium, across the beautiful Potomac in DC on 21 and 22 September. A full roster of speakers is set, including FCC Chairman designate (maybe by now Chairman) **Al Sikes**.

SBE's national convention is from 5-8 October in Kansas City (here I come), with special Ennes Engineering Workshops to start the day before it all begins.

The University of Wisconsin's Broadcasters Clinic will kick off on 16 October in scenic Madison and run until the 19th. I'd go for the famous **Pizza Engineering Forum** alone.

Then there's AES in Noo Yawk City. Audio engineers hit the streets of the Big Apple from 18-21 October.

Whew! Getting tired just thinking about it all. Hope to see y'all there.

☆☆☆

From SBE Chapter 47 in Los Angeles comes a story I love. Seems a town back east in Willimantic, CT (population: 15,000), had marchers aplenty for its **July 4th parade**, but no band.

Radio to the rescue. The townfolks each carried portable radios tuned to **WILI-AM**, which cooperated by playing appropriate marching music.

They've been doing this since 1985, and this year, there was even a float in the shape of a giant boom box.

Can't you just see it? Row after row of happy parade watchers with boom boxes on their patriotic shoulders, all tuned to the same great AM station? To quote Yakov Smirnoff: What a country!

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.

Remote Control You Can See and Hear

Want to know what's happening at your transmitter all the time? There's no better way than the ARC-16 Remote Control System from Burk Technology.

When something happens, your studio operator will know instantly. You can take prompt corrective action, observing the results on the front panel display. Alarms, meter readings and status are displayed in clear text, with labels you define.

When you're away from the station, let the ARC-16 call you. The DSU option will dial up to nine numbers, announcing readings and alarm conditions. You enter commands from your Touch-Tone® phone, then listen to the highly intelligible digitized voice.

Need to control two transmitter sites? No problem with the ARC-16 Multi-Site option. Connect up to three ARC-16's for simple, unified control of your entire operation. All units in the system can be used as control terminals for the other sites.

Imagine switching the studio audio processor from the transmitter or resetting the automation by telephone. The Studio I/O option puts control of studio equipment at your fingertips even when you're not there. EBS equipment, tape decks, security systems and STL transmitters are just a few of the many possibilities.

Break away from telephone lines with subcarrier generators available at no extra charge.



ARC-16 Remote Control System

Burk Technology is finding solutions to today's remote control challenges. Our systems are built to last and are backed by a 2-year warranty.

Want to know more? Call us TOLL FREE at 1-800-255-8090. We'll help you find the best remote control solution.

Burk Technology, Inc.
7 Lomar Drive
Pepperell, MA 01463
(508) 433-8877

BURK
TECHNOLOGY

Circle 63 On Reader Service Card
World Radio History

formerly

Advanced Micro-Dynamics

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.

Open forum or open court

Dear RW:

In regard to the spectrum battle between FM proponents and the FAA, I would like to offer my thoughts on the matter.

Congress opened a Pandora's Box in 1987 when it endorsed the FAA's authority to regulate electromagnetic interference (EMI) to airport facilities by broadcast stations. This is like giving a real estate developer the power to make its own zoning laws. With this authority, and the public-be-damned attitude that seems to pervade the FAA's upper management, it is no wonder how the situation has gotten as bad as it is.

If the FAA is so confident that it is right in what it is doing, why doesn't it defend its interference standards in an open public forum? Perhaps it is because (the FAA) knows that in a free discussion of this issue between aviation experts and broadcast engineering experts, the FAA's administration of its authority to regulate EMI would lose all credibility.

The FAA has unilaterally forged its own criteria for determining whether or not a broadcast station will cause interference in aircraft receivers, and nobody else, not even the broadcaster, has an opportunity to show otherwise.

Applicants for new stations are not the only ones being snared in the FAA's net. Existing stations that apply for a minor change in transmitting facilities also run the risk of getting an EMI hazard determination from the FAA even though those stations have been on the air for twenty or more years without a single

reported complaint of aircraft receiver interference. This demonstrates the folly of the FAA's interference standards.

What will the FAA do next? Will it go after stations applying for license renewal?

It's high time that the FAA stopped practicing this form of bureaucratic vigilantism, and sat down with the FCC and representatives from both the aviation industry and the broadcast industry to resolve the interference complaints, and to formulate an appropriate set of standards for electromagnetic compatibility between broadcast stations and navigational facilities.

Perhaps EM compatibility problems should be handled by the Interdepartmental Radio Advisory Committee (IRAC) or another inter-agency committee. In addition, the FCC and the FAA should once again consider issuing conditional construction permits, whereby if a station is found to cause interference to aircraft receivers, the permittee must reduce power to a non-interference level until the problem is resolved by the station owner.

Whoever decides to take action first, it will be the FAA that will determine in what environment it will defend its methods—in a public forum or in a federal appeals court.

Ben Evans
Evans Associates
Thiensville, WI

Casualties of war?

Dear RW:

Your article regarding the "FCC-FAA Turf Battle," your editorial on "Airwaves Versus Airspace" and Dale Ganske's guest editorial on the same subject hopefully may have some effect on an otherwise hopeless situation. It's time the parties involved got together to work out something, otherwise the class action suit you mentioned may be the only solution.

Most of my dealings with the FAA have been rather pleasant. However, on a few cases in recent months (Wauaukee, Wisconsin was one of those cases), the FAA has taken a "that's the way it is, we're not going to change, so to hell with you" attitude.

The problem almost always seems to be "intermodulation interference," something which the FAA does not even have the authority to regulate. Since when did Congress give the FAA authority to regulate the use of specific frequencies and transmitter powers in a given location?

On several occasions, I've questioned various FAA people about what could be done to solve the problem. The answers I received were ludicrous, including "change the frequency" (in most areas there are no other available frequencies), "lower the power" (thus severely crippling the coverage of a Class A) and "move the tower" (in one case, I was advised to move 12-15 miles away, far outside the permissible site zone and also making it impossible to provide city-grade coverage to the city of license).

A few disgruntled broadcasters and a handful of consultants are not going to

The FCC's recent decision on the Class A power hike brings to light the other side of the deregulatory coin.

The selective approach, while a fair tradeoff between one faction's desire for greater coverage and the other side's fears of greater interference, will result in more paperwork at the Commission.

Commissioners are estimating that some station applications will take as long as 18 months to process.

Clearly, as the climate of eliminating regulatory burdens has flourished in this country, the agencies tasked with keeping watch have seen their resources become gradually eroded from the inside.

As the FCC has taken a decreasing role in the day-to-day concerns of broadcast operations, it has become more difficult for the Commission, and agencies in similar situations, to justify increases in staffs and budgets.

While this has represented good news to taxpayers and to station managers who feel their regulatory burdens eased, there are hidden costs.

An increase in the length of time for the processing of applications to the FCC means a delay in new service to underserved areas and has an economically stifling impact on the industry as a whole.

This is true not only with the FCC, but also with the EPA, which ran out of money and abandoned the setting of RF radiation standards, leaving stations to fend for themselves in communities where overeagerness to impose stringent local standards is a continuing threat.

As Congress considers new Commission appointments, it should heed the words of outgoing Chairman Dennis Patrick and look closely at those burdens straining the FCC's diminishing resources.

And while the Commission shouldn't avoid making tough decisions that will add to its paperwork, the tougher decisions required in a time of increasing self-regulation and overcrowded spectrum conditions should prompt a more realistic attitude from Congress on much-needed funding.

The costs of deregulation are too high if they prevent expedient improvements in broadcast service to all.

—RW

Costly Choices

sway the FAA. The FCC is going to have to take a stand and assert its regulatory authority over matters relating to spectrum management (I know that's asking a lot—remember the AM stereo fiasco?) Until they do, the problem is not going to go away.

Larry G. Fuss
Broadcast Consultant
Fayetteville, GA

Supporting "dead air" campaign

Dear RW:

I've always had a great deal of pride and optimism concerning the broadcasting (radio) profession, but after reading some of the pitiful responses to the NAB/RAB's "Dead Air" promotion, I'm having serious second thoughts about the future of radio!

It was, and is, a noble cause: to unite radio broadcasters to promote their industry's importance and demonstrate that competition could be set aside for 30 seconds! Noble, and simple; but the NAB and RAB underestimated the egos and Know-It-All attitude of radio broadcasters . . . we have met the enemy and it is us!

The "one time opportunity to be the only station on the air" attitude of Bob Burch is typical of the "Biggest Pygmy" syndrome that dominates our industry! Until that attitude is overcome by the Richard Parkers of broadcasting, radio will continue to be considered a third rate medium!

We have, indeed, a long way to go; and, like every journey, we must begin with a single step. As an industry, we have yet to take that step! But congratulations to the NAB and RAB for their cooperation in giving us another opportunity that once again we have apparently failed to take advantage of!

The decision to go with the promotion was unanimous on our two market leading stations, KTRF-AM (Thief River Falls,

Minnesota) and KSNR-FM (Grand Forks, North Dakota); and it was well worth it! The results might be considered intangible (a label *some* people put on radio advertising), but we made a point—to our listeners, our advertisers, and most importantly, ourselves!

Radio is an exciting business; but it can be terribly frustrating too, especially when we have to deal with so many, as my sales manager so aptly put it, "1%*&* amateurs!"

Joel Swanson, GM
KTRF/KSNR
Grand Forks, ND

Bill a bad idea

Dear RW:

The "Broadcast Radio Quality Improvements Act of 1989" as currently written is a bad piece of legislation should not be supported.

Why should listeners be forced to pay extra for AM/FM receivers if all that they want is just one or the other? Or why should they be forced to pay extra for AM stereo if they listen only to FM?

This is like saying that all TV sets should be able to receive color as well as black and white. People should not be forced by legislation to pay extra for something that they don't want.

I previously lived in a house with light dimmers that produced so much noise on the AM band that only a few local stations were listenable. Who wants to listen to stereo noise?

On another subject, I believe that the FCC made a big mistake when they permitted VHF TV to remain when the UHF TV band was opened up.

There are lots of other services that could make use of the VHF spectrum. Move all TV to UHF with 12 MHz bandwidth so they can have HDTV.

Stanley Swanson, Network Engineer
World Radio Network
Laredo, TX

Radio World
Vol 13, No 15 August 9, 1989

Editor, Judith Gross

Associate Editor, Alex Zavistovich

Buyers Guide Editor, Richard Farrell

News Editor, Alan Carter

Charles Taylor, John Gatski

Frank Beacham/L.A.

Production Director, Judith Chamberlain

Production Manager, Jeanne Pearson

Ginger Bamford, James Gillgam,

Kim Lowe, Bill Spencer

Publisher, Stevan B. Dana

Associate Publisher, Arthur Constantine

Ad Coordination Manager, Simone Leaser

Robyn Rosenthal

Circulation Manager, Tiana Hickman

Accounts Receivable, Caroline Freeland



Radio World (ISSN: 0274-8541) is published

semimonthly by Industrial Marketing

Advisory Services, Inc., 5827 Columbia

Pike, Suite 310, Falls Church, VA 22041.

Phone: 703-998-7600, Fax: 703-998-2966. Application

to mail at second-class postage rates is pending at Falls

Church VA 22041 and additional mailing offices. POST-

MASTER: Send 3579 forms and address changes to Radio

World P.O. Box 1214, Falls Church VA 22041.

Copyright 1989 by Industrial Marketing Advisory Services,

Inc. All rights reserved.

Free subscriptions are available to professional broadcasting and audiovisual

equipment users. For address changes, send current and new address to RW

one month in advance of the above address. Unsolicited manuscripts are wel-

comed for review; send to the attention of the appropriate editor.

Next Issue RW
August 23

Built for Business.



The Revox PR99 MKIII Professional Recorder

\$2,495 this machine *means* business. Put the PR99 up against the obvious competition.

Not the cheaper MX50. And certainly not the Tascam 3030. Put it up against the much higher priced 5050 BII. Compare the superior construction quality of ours with theirs. And let them try to match our reputation for service and technical support... With the PR99, you've got *more* than a tough machine that's tough to beat. At \$2,495, it's *impossible* to beat.

Take note of these PR99 features: • a solid die-cast aluminum transport chassis and head block • record and playback heads built

to the same tolerances as the heads for Studer multitracks • easily accessible modular electronics for tough, reliable broadcast performance • an Autolocator with digital counter in hours, minutes and seconds • rack mounts standard.

This is a no-nonsense machine that takes you over radioland's toughest terrain. Taping news call-ins, downlinking or uplinking satellite feeds, producing commercial spots—wherever you need to go, it's radio's all-terrain vehicle that gets you there.

For value and performance over the long haul, **Playa Pro.** The one built for business.

STUDER REVOX

Studer Revox America, Inc.
1425 Elm Hill Pike • Nashville, TN 37210 (615)254-5651
New York (212) 255-4462 • Los Angeles (818) 780-4234
Studer Revox Ltd., Toronto (416) 423-2831

* Price subject to change without notice.

Call your Studer Revox Professional Products Dealer for more information about the complete line of Studer Revox Professional Products.

Class A's Get Selective Hikes

(continued from page 1)

sumed use of a 6 kW ERP, which reflects the power increase granted to the select stations under docket 88-375.

According to Bernard Gorden, a staff engineer with the FCC's policy and rules division, the Commission will continue for now to accept applications under such criteria, despite their irrelevance to Class A's not affected by the July ruling.

"We're working on a response to a petition for reconsideration, and we expect to address the Class A matter in there," he said. The response is expected before the Commission's list of 500 affected stations comes out in November.

Not included in hike

Not included among the 500 stations allowed to boost power are about 800 Class A's that the Commission said do not meet new distance separation requirements. They are eligible 1 December to file FCC Form 301 to construct directional antennas and thus increase power, according to Felker.

Also excluded are about 600 Class A stations that border Canada and Mexico, which will be examined case by case; as well as 100 short-spaced Class A stations that were grandfathered to meet original Class A distance requirements, Felker said.

Felker said that in all cases, these stations will maintain the classification as Class A's, despite varying levels of power.

"If you're operating at 3000 W, you'll still be a Class A, but you'll be operating at less than maximum facilities," Felker noted. "And as long as you're above the minimum (wattage), then you're still classified as Class A. It's not unheard of in other classes."

Reaction from broadcasters regarding the ruling was mixed.

NAB, which had forcefully opposed a blanket Class A increase, and asked for a more selective implementation, said in a statement that the ruling was "wel-

come news."

"The FCC wisely recognized that general across-the-board increases could do serious harm to the integrity of the FM spectrum," said NAB President and CEO Eddie Fritts.

"The Commission's case-by-case consideration of additional power increase

sue of whether they could even qualify for it."

Nutmeg Broadcasting President Michael Rice of Willimantic, CT, who helped bring together regional radio owners and operators to underscore NAB's efforts against a blanket Class A power increase, commented that aside

"We might have to heave a sigh and go on to something else and say we gave it a good try."

applications may alleviate any other interference problems that may be presented," he said.

Michael Rau, NAB science and technology VP, added that the Commission decision was fair, not overly stringent in its view of Class A stations.

"I think the NAB's position recognized that some Class A's would not be able to take advantage of the power hike," he said.

"Some stations aren't going to be able to do what they want to do, but in my view, the engineering standards of allocation come first, and then within that framework, stations should be able to decide what they want to do—not the other way around," said Rau.

New Jersey not pleased

The New Jersey Class A Broadcasters Association, a vocal supporter of a blanket power increase, was not pleased with the text released by the FCC on the issue, according to Ken Keane, an attorney with Wilner & Scheiner and the association's representative on the issue.

"I think certainly the thrust of the (FCC's) press release is not favorable to the New Jersey position," he said. "It's going to make it much more difficult and much more expensive for many Class A's to even seek relief, putting aside the is-

from the 500 stations that were granted the power hike, "the rest of us are going to have to fight our individual battles to see what we can do, if anything at all. I suspect for us up here in New England, there's not going to be much."

Rice said the stations in his area would consider appealing the ruling, but only if they could raise money among themselves to cover legal expenses. "We're still paying for what we did before," he said. "We might have to heave a sigh and go on to something else and say we gave it a good try."

Paperwork burden

The fact that the Commission took the selective, instead of blanket approach to the Class A hike will mean an increase in paperwork and therefore in time to process the applications, Commissioner Patricia Dennis noted after the decision.

She raised the concern that it will strain already strained Commission resources at a time when the Commission's budget has not been increased by Congress.

Dennis estimated that the time to process new station applications will likely increase from four months to 12 months, while minor modifications will probably increase from six months to 18 months.

But, she added, "I assume that sta-

tions who want an increase in power would rather wait 18 months than not have one at all." She also said she hoped Congress would see fit to allocate more funds to the Commission.

Patrick agreed, noting that the Commission is operating more efficiently, but there have been cutbacks at a time when the FCC's responsibilities are increasing.

However, "we should not forego making good decisions because they strain our resources," he said.

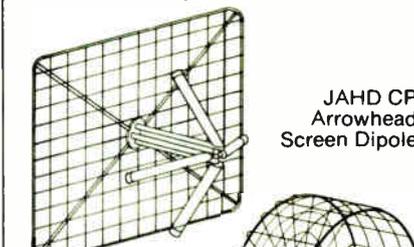
The NAB's Rau agreed: "The administration issue may be a 12-month or an 18-month issue, but the technical standards issue is something the industry would have to live with forever."

For more information on docket 88-375, contact Bernard Gorden at the FCC, 202-632-9660; Michael Rau at NAB, 202-429-5346, and Ken Keane at 202-861-7845.

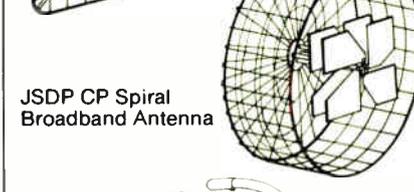


Puts your signal in it's place!

If you need a quality antenna, you need: **JAMPRO ANTENNAS, INC.** The really experienced one for over 30 years.



JAHD CP Arrowhead Screen Dipole



JSDP CP Spiral Broadband Antenna



JBBP FM Antenna Balanced Excitation

JAMPRO is the world leader in custom-designed, directional, CP antennas.

- With over 1600 of our penetrators delivered, more stations have penetrated their market.
- Our custom-made directional antennas are operating world wide.
- Full-scale antenna measurements on **JAMPRO's** all-year, all-weather test range.
- We custom-make tower structures to duplicate your's, for optimum results.
- Ask about **JAMPRO's** low-power educational packages. Give us your requirements and see how fast we produce.

JAMPRO Antennas, Inc.
6939 Power Inn Road
Sacramento, CA 95828
(916) 383-1177 • Telex: 377321
FAX (916) 383-1182

Vanguard Series™

Broadcast Audio Consoles



Performance, Value and Reliability through Innovative Technology

- Raised, tactile feel, lighted membrane switch panel—digitally scanned
- 12 stereo inputs plus optional expander
- VCA controls, rotary and linear
- Analog and fluorescent meters
- Modular, plug in electronics
- Easy punch block installation
- Effective RF protection

**BC8DS
8 Mixer
Dual Stereo**

only **\$3,195**

AUDIO TECHNOLOGIES INCORPORATED



328 Maple Avenue, Horsham, PA 19044 • (215) 443-0330

FMX Opponents Outline Tests

(continued from page 3)

Some station engineers said the Bose testing guidelines are a good idea because of the controversy. Others reportedly have been insulted by the test guidelines because they feel the implication is that engineers don't know how to conduct their own tests.

Let stations decide

"They (the Bose Corp.) probably have done the right thing," WPKT-FM CE Stew Jaeger said. "They have made their point and they have suggested ways for people to go out and decide for themselves."

WPKT, a public station in Middlefield, CT, was the first station to test FMX and it still broadcasts with the technology with no degrading effect on the signal, Jaeger said.

However, Jaeger would not speculate on how it works or would work for other stations.

Although the Bose research probably was conducted for self gain, it motivated stations to take a closer look at the technology by testing it themselves, said Jim Wood, president of Inovonics, the only manufacturer of FMX generators.

"What we have advocated all along is for people to do their own tests," Wood said.

Broadcast Technology Partners (BTP), the developer of FMX, said it always has encouraged independent station evaluation.

"We have always encouraged testing of the system. In a lot of cases, the testing goes in much more depth than Bose does," BTP Marketing Manager Ben Micznick said.

According to Short, FMX still causes the same problems that were explained in the original report. Although he has not tested the latest generation FMX decoder chip from Sanyo, or the new

According to Short, FMX still causes the same problems that were explained in the original report.

The FMX controversy mushroomed on 25 January, when Bose, also a professor at Massachusetts Institute of Technology (MIT), released the critical FMX study to invited members of the media and industry.

The study was based on laboratory calculations and field tests, which concluded that FMX adds more noise and distortion to FM broadcasts under multipath conditions.

BTP denied that FMX increased noise under multipath conditions and said the Bose research was flawed.

However, several stations have reported problems with FMX including incompatibility with paging subcarriers and noisy, distorted signals.

Despite criticism and innuendo that Bose Corp. undertook the test to further a system of its own, Short said there has never been such a system.

one from Sprague Semiconductors, he said he is sure they will perform with the same results.

Anti-multipath circuitry

Short noted that BTP apparently has tried to enhance performance of FMX under multipath conditions since the Bose study came out.

He was referring to a June technical information letter sent to receiver manufacturers using or considering using FMX. BTP advised using additional circuitry to make FMX perform better under multipath conditions when using the latest Sanyo LA 3440 FMX decoder chip.

But BTP President Emil Torick refuted Short's position. "There is nothing new that we haven't communicated to our licensees," he said.

Short said the letter confirms Bose's

contention that FMX requires "a patch-work" of additional circuitry to offset additional problems created by the technology.

"That's not true," Torick responded. "It is an appropriate way to use that particular chip."

The supplementary circuitry, according to BTP, includes a "gate" control on the FMX expander to stabilize stereo performance during moderate-to-heavy multipath. The FMX expander also can be modified to add "blend" during heavy multipath when "noise reduction may be of greater concern than stereophonic separation preservation."

For information, contact William Short at 508-879-7330, Ben Micznick at 313-540-4380, Emil Torick at 203-655-5132, Stew Jaeger at 203-622-2804 or Jim Wood at 408-458-0552.

Bose's Tests

(continued from page 3)

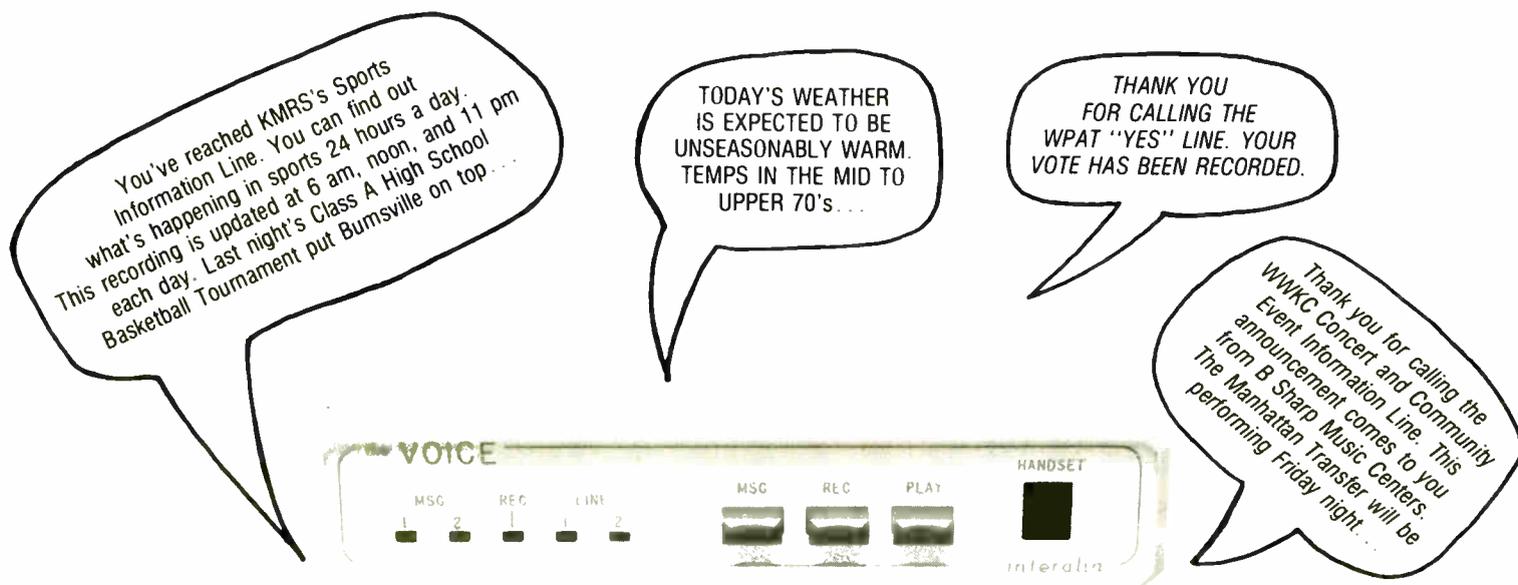
mended circuitry and the latest FMX generator is used for transmission, FMX reception will provide wider stereo coverage and less noise than FM even under multipath conditions.

Bose's initial field testing was flawed because its receiver did not use an "approved" decoder chip and the test station had problems with synchronous AM noise, according to BTP.

Bose has denied the test was tainted by a bad chip or transmitter problems at the test station.

For information, contact Bose Corp. at 508-879-7330.

Broadcasters like the sound of our Voice



The VOICE as a revenue producer. By allowing advertisers to procure a spot at the beginning or end of any of the above listed telephone information messages, broadcasters finance their public information services. Because the Voice can link two messages together so they sound to the caller like one, part of the message can be easily changed while leaving the other part of the message intact. For example, callers would hear a short, sponsored advertisement followed by today's weather, concert line, etc. The message portion would be changed daily while the sponsored portion would remain for the amount of time for which it was paid.

The VOICE for high quality sound, reliability and functionality. When it comes to sound quality over the telephone, there's none to

surpass Intermedia. Direct interfacing to the telephone network means no adaptors are necessary, as there would be with a cart machine, which results in a cost savings for the broadcaster. The solid-state digital design of an Intermedia announcer makes it maintenance-free, with no tapes to change and no potential for sound quality degradation.

You may want to listen to some examples of other radio stations that have used Intermedia announcers. Don't hesitate to call any of these numbers: WCMY in Ottawa, IL at 815-433-4545; WGGB-TV in Springfield, MA at 413-731-WGGB; KRMG in Tulsa, OK at 918-492-8000; or WNEB in Worcester, MA at 508-795-1230.

ATLANTA, GA CHICAGO, IL DALLAS, TX
LOS ANGELES, CA RICHMOND, IN

800-622-0022

ALLIED

Broadcast Equipment

— A HARRIS COMPANY

AM Project Started

(continued from page 1)
to do just that.

After the ground system work, the main goal of the antenna project—testing to see if the antenna design can suppress skywave—will be the focus of the remainder of the year's worth of testing.

Prestholdt design

The Prestholdt antenna is designed to suppress skywave in a single direction by directing skywave energy into the groundwave signal.

The horizontal radiator three-quarters of the way up the tower can be turned to the direction in which skywave presents the greatest problem.

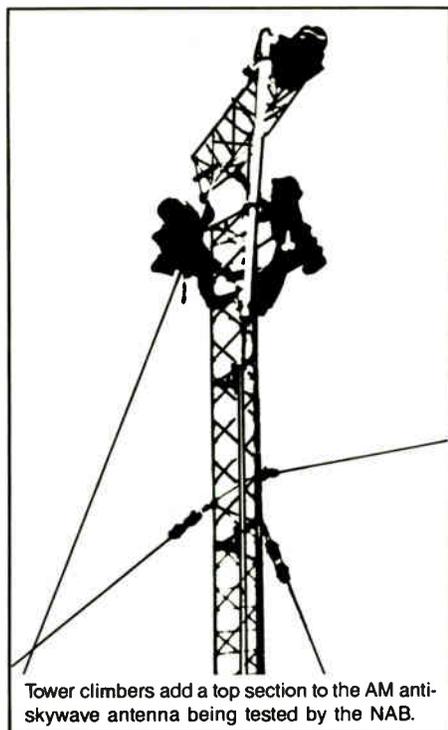
The NAB will use volunteers to monitor signals at various points both near and far from the transmitter, which has been authorized on 1660 kHz for up to 5 kW, although the NAB will use lower values to conduct most of the tests.

When the year-long tests are completed, Williams said the NAB will have a vast amount of information on antenna systems which it will make available to radio engineers.

He also said that after the main focus of the antenna tests, the site may be used for other types of tests.

The NAB had initially planned to test a second anti-skywave design by Richard Biby, but the designer asked that that project be tabled indefinitely.

The NAB had also mentioned a pos-



Tower climbers add a top section to the AM anti-skywave antenna being tested by the NAB.

Photos courtesy of NAB

sible test of a low-profile antenna, but its proponents say that physical testing may not be necessary because of the simplicity of the low-profile concept and design.

Williams said the NAB will consider other testing possibilities while the work on the antenna site continues.

For more information, call Kelly Williams, NAB Science & Technology, 202-429-5346.

FROM THE ALLIED TECHNICAL NOTEBOOK

HENRY PROUDLY ANNOUNCES THEIR NEW U.S.D.A.

U.S.D.A. stands for "Utility Summing & Distribution Amplifier." It's a 'Mini DA' that has the unique ability to combine as well as split audio signals for distribution.

U.S.D.A. can be used as a mono (1x4) or stereo (2x4) DA. It has two inputs (one stereo pair) and four outputs (two stereo pairs).

But here's what makes U.S.D.A. unique: mono-stereo mode switching for each stereo output pair! You can feed a stereo input into U.S.D.A., and get your choice of stereo or mono outputs, or both!

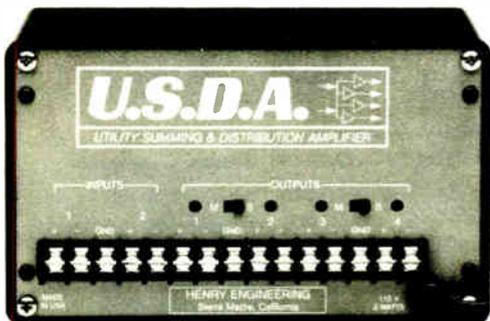
Use U.S.D.A. to add a mono output to a console... use U.S.D.A. to combine the output of a stereo tuner to feed a mono PA system... use U.S.D.A. to create isolated stereo and mono outputs simultaneously from a single stereo input... all without sacrificing the separation of the stereo source signal.

U.S.D.A. also has gain adjustments for each output. Feed any input between -20 and +8... use U.S.D.A. to boost levels of a -10 unbalanced source (CD player, etc.) to a +4 balanced output. The specs are excellent, the cost is low, and the versatility is high!

SPECIFICATIONS:

Input range: -20 to +8dBm
Input imped: 20K balanced
Gain: -6 to +20dB
Output level: +25dBm max.
Output load: 600 ohms x 4
EIN: -95dBm

U.S.D.A. is another "why-didn't-they-think-of-this-years-ago?" product from Henry Engineering.



U.S.D.A. is in stock NOW for immediate shipment. \$195.00

800-622-0022

ATLANTA CHICAGO DALLAS
LOS ANGELES RICHMOND

ALLIED
Broadcast Equipment
— A HARRIS COMPANY

WE'VE MADE DEAD AIR A DEAD ISSUE.

There are worse things in radio than dead air. But not many.

And if your CD players aren't built to resist tracking errors, you could find yourself listening to some very embarrassing silence.

Not with the new CD-701 from Tascam. Its unique disc clamping system is a technological triumph that virtually eliminates disc vibration. So you never hear the awful hush that means a tracking error has occurred.

What you do hear is the finest sounding CD unit you can buy, with the same proprietary "ZD Circuitry" praised by two of Japan's top audio magazines* for eliminating low-level digital distortion.

Then there's the optional RC-701 Remote Control with Auto Cue so you can cue to the music instead of the track (for even less dead air). Or you can add the Ram Buffer for true, instantaneous startup.

And with four times oversampling and 16-bit D/A converters in an extra-rugged chassis, the CD-701 is superbly designed for the broadcast environment.

Can a CD player really deliver this kind of performance, track after track, disc after disc? Only if it's a Tascam.

Contact us or visit your Tascam dealer for more information about the CD-701. And take the sounds of silence off your playlist.

TASCAM



©1989 TEAC America, Inc., 7733 Telegraph Road, Montebello, CA 90640, 213/726-0303
*Radio Technology Component Grand Prix '88, CD Division, Stereo Sound Component of the Year (1988) & Best Buy (1988)

Diversity Tuning Coming of Age

Slow to Awaken, This Decade-Old Technology Is Winning Supporters

by Charles Taylor

Washington DC More than a decade ago, an automobile tuner was developed with circuitry that reduced FM multipath distortion by switching rapidly between antennas located at the front and back of the car in search of the strongest signal.

The concept, called diversity tuning, was heralded by engineers, hotly discussed at broadcasting conferences and admired by consumer audio critics. Many figured that within a few years, it would become standard equipment on American car radios.

But instead, the diversity tuner has become somewhat of a "sleeper" in the domestic consumer audio industry. It exists in higher end audio products, but gets overshadowed by other improvements such as FMX, touted to help FM reception but requiring special transmission equipment for broadcasters.

Only two companies, Clarion and Fujitsu Ten, currently manufacture a diversity radio—Sony, Kenwood and a few others gave it a try, but discontinued the product following lackluster sales.

Vanish in the airwaves

Some claim that unless the product receives a significant marketing push from a major manufacturer, it likely will vanish into the airwaves. Others say it hasn't caught on because it had bugs to work out and a price to work down, but that its day will arrive.

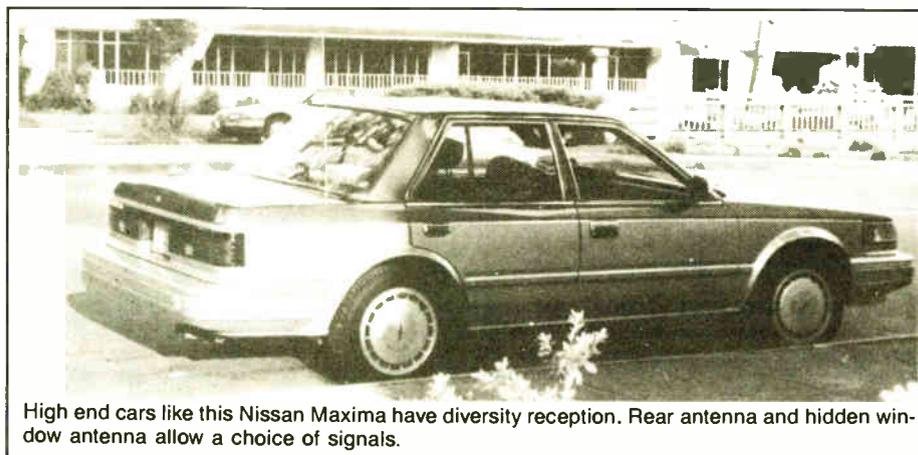
"Ten years ago when I first saw it, I said to myself, 'That's got to become a standard option for automobile radios,'" said Almon Clegg, a consultant and advisor for Nippon Columbia Co. Ltd., the parent company of Denon America. "I still think it's coming."

One factor in its favor is relatively simplistic technology. Most diversity radios

utilize the signals from two FM antennas placed at least three feet apart on each end of a vehicle.

The FM signals feed from the antennas into a tuner with circuitry that continually judges which antenna is receiving the strongest signal and the least intermodulation disturbance, and switches back and forth in favor of the stronger.

The result is less signal drop-out, and is particularly effective in metropolitan



High end cars like this Nissan Maxima have diversity reception. Rear antenna and hidden window antenna allow a choice of signals.

areas or areas where multipath is a severe problem, according to a number of sources.

Results of tests by Clarion said that reception is improved by between 20% and 40% with diversity tuning, said Jack DeBiasio, the company's product manager.

Favorable reviews

Julian Hirsch, a contributing editor of *Stereo Review* magazine and its chief audio products reviewer, said, "It is a great idea. It's almost the only practical way of beating multipath reception in a car."

A 1981 paper written by Emil Torick and Robert Finger, then engineers with CBS Technology Center, concluded that diversity receivers offer significant performance advantages over conventional single-antenna arrangements for reducing multipath in moving vehicles.

Results of their tests showed that "there

exists the potential of changing intolerable listening conditions to good ones for a wide class of problem situations."

In Europe, diversity radios have caught on to a more significant degree, according to Eric Small, VP of engineering for Modulation Sciences Inc., however, "they carry a premium price tag—though from the electronics that's in them, there's no reason they should. It's just that right now they're a 'sexy' item."

He added that in Europe, manufacturers are satisfied with low-volume sales because they can "sell 100 receivers at \$1000 apiece rather than 10,000 receivers at \$400 apiece."

Japan also has more readily embraced the technology, according to Clarion's DeBiasio: "They want better performance on a car radio, even if it means spending a little more money. They want all the new goodies on a car stereo."

Why so slow in US

Theories on its slow acceptance in the US vary among audio experts. Foremost, it appears to be a matter of consumer vanity, according to DeBiasio.

"From a retail standpoint, people will sacrifice performance for cosmetics. People here do not want two antennas on their cars. That's the bottom line," he said. "Thus, it's no good."

Added Clegg, "It's just slowly finding



Diversity tuning is currently a feature of high-end automobile stereos.

its way from the laboratory into the product. They've been trying to figure the best way to ergonomically add the feature to the automobile."

But apparently, the efforts—at least on the retail consumer level—have been moot. Clarion has been so unimpressed with retail sales that it plans to withdraw its \$600 Audia 2000 consumer high-end diversity radio this year. Fujitsu, the other current manufacturer, never has offered a consumer model.

Real hope for the concept remains in direct sales to automobile manufacturers. For four years, Clarion has manufactured a diversity tuner as a standard feature for the Nissan Maxima, 300ZX and Pathfinder truck.

Fujitsu has built it for three years as standard equipment for Toyota's high-end cars, such as the Supra, according to Rob Putnam, the company's manager of product development.

Factory-installed diversity radios commonly include one standard whip antenna with the second antenna built into either the front or back windshield, thus avoiding the cosmetic flaw that DeBiasio said harmed retail sales.

Major market push

Still, proponents say a major market push is needed for diversity radio to reach its potential.

"It would take a huge advertising campaign to let the consumer know about it and its benefits," said DeBiasio, "more money than any one manufacturer really

(continued on page 17)



Beaven Els, Chief Engineer, WFAA-TV Dallas

"Our ratings are powerful...and so are the demands of our equipment."

A television signal going to millions of homes can be a very complicated process. In Dallas, WFAA-TV has been THE dominant force for decades. This success is due, in large part, to the technical expertise BEHIND the camera.

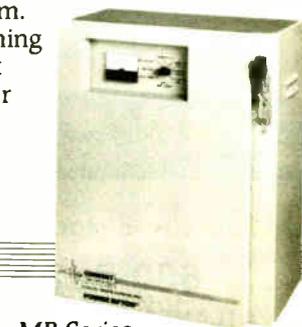
As Beaven Els will attest, WFAA-TV is committed to investing in the finest equipment. From the most sensitive recording instruments to the electric clock in the lobby, WFAA-TV must have a reliable source of power. That's why Chief Engineer Els chose to have *everything* protected by the POWER SIFTOR® from Current Technology.

The effects of unfiltered power can wreak havoc in a television station. Digital equipment and computers can be destroyed by "dirty power", and the POWER SIFTOR typically eliminates these effects. And, Underwriter's Laboratories has made the picture even more clear by giving the POWER SIFTOR outstanding marks in the 1449 testing program.

Beaven Els is right. WFAA-TV's investment in programming and equipment are two reasons for the station's success. But without power protection, the station's "sign off" might occur earlier than scheduled.

Don't wait. Failure to act can result in permanent damage to your equipment! Our analysis of your power protection needs is free...and so is the call. 800 238 5000 ask for Peter Diamond, ext. 480

The Power to Succeed™



MP Series

CURRENT
Technology

1400 South Sherman • Richardson, TX 75081
(214) 238-5300

Power Siftor and The Power To Succeed are registered trademarks of Current Technology, Inc.



Put Dolby SR before the cart

There's no doubt that compact discs and other digital audio sources have helped to raise broadcast audio quality to new heights. And to some degree, almost all broadcasters have embraced this new technology.

But you probably continue to use carts right along with these new formats. For on-air playback of your programming, as well as commer-

cials, spots, and jingles, carts are still tough to beat for convenience, ruggedness, and familiarity.

Carts do have one limitation, though: sound quality that doesn't measure up to today's high expectations. Dolby SR (spectral recording) overcomes that limitation. With Dolby SR, your carts can capture the full range of dynamics present in all your source

material, digital or analog. And using Dolby SR to produce spots and jingles ensures an outstanding finished product.

You've always had good reason to use carts. Now with Dolby SR there's a great one: sound quality updated for today's demanding broadcast environment.



The Dolby Model 363 provides two channels of Dolby SR in a compact, reliable package ideally suited for both production and on-air playback.*

Dolby[®]

Dolby Laboratories, Inc., 100 Potrero Avenue,
San Francisco, CA 94103-4813, Telephone 415-558-0200,
Telex 34409.

346 Clapham Road, London SW9 9AP,
Telephone 01-720-1111, Telex 919109.

*Broadcast units incorporating up to 12 channels of Dolby SR for use with multiple cart machines or open-reel recorders are also manufactured by Pacific Recorders & Engineering Corp., Carlsbad, CA.

"Dolby" and the double-D symbol are trademarks of
Dolby Laboratories Licensing Corporation. S89/8689

Music Fee Claim May Be Scam

by Charles Taylor

Boise ID A woman claiming that more than a dozen popular songs were stolen from her by other composers is attempting to collect royalty fees from radio stations across the country, citing ownership of the music through federal copyrights.

Sally Sun and her business, American Music Licensing Company, have so far sent invoices to about 180 stations in West Virginia, Wyoming, Washington and Wisconsin.

The Idaho State Broadcasters Association, however, suspects the company is a fraud.

The association is advising any station receiving an invoice to send it to the Better Business Bureau in Boise, which in turn will forward information to the mail fraud division of the US Postal Service and the local police department, according to Connie Searles, executive director of the association.

ASCAP sends alert

ASCAP, a licensing company for artists, meanwhile, has sent an alert to radio licensees, advising them that fees should not be paid to Sun.

Gloria Messinger, managing director of ASCAP, said the organization had suggested to stations that Sun's company seemed to be a fraudulent scheme.

BMI, another major music licensing

company, said it had received copies of Sun's invoice from member radio stations, wondering what her intentions were. Dan Gold, an attorney with BMI, said BMI is planning to investigate.

Sun's fees hinge on the copyright of 16 popular song titles, including "I Write the Songs," "The Gambler" and "Don't Cry Out Loud." She claims the songs were stolen from her by the artists whose names appear on the songs' record labels.

American Music Licensing Company is charging contemporary, MOR and easy listening stations 1% of the station's net profit for playing the songs during 1987 and 1988. Country stations are charged a flat fee of \$1800.

Normally, stations pay annual fees to licensing companies—such as ASCAP and BMI—as a royalty for the use of artists' music, based on the station's format and annual net income.

Most of the songs titles listed on invoices Sun sent to stations are, in fact, federally copyrighted with either Sun or one of a number of pseudonyms (including Mama Sally, Sally Ann Griffith Schueltze, Quail Doolittle, Sally Montana and Ursula) listed as the composer of lyrics and music.

But, as an official of the Library of Congress explained, any number of copyrights may be granted to a particular title, aside from its popular version.

The song title, "Let Your Love Flow," for example, has 11 federal copyrights. One of them is owned by Sun, another by Larry E. Williams, who, according to the single's label, composed the hit version sung by the Bellamy Brothers.

Sun stands by the claim that her copyrighted versions are the ones that radio stations play: "I'm the true origi-

"Any serious songwriter would have joined (a music licensing organization)."

nal composer of these songs and they were stolen from me," she said.

"I can only say that I can refer someone to United States copyright law," Sun added. "That's the total grounds of my claiming my legal rights as the true, original composer."

Sun, 51, said many of her songs were written as a child, and were stolen from her after the age of 18, despite attempts to protect them at a young age.

Started at age 4

"I started writing songs at the age of 4 and my parents made a horrible mistake of refusing to allow me to get

the copyrights to my songs," she explained. "They said I had to wait until I was legal age, so they stored them away from me with the idea that we would copyright them when I was 18. Then at 18, my stepfather hid them from me."

Subsequently, the songs were popularized by artists who either stole them or heard them and claimed them to be their own, Sun claimed.

But most aren't buying it.

"Any serious songwriter would have joined (a music licensing organization)," ASCAP's Messinger said.

An artist has little chance of collecting royalties without registering the songs with one of the companies, she added. "It would make no sense for a person not to be affiliated with ASCAP or another (licensing) organization."

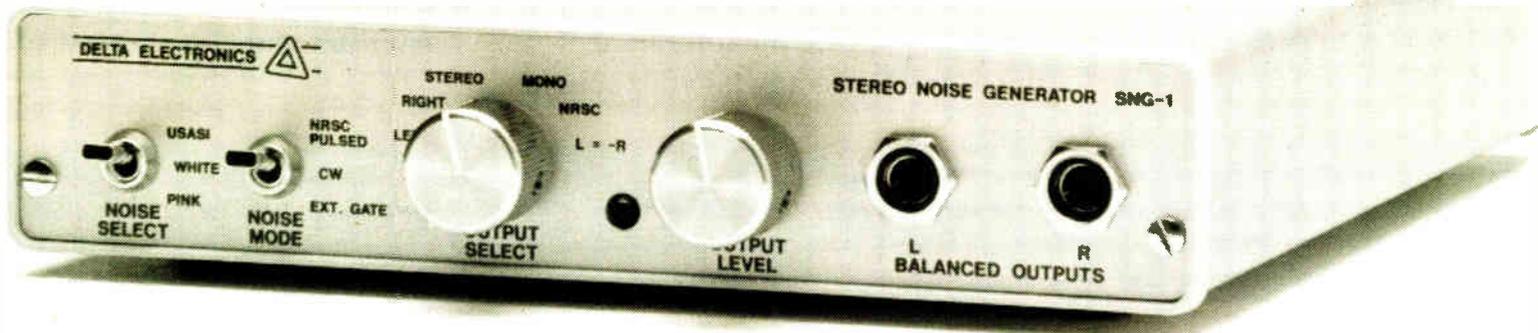
"We're trying to figure out what this is all about," said Lana Smith, bookkeeper at WTTN-AM/FM, which received two invoices from Sun, neither of which had an amount due printed on the bill.

Smith said the station did not intend to pay any fee unless gaining a clear understanding from American Music Licensing Company regarding the charges.

Vernon Stanfill, GM and CE of WFGH-FM in Fort Gay, WV, said his high school-operated station also

(continued on page 22)

Little Noisemaker.



This little gray box is about to have a big effect on the way you test your audio equipment.

No longer will you have to bother with individual tones to set proper audio levels. With Delta's SNG-1 Stereo Noise Generator you can make a variety of tests with *true* stereo noise, all at the flip of a switch.

You'll get a much more realistic view of what your equipment is doing. Whether you prefer white, pink, or USASI noise spectra, the SNG-1 provides it, in both continuous and pulsed output modes.

Say goodbye to hit or miss processor adjustments using varying program material. The award-winning SNG-1 spans the entire frequency range, so you'll cover the highs, the lows, and everything in between.

The external gate input permits an infinite variety of pulse shapes and durations so you can test your equipment to the absolute

fullest. For standalone convenience simply switch to the internal pulse mode.

With the SNG-1 you'll always get an accurate and repeatable standard to base your measurements on. And for only \$495, there's no bigger value.

To discover how the Little Noisemaker can help you in a big way, call or write today. And be sure to ask for your free copy of Delta's Noise Primer, "Employ Some Noise." Delta Electronics, Inc., 5730 General Washington Drive, P.O. Box 11268, Alexandria, VA 22312. Phone: (703) 354-3350, FAX: (703) 354-0216, Telex: 90-1963.

The Above Standard
Industry Standard.

DELTA ELECTRONICS



©1989 Delta Electronics, Inc.

Montoya Throws Hat In SBE Election Race

(continued from page 1)

be considered in determining who is qualified to be SBE president.

"I hate the term working engineer," Dick said. "As far as I'm concerned, every engineer is a working engineer."

He also said precautions are in place at *BE* "to assure absolute editorial honesty" in the magazine's coverage of the society. Dick said *BE* gives "100% control" to SBE for the monthly update column. "I would continue that practice," he said.

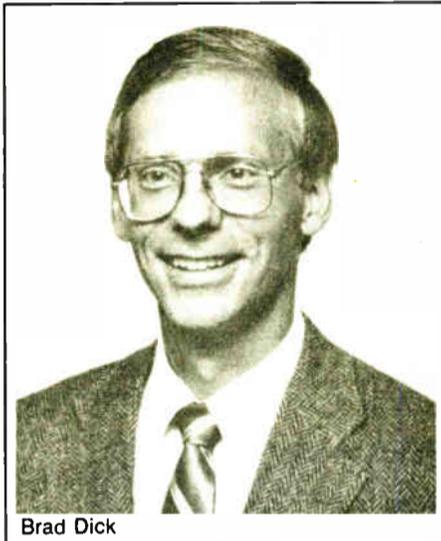
Dick said his job as an editor gives him an overall perspective on the industry and therefore an advantage to help SBE "make positive decisions. I think I can do that better than someone forced to sit there . . . adjusting knobs on a tuner day after day."

Dick also said, from a management perspective, current SBE President Jack McKain is not a working engineer.

McKain, VP, Woodland Communica-

new the contract when it expires after the 1990 convention. He said the decision was made before his candidacy became a factor.

Dick has been radio technical editor at



Brad Dick

BE since 1985. He was chairman of the Kansas SBE chapter for two years and has been certification chairman about 10 years.

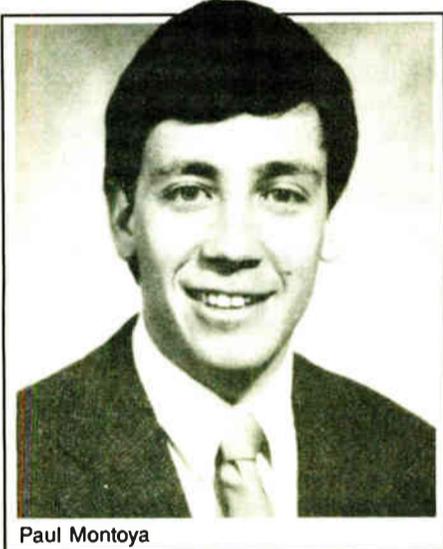
He said he has more than 20 years engineering experience as a CE in radio and TV. "I'm not writing about stuff I've read in a book. I've done it," Dick said.

Montoya has been director of engineering at KXKL for two years. Previously, he said he was corporate director of engineering for Surrey Broadcasting from 1985 to 1987; CE for KBPI-AM/FM, Denver, from 1980 to 1985; CE for KLUC in Las Vegas from 1978 to 1980, and assistant CE for KHOW, Denver, from 1975-1987.

Dick said SBE needs "continued growth" membership-wise and financially.

Montoya said attention should be placed on the national convention and possibly hiring a convention director as the event grows. He also said emphasis should be on a newsletter, cost accounting and budgeting, communication among the board of directors, the certification program and hiring a national director.

The issue over who would run for SBE president developed when current VP Bob Van Buhler announced at a SBE meeting during the NAB convention that he would not seek the office because of time restrictions at his new job at KNIX in Phoenix.



Paul Montoya

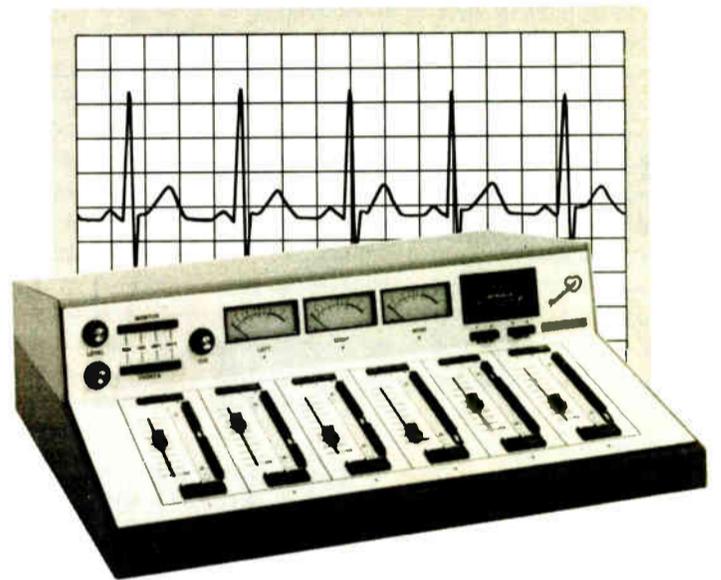
tions Corp. agreed that in terms of management, he is not a working engineer. But he added, "I think we all are (working engineers) to some degree."

With a real campaign looming, McKain said he would not endorse a candidate. "I'm not backing out of anything because both are quite qualified," he said. He said there has not been a two-way race in three elections.

BE magazine currently coordinates the seminars for the annual SBE convention under a three-year contract between the two.

In addressing potential conflict-of-interest issues, however, Dick revealed that the magazine does not plan to re-

Is The Heart Of Your Newsroom Missing A Beat?



Install A Pacemaker

Here's the ideal product to revive an overworked newsroom. The PACEMAKER from Autogram and BSW is the perfect console for fast-paced news operations. Compact and extremely durable, the PACEMAKER 648 has an unbelievable 8 stereo inputs for each of its 6 channels. That's a total of 48 inputs. Remote start for all inputs is standard. Quality components such as P & G faders, Schadow switches and extensive use of VCA's assure you high quality audio.

Now all the inputs you need for the newsroom can be routed entirely through one console without the need of other switchers. Get all the facts today from your BSW Sales Representative, toll free, 1-800-426-8434.

BSW

BROADCAST SUPPLY WEST

America's Full-Time Broadcast Supplier

1-800-426-8434

ORDERS • INFORMATION • SPECIFICATIONS
BSW • 7012 27th Street W • Tacoma, WA 98466 • FAX 206-565-8114

THE ULTIMATE SOLUTION

STICK-ONS

Unparalleled Performance ..Convenience.. Value

FREE APPLICATION DRAWINGS AVAILABLE!!

STM-1 MIC TO LINE LEVEL

- STA-1 Electronic Transformer PAIR, Bal↔Unbal conversion with adjustable gain OR loss
- STM-1 Low Noise Microphone Preamp
- STA-3 3 Watt RMS Audio Power Amplifier
- STA-6 6 Watt RMS Audio Power Amplifier
- STP-1 Adjustable Audio Pad PAIR, Hi or Lo Z
- STD-1 150 or 600 Ohm Audio Divider-Combiner

RADIO DESIGN LABS (805) 684-5415

Get the message?

C-QUAM® is setting the AM Stereo standard.

We said so last year . . . and the year before . . . and the year before. And it's still true! C-QUAM is setting the AM Stereo standard the hard way — in the marketplace.

We can prove it. Just count the number of C-QUAM stations, receivers, IC's, plus equipment manufacturers and countries committed to C-QUAM. The numbers tell the story.

With the whole world turning to Stereo . . .



You can stop worrying about who's setting the AM Stereo standard.

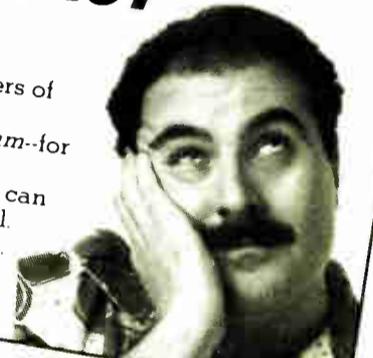
We Are. With C-QUAM™ AM Stereo!

Some people will think we're pretty bold making that claim. You bet we are! Because we're confident. And here's why: when you modernize with C-QUAM AM Stereo, you can be confident too.

- **MORE STATIONS** . . . Nearly 9 times more C-QUAM stations worldwide than any other AM Stereo system . . . over 600! And still growing.
- **MORE RECEIVERS** . . . C-QUAM is already in over 30

Music really Mono?

letters of
ow.
o-hum--for
ereo can
gnal.
ues.



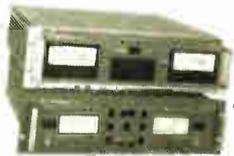
C-QUAM™ AM Stereo . . . setting the whole standard and nothing but the standard.



You be the judge. Here's proof that C-QUAM AM Stereo is 'Setting the Industry Standard' with more:

- **MORE STATIONS** . . . Over 700 C-QUAM stations worldwide! More than 20 times any other AM Stereo system . . . and growing.
- **MORE RECEIVERS** . . . Over 17 Million C-QUAM IC's shipped to date! And C-QUAM is already in more than 50 models marketed by over 30 manufacturers.
- **MORE IC's and NEW FEATURES** . . . Automatic band width control, notch filtering, low or medium voltage operation. Plus a whole C-QUAM family of IC's to offer enhanced AM Stereo performance!
- **MORE COUNTRIES** . . . 3 Nations already have named C-QUAM their official AM Stereo standard . . . many more are currently testing.
- **MOTOROLA COMMITMENT** . . . From station to listener, we're totally committed to AM Stereo. IC technology, broadcast equipment, receiver design, international seminars, technical, marketing support.

Your verdict? Right . . . even blindfolded. C-QUAM is Setting the AM Stereo Standard. So put the Standard to work at your station. Call Steve Kravitz (collect) on the Motorola C-QUAM Hotline 312/576-0554.



MOTOROLA
C-QUAM™ SETTING THE INDUSTRY STANDARD



- **MORE STATIONS** . . . Over 12 Million C-QUAM stations worldwide than any other AM Stereo system . . . and growing!
- **MORE RECEIVERS** . . . Over 17 Million C-QUAM IC's shipped to date!
- **MORE IC's and NEW FEATURES** . . . Automatic band width control, notch filtering, low or medium voltage operation. Plus a whole C-QUAM family of IC's to offer enhanced AM Stereo performance!
- **MORE COUNTRIES** . . . 3 Nations already have named C-QUAM their official AM Stereo standard . . . many more are currently testing.
- **MOTOROLA COMMITMENT** . . . From station to listener, we're totally committed to AM Stereo. IC technology, broadcast equipment, receiver design, international seminars, technical, marketing support.

MOTOROLA

C-QUAM
Setting the Industry Standard

For more information, call Steve Kravitz (collect) at 312-576-0554. FAX 312-576-5479.



MOTOROLA
C-QUAM® SETTING THE INDUSTRY STANDARD

C-QUAM™ IS A REGISTERED TRADEMARK OF MOTOROLA, INC.

Here's a Direct Line to your Factory-Direct source.

In our continuing effort to make it fast, easy and economical to do business with Radio Systems, we present another Industry First: the Factory-Direct Response Card.

As Easy as 1-2-3-4.



RS Series Consoles



RS Broadcast DAT



Studio Products



Turnkey Installations



1. Check the box



2. Address & stamp the card



3. Mail it



4. We'll contact you...

"Look for a new card in the first 'Radio World' of each month. It's never been easier to save money by buying direct!"

VOA Shakes Out After Phase I

by Charles Taylor

Washington DC With the first phase of Voice of America's (VOA) 19 broadcast studio renovation at last complete, the agency is breathing a sigh following months of obstacles during each step of the project's progress.

But the victory is bittersweet, due in part to a contract with general contractor Grunley-Walsh that left unaddressed nearly 100 glitches, including malfunctioning new equipment and poorly designed studio furniture, which VOA staff technicians had to correct in order to

But, said the engineer, the accomplishment is overshadowed by the enormity of additional work required by the VOA staff outside of the contractor's contract.

"We made 90 additional installations of equipment that sort of fell through the cracks with the engineer in charge," he said. "We completed all that in one week to proof the studios."

One reason the modifications were so time consuming, the technician said, is that the studios were designed without easy access to equipment racks.

"To get at any equipment in the racks, every piece of gear must be pulled out

almost entirely from the front. There is no access from the top, sides, back or bottom," he said. "It is extremely labor intensive to change anything."

Another unexpected turn came when Harrison Systems, which manufactured custom consoles for the project, was acquired by GLW Enterprises, which declined to honor Harrison's warranty on the new equipment.

General contractor Grunley-Walsh agreed, however, to accept warranty responsibilities on the equipment, said a VOA spokesperson.

One concern that has threatened to

make the entire effort moot is discussion over the past year that in 1994, VOA might be moved from its present headquarters to a location that would unite the organization with its parent agency, the United States Information Agency (USIA).

According to Coonrod, the possibility of such a move is slim.

"No final decision has been made," he said, "but it would make the most sense to maintain our broadcast facility where it is."

For more information, contact VOA at 202-485-8238.

Current contract estimates promise to have Phase II finished at the end of March 1990.

complete Phase I's nine broadcast studios.

The staff work included specific jobs not outlined in the project contract, according to a VOA engineer working with the project. "(The contractor) said, 'Hey, if it ain't in it, we're not going to do it,'" he said.

In all, the job required about 750 extra hours of VOA staff time, according to the agency's acting deputy director, Robert Coonrod.

Ten to go

Remaining in the modernization scheme, which was begun in May 1987, is the remodeling of 10 more studios, originally slated to have been completed last January. Current contract estimates promise to have Phase II finished at the end of March 1990.

Coonrod said he is confident that the deadline is tangible.

"Most of the equipment for the next 10 has already been delivered, so we don't anticipate delays that were caused by a piece of equipment not showing up," he said. "A couple of times (during Phase I), work had to stop because a piece of key equipment hadn't come from the subcontractor."

Coonrod added that those involved in Phase II have been through the process once, so "I hope we and the contractor have both learned what needs to be done to make the second group of construction go smoothly."

The contract with Grunley-Walsh was adapted slightly for the remaining work, Coonrod said, authorizing some additional repair work with the building's HVAC system and additional acoustical treatment in the studios to provide better sound isolation.

Those changes added \$130,000 to the value of the contract, which VOA said otherwise remains at \$6.63 million.

The 10 studios were shut down 12 June and were being cleared of equipment to prepare for work to begin.

Training has begun

The first set of nine studios, meanwhile, appears essentially complete—training of employees began in late June, according to Coonrod and the VOA staff engineer.

A clean, crisp, functional design. A design that places wires out of the way, where they belong, where everything is lined up and easy to reach. A design that suspends turntables from furniture, to avoid vibration. A design that's comfortable, so your personality won't get tired - even on long shifts. And if your station features programming with dual announcers, consider our Talk Show/Interview Option. This option allows eye-to-eye contact for a more natural sound. The furniture is built to the high standards of Grand Rapids' famed fine furniture industry. All outer surfaces are covered, using Formica® or laminated plastic. Inner surfaces are protected by a sealed coating. Leveling devices are installed at each corner...kick panels are placed in all the right places.



Studio Furniture... Human Engineered!

Better Broadcast by Design

Designed and built like no other furniture—anywhere

For a great price and fast delivery, call Dave Howland 1-800-999-9281

The AUDIO broadcast group inc.

2342 S. Division Avenue • Grand Rapids, Michigan 49507 • Established 1960

© 1989

Plane Crash Details Suspicious

Washington DC The story, unraveling with a new twist each day, is better than any detective writer could dream up.

Headlines and newscasts blare with any tidbit surrounding the bizarre plane crash in the Atlantic and mysterious shooting of Washington communications lawyer Thomas L. Root who survived the ordeal in mid-July.

And the incident has shone light on the attorney's association with Sonrise Management Services Inc., a Georgia-based company that organizes partnerships to apply for new FM licenses.

Sonrise is under investigation at the FCC on suspicion of being party to application allegedly filed for payoffs, according to FCC documents.

Root, 36, of Alexandria, VA, was piloting his private Cessna 210 when it crashed July 13 near the Bahamas. Flight plans showed he was traveling from Washington's National Airport to Rocky Mount, NC.

But about two hours into the trip, Root notified air traffic controllers he was suffering from chest pains and having difficulty breathing.

With the plane on automatic pilot, military aircraft followed Root for about 200 miles before the plane crashed, out of fuel, some 250 miles east of Miami.

Military pilots at first believed Root was unconscious during the latter part of the flight, and it was speculated he was sick from carbon monoxide poisoning. Now, investigators suggest he may have faked unconsciousness because no trace of carbon monoxide poisoning was found in blood tests.

When examined by doctors, it was discovered Root had been shot in

the stomach.

In an interview with *The Washington Post*, Root said he kept a revolver in his plane, which he speculated might have discharged on the craft's impact. He disputed speculation that he attempted to commit suicide.

Before the crash, Root was charged with failure to register a machine gun after investigators in April found a MAC-11 fully automatic submachine gun with silencer, along with other registered guns on a search of his airplane hangar.

A court affidavit further stated investigators found five gallons of ether, communications and navigation equipment

and chemical light sticks used by pilots as a backup lighting system.

Root told the *Post* that he was not involved in drugs, responding to reports that ether is used in refining cocaine and that drug traffickers use the light sticks to illuminate drops.

However, a Florida newspaper quoting federal sources reported Root was under investigation by a team under federal drug czar William Bennett.

In published reports, Root took pains to draw a distinction between Sonrise's activities and his own. He said he represented the partnership before the FCC. "I'm not now, nor have I ever been,

an officer, director, or stockholder or owner of any interest in that company."

Root said he did not take part in Sonrise's raising of money from investors to buy stations. He said that since he began representing Sonrise in 1986 about 167 partnerships have been formed to seek licenses.

Sonrise issued a statement separating the partnership from Root and noted that the group had not been found guilty of securities-related violations or wrongdoings, investigations that were publicized in news accounts. Reports indicated investigations were underway in North Carolina and possibly Tennessee, Florida and Mississippi.

Sonrise also filed a breach of contract suit against Root since his ordeal, accusing him of misusing escrow funds and double billing.

FM Diversity

(continued from page 10)

really spends in a year on advertising—millions and millions of dollars."

"Nobody has introduced a diversity radio with a lot of fanfare that would attract some attention," said Torick, now president of Broadcast Technology Partners (BTP), the developer of FMX.

Small agreed: "No one here has marketed them and the established powers aren't pushing them." But, he said, the lackluster acceptance also could be a result of politics within the manufacturing community.

"You have to understand the dynamics of the United States in the introduction of stuff like this. Automobile manufacturers have so much money invested that they will fight anything new simply because it risks the massive investment they have made," Small said. "If they don't come up with the idea and they may be forced into it by other people, then they're opposed to it."

Even so, backers of diversity radio hold up faith that whether the world yet knows it or not, they've got a hot product on their hands.

Said Torick, "I think there is a future because it clearly can make a significant difference in a good deal of the reception. It doesn't solve all the problems, but it certainly does help."

For more information on diversity radio, contact Clarion's Jack DeBiasio at 213-973-1100; or BTP's Emil Torick at 203-622-2804.



Get One Free!

Now, buy any three Radio Systems studio products at our already-low direct prices, and get the fourth free. Mix and match as you like! You write the order.

The savings are tremendous. Consider just one example: Order three TM-2R timers and one stereo DA-16. Our normal low price would be \$820; you pay only \$495.

Call Radio Systems, your factory-direct source. No dealers, no markup, just great products. Call 1-800-523-2133 to order today.

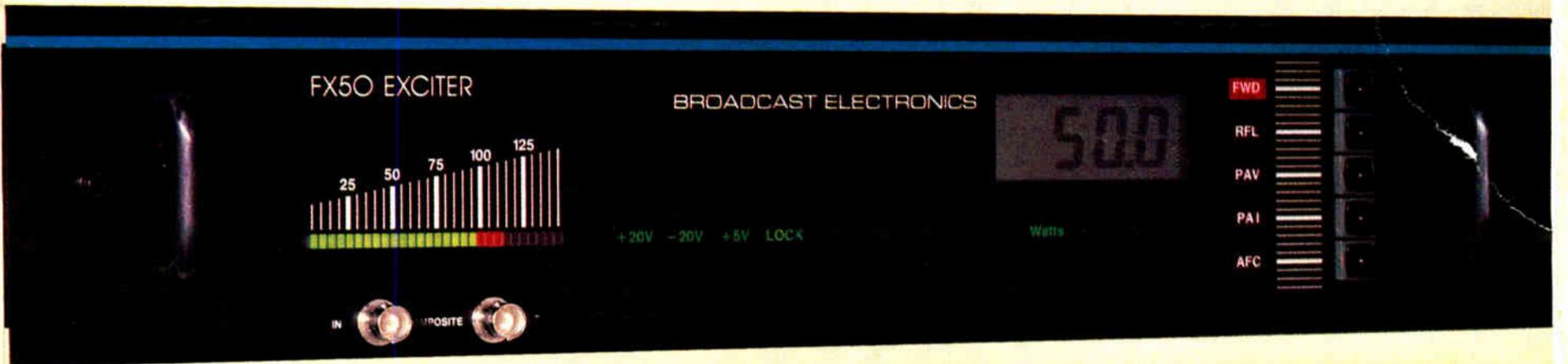
- | | | |
|-------|--|--------|
| TM-2R | Our popular remoteable six-digit up-timer. Crystal reference. | \$165. |
| DA-16 | Stereo 2 x 8 distribution amplifier. Individually adjustable, active balanced outputs. | \$325. |
| DA-8 | Mono 1 x 8 distribution amplifier. | \$255. |
| CL-2 | Digital time-of-day clock, 12 or 24 hours. | \$145. |
| PA-1 | The industry's best phono preamp. | \$225. |

RADIO SYSTEMS INC.

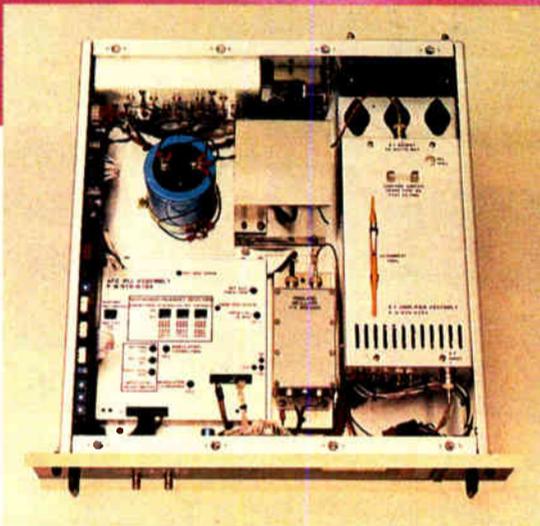
110 High Hill Road ■ P.O. Box 458 ■ Bridgeport, NJ 08014-0458
609/467-8000 ■ 800/523-2133 ■ FAX 609/467-3044

New FX 50 Exciter

Audio Performance That Rivals CD's



THD and IMD 0.003%, 93 dB S/N, 50 Watts



Broadcast Electronics introduces the ultimate FM Exciter - the new FX 50 - with performance even superior to the world standard FX 30.

CD Sound

The new FX 50 Exciter has the lowest distortion of any exciter available with THD and IMD of 0.003%.*

Move Up To CD Standards

Every new "B" Series FM Transmitter incorporates the FX 50 for true CD transparency. And, the FX 50 is the ideal retrofit for your present exciter.

*Typical

CD Dynamic Range

With a signal to noise ratio (S/N) of 93 dB* the FX 50 can handle all of the nuances and power of compact discs.

Set It And Forget It — 50 Watts

Sophisticated automatic control systems assure stable and reliable 50 watt MOSFET power output even under mismatch conditions.

For information on the FX 50 Exciter and on Broadcast Electronics' new "B" Series FM Transmitters which incorporate the new FX 50 Exciter, call Bill Harland or Russ Erickson at 217-224-9600.

BE® **BROADCAST ELECTRONICS INC.**

4100 N. 24th ST., P.O. BOX 3606, QUINCY, IL 62305-3606 U.S.A., PHONE (217) 224-9600, TELEX 250142, FAX (217) 224-9607

Circle 44 On Reader Service Card

World Radio History

Bill May Add Radio Spectrum

by Benn Kobb

Washington DC Proposed legislation could set the stage for a major infusion of new spectrum including more room for radio services of the future, such as digital transmission.

A bill proposed by House Energy and Commerce Committee Chairman John Dingell (D-MI) and Telecommunications Subcommittee Chairman Edward Markey (D-MA) would reallocate 200 MHz of prime spectrum from the federal government to the private sector for commercial purposes.

The Emerging Telecommunications Technologies Act of 1989 (ETTA), as the bill is known, points out that some 40% of the assigned spectrum is reserved for federal use, yet many of these reserved frequencies remain unused.

The bill maintains that scarcity of spectrum impedes national productivity and development of new services, and directs the president, the Commerce Department and the FCC to take steps to "correct these deficiencies."

Look for frequencies

Under delegated authority of the president, the Commerce Department's National Telecommunications and Information Administration (NTIA) authorizes government stations and monitors their spectrum use.

If ETTA is enacted, Commerce would have two years to find unnecessary frequencies which have the greatest potential for commercial uses.

At least 200 MHz of the recommended bands would have to be located below 5 GHz. Special provisions would enable the government to keep using up to 20% of the spectrum recommended within a geographic area, but the area could not include more than 20% of the US population.

A private sector advisory committee

would be formed during the reallocation process. This committee would include US radio equipment manufacturers, communications carriers, radio licensees, FCC representatives, and "interested members of the public who are knowledgeable about the uses of the electromagnetic spectrum."

"For us to allocate the frequencies unilaterally might raise questions of international coordination."

Within a year after the Commerce Department compiles the frequencies to be made available, the FCC would have to produce a plan to distribute the spectrum to commercial licensees.

The plan would need to reserve a "significant portion of the frequencies for distribution more than 10 years after enactment," and "gradually distribute the remainder over the course of not less than 10 years."

The plan would also have to ensure the availability of frequencies for new technologies and services.

The proposal would grant the federal government the power to reclaim spectrum made available to the FCC but not actually assigned by the Commission to anyone.

If the government desires to reclaim assigned spectrum, it could do so but it would have to pay all costs of reclamation, including the cost of equipment rendered unusable.

Although some reports stated that the spectrum may be used for advanced television (ATV) systems, the bill itself does not mention any specific services to which the new spectrum should be applied.

There are already indications that the radio industry may seek additional

spectrum.

In one case, National Public Radio reminded the FCC in ATV comments that advanced digital radio technologies will require transmission bandwidths wider than those presently allocated to FM broadcasters.

"It does not seem likely that advanced

radio systems incorporating digital techniques will be feasible using existing AM or FM bandwidths," NPR said. "In addition, downward compatibility (continued use of existing radio receivers to receive analog signals) for advanced radio systems would be impossible.

"Therefore, new spectrum will almost certainly be required."

Effect on radio

NPR Senior Engineer Michael Starling said 200 MHz provides a lot of opportunities but noted it has implications for the International Telecommunication Union (ITU).

"For us to allocate the frequencies unilaterally might raise questions of international coordination," he said. "For example, what would be the procedures to control interference along US borders?"

Consultant Ron Rackley of du Treil, Lundin & Rackley pointed out that the spectrum referred to is in microwave for point-to-point service. But anytime there is an evaluation of spectrum, he said, "I think broadcasters ought to keep their eyes open."

Other demands for the spectrum could come from the land mobile radio

sector.

Industry representatives said they expected the Defense Department to oppose ETTA. A July 1988 NTIA report on federal government use of spectrum show that the armed forces use more than 40% of the approximately 250,000 government frequency assignments. A single assignment can represent hundreds or thousands of stations.

Much of the Pentagon's use of the spectrum is classified. The degree to which military planners will publicize their spectrum needs in hearings, or reveal them only to legislators, remains to be seen.

If the bill does gain approval and become law, in addition to who will become the new users of it is the question of how it will be allocated.

(continued on page 21)

Use Your 1989 Radio World Annual to find:

- Top Ten News Stories of 1988
- Earwaves
- Convention Reviews
- FCC Phone Listing
- NAB Phone Listing
- Industry Perspectives
- Product Source Book
- Supplier Source Book
- Company Profiles
- R/W Author Index
- R/W Subject Index
- Buyers Guide Reprints

Don't have yours ?
Get One Fast!
Send \$14.95 for
each Annual to:

1989 R/W Annual
P.O. Box 1214
Falls Church, VA 22041

Only 10 of these 
& nine of these 
can save you a lot of these 
& thousands of these 

The National Supervisory Network redefines the minimum wage—\$1.09.

If you're paying more than \$1.09 per hour, including wages, payroll taxes, and insurance for duty operators, you're paying more than you have to. And more than likely, getting less than you should be.

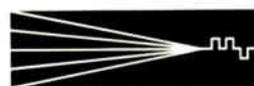
Introducing national off-premise control from the National Supervisory Network.

For \$1.09 per hour—total—you can have a licensed engineer/operator on duty 24 hours a day via satellite, ensuring full FCC and EBS compliance, proper transmitter operations, accurate logs and the level of reliable quality that today's market demands. We even provide your engineer with equipment performance reports.

CFR Part 73 sets the standards. We help you maintain them and much, much more.

Call now to learn more about this revolutionary new service
1 (800) 345-VSAT

"Compliance, Economy, and Quality for Today's Broadcaster."


**NATIONAL
SUPERVISORY
NETWORK**
Avon, Colorado

Digital Phone Line Being Tested

by Alan Carter

Middletown Township NJ Bellcore is trial testing a new end-to-end digital telephone delivery system that the research and engineering consortium said has applications for talk radio.

Called Integrated Services Digital Networks (ISDN), the process produces a 7 kHz audio signal that is more than twice the quality of today's analog telephone, which is just more than 3 kHz, with connection at 64 kilobits per second.

There would be no more of that "telephone" sound.

While market penetration is admittedly some ways down the road for the average telephone junkie, eventually, people calling a radio talk show would sound as good to listeners as the talk show host. There would be no more of that "telephone" sound.

Closer at hand for radio broadcasters, however, is the possibility of a radio station airing the local football game by switched telephone connection, explained Bellcore Signal Processing Dis-

trict Manager Milton Anderson.

Rather than using an equalized loop, a radio station would reserve a dedicated ISDN line and have audio as good as a high-fidelity stereo system, Anderson explained.

(The system was presented in 1987 at the NAB convention by Anderson and Gary Pearson and is published in the proceedings manual.)

ISDN is undergoing trial tests in St. Louis by Southwestern Bell, and initial applications will be for business, government and educational markets, Anderson said.

ISDN is also proposed for audio teleconferencing and hands-free telephone systems. AT&T is one of several vendors designing telephones to meet Bellcore interface specifications.

The procedure for digitizing voice is very similar to the process used by compact disc players, Bellcore explained. But the step-by-step transmission procedure, though relatively simple, requires complex hardware and software.

The signal passes through a filter before being sampled and converted to digital code words. Once digital, the signal is encoded and transmitted. At the receiving end, the signal is decoded, reconverted to analog and passed through a reconstructive filter.

In existing phone company digital data service (DDS) facilities, Anderson said an encoded 7 kHz signal can be used. Even at 56 kbits/s on DDS, the new coding method makes a remarkable improvement in sound quality, he continued. With ISDN at 64 kbits/s calling, the improvement is better, he said.

In the future, a phone call might be passed through a codec (encoder-

decoder) that has been designed to proposed standards. Developing equipment for broadcast application with the codec is where radio equipment manufacturers enter the picture, Anderson said.

The standard was approved last year by the CCITT, an international standards body, and is pending before the T1 national telecommunications committee of the American National Standards Institute (ANSI).

For information from Bellcore, call 1-800-521-CORE or write Bellcore Licensing, 290 West Mt. Pleasant Ave., Livingston, NJ, 07039-2729.

ABC Signs Sat Deal

New York NY ABC Radio Network has signed a 10-year agreement with GE American Communications (GE Americom) for satellite transmission of the network's programming and data services into the year 2001.

The \$25 million agreement calls for an extension of the Digital Audio Transmission Service (DATS) contract via GE's SATCOM C-5.

The current agreement, which expires in 1991, provides service on SATCOM 1R. The new agreement includes DATS distribution of network programming via SATCOM C-5, a satellite that GE Americom will launch in 1991.

GE Americom operates the SATCOM fleet—five C-band and two Ku-band communications satellites that service broadcast radio and television, cable TV as well as business information and

government markets.

ABC currently distributes network programming to more than 2200 affiliates nationwide by GE's DATS service.

ABC Radio Satellite Systems Director Robert Donnelly said DATS continues to be the "superior performer" for radio network audio and data distribution. "It has the best sound quality," he said. "From an engineering standpoint of view there still isn't anything better for transmitting Hi-Fi sound."

ABC will have "seamless continuity" in service as its programming shifts from one satellite to its replacement, said GE Americom Broadcast Services Director Andreas Georgiou. "ABC has been foresighted in planning its future generation transmission program," he added.

For information from ABC, contact Robert Donnelly at 212-887-5602.

It's Not Just A Phase We're Going Through.

The tremendous success of the Tannoy PBM series of reference monitors is by no means coincidental. Since the introduction of the world renowned NFM-8 nearfield monitor, much time and effort has been spent on discerning the needs of the mixing engineer and the applied requirements of "playback monitors". The PBM Line exemplifies this commitment to excellence in reference studio monitoring. These compact loudspeakers sport robust poly cone mid-bass transducers utilizing efficient long-throw, high power voice coils. The low frequencies are carefully controlled by optimally tuned ports located on the rear of the loudspeakers. Hi frequencies are provided by Hi Power ferro fluid cooled polyamide dome tweeters which extend H.F. bandwidth beyond 20KHZ. The driver accompaniment is knitted

together by means of a precision hardwired crossover unit, utilizing robust low loss components, and heavy-duty input terminals which will accept standard 3/4" spaced banana plugs and the majority of high quality, specialist audio cables. Transducers and crossover assemblies are neatly housed in a stylish, high density, partial wrap cabinet, specially designed to minimize unwanted cabinet resonance, and high frequency reflection. In summarizing, we have left the best feature of all for last "price versus performance."

TANNOY
Professional Products

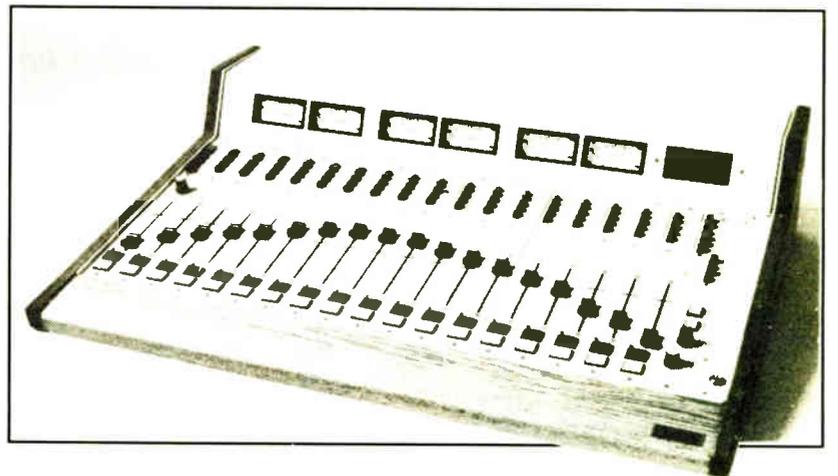


TEC AWARD WINNER

TANNOY

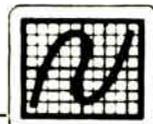
Tannoy North America, Inc. 300 Gage Ave., Unit 1, Kitchener, Ont., Canada, N2M 3C8
Telephone (519) 745-1158 Telex 069-55328 Fax (519) 745-2364

Arrakis Authority



Northeast Broadcast Lab proudly presents the new Arrakis 12,000 Series. We'll help you choose the proper configuration to meet your present need and provide room for future expansion.

Get accurate advice, superior service *and* a paltry price from the Arrakis Authority. Call us today!



NORTHEAST BROADCAST LAB, INC.

NEW YORK
P.O. Box 1179
S. GLENS FALLS, NY 12803
Tel: 518-793-2181
Fax: 518-793-7423

PENNSYLVANIA
P.O. Box 565
SOUTHAMPTON, PA 18966
Tel: 215-322-2227
Fax: 215-953-0523

NEW HAMPSHIRE
P.O. Box 406
AUBURN, NH 03032
Tel: 603-483-1002
Fax: 603-483-2352

Shure's Stereosurround Looks to Radio Market

by Frank Beacham

Evanston IL A new stereo surround sound system—the first such system to be marketed to radio broadcasters for sports, music and special events remotes—has been introduced by Shure Brothers.

The new license-free process, labeled "Stereosurround," is the first such system ever offered to the radio broadcast market and is compatible with surround sound decoders that Shure estimates to be already installed in more than 1.5 million US homes.

The Stereosurround process goes beyond traditional stereo by making it possible to recreate for broadcast the acoustic ambience and spatial realism of a live event. The technology is an outgrowth of motion picture surround sound technology.

In addition to radio broadcasters, Shure also is offering the new surround system to television broadcasters and home video producers for use with visual programming.

"On the radio front, our main focus now is for producers who do concert recording for radio broadcast syndication . . . classical or rock concerts and for sporting events," said Robert Schulein, GM of Shure's Home Theatre Sound (HTS) Division.

Shure's chief competitor, Dolby Laboratories, has long dominated the surround sound industry. Beginning in motion pictures, Dolby only recently expanded its services to broadcasters.

Dolby consumer and profes-

sional decoders—which range in price from \$200 to \$2000, depending on sophistication—are compatible with the Shure system. In addition, some new models of AM/FM stereo consumer receivers have surround processors built in.

Shure is aiming its product at a wider range of media, including radio, and also sells equipment directly to the end user.

Dolby charges a license fee, while Shure offers a license-free process.

Though technically compatible, Dolby and Shure are pursuing different marketing strategies for their respective broadcast systems. Dolby considers its market television and home video, not radio. Dolby leases equipment and personnel to individual productions and

clients and does not sell encoding equipment.

"Our decision not to market to radio is financially driven and not a matter of engineering," said Anthony Grimani, Manager of Dolby's Engineering

is capable of absorbing the kind of budget needed to make sure everything works right on a surround production."

Grimani was quick to point out that should radio producers desire surround sound pro-



Department. "There are bigger budgets for TV productions, which allow us to spend the time it takes to do these projects. I'm not sure that radio

programming, Dolby will gladly offer its services.

But at least one of the largest potential clients for surround

(continued on page 23)

Spectrum

(continued from page 19)

ETTA rejects auctions as a means for the FCC to allocate the newly available spectrum.

However, because the spectrum will likely be so valuable, pressures may increase to generate some revenue for the government in the form of auctions, spectrum use fees or transfer fees.

Reagan and Bush administration budget proposals have suggested that 6 MHz now under consideration by the FCC for allocation could bring \$3.8 billion if auctioned.

Applying that figure to ETTA's 200 MHz results in a theoretical worth of over \$100 billion.

■ ■ ■

Benn Kobb is a Washington-based contributor to RW and editor of Federal Communications Tech-News, P.O. Box 435, Falls Church, VA 22046, 202-837-9891.

**FINALLY,
8 TRACKS IN THE PALM
OF YOUR HAND.**

Others have tried. But 8-track capability on a standard audio cassette remained elusive. Until now.

Introducing the remarkable new 238 Syncaset® from Tascam, the company that invented portable, multi-track recording.

If you've been working with a 4-track for pre-production composing or demos, the 238 doubles your capacity right now. Running at 3¾ ips, and taking advantage of Tascam's proprietary head technology, the rack-mountable 238 gives you sound you won't believe was recorded on a standard audio cassette.

But the 238 doesn't stop there. It's fully synchronizable with MIDI/SMPTE time codes, it's got a serial port for computer interfacing and it's designed with open architecture for software upgrades.

Add to that the advantages of full-function remote control, auto punch in/out, shuttling capability and dbx II noise reduction, and you've got a machine that just about does it all.

If this all seems a little too good to be true, talk to your Tascam dealer. To understand how good the 238 Syncaset really is, you'll just have to try your hand at it.

TASCAM

© 1988 TEAC Corporation of America, 7733 Telegraph Road, Montebello, CA 90640, 213/725-0303.

RAC Group Hears Plan for RSS

Coverage Calculations Seek to Include Co- and Adjacent Interference

by Judith Gross

Washington DC A working party of the FCC Radio Advisory Committee technical subgroup has come up with a method for dealing with adjacent channel nighttime contour calculations using the newly proposed 25% exclusion criterion for AM stations.

The FCC supports a method for using the 25% method to calculate RSS, but is considering the use of a single RSS which would take into account both co- and adjacent channel signals.

In the past, FCC allocations criteria have not included adjacent channel interference. The Technical Subgroup—and its working party—was tasked with devising an appropriate value for the adjacent channel protection ratio.

Greater interference?

Initial concern was that a single RSS approach, one which included adjacent channel protection, would increase overall interference on the AM band.

This fear stems from studies, cited by the working party, which show that including adjacent channel signals tended to raise the RSS value, which would allow some co-channel stations to increase their signal levels.

Since the FCC's RSS calculation pro-

posal was part of its overall efforts to help AM's technical problems, the group pointed out that such a result runs counter to the original intentions.

Therefore, the working party's approach recommended that a single RSS calculation including the adjacent channels not be adopted.

The group then discussed three alternative options: leaving things as they are; using separate RSS values for co- and the two adjacent channels; or protecting only the co-channel without looking at adjacent channel interference.

Maintaining the status quo—that is, not considering adjacent channel sky-wave interference in nighttime RSS calculations—appears to have added to AM stations' problems by allowing adjacent channel interference levels to be high, the group concluded in its report.

"This factor, combined with the saturation of the AM band, limits the potential for improving existing conditions," the report said.

The working party pointed out that the need to prevent further degradation of the AM band, coupled with the desire to have one set of allocations for the existing and the expanded AM band, argue against leaving the situation as it exists.

The report looked at the possibility of separate RSS calculations for co-channel, upper and lower adjacent channels.

But in addition to the burden of using three separate numbers, the group voiced concern that if, in depicting a station's coverage area, a value other than

the lowest one of the three were used, it would pave the way for raising any lower RSS calculation to the higher one, possibly resulting in greater interference.

Co-channel protection

The final consensus of the working party was to go with a nighttime contour calculation for only the single co-channel RSS as is the current practice, but with one important difference.

... (the) procedure would establish protection criteria for wideband service ...

The group recommended that this value then become the projected contour for both co- and adjacent channel stations.

"New adjacent channel stations and proposed changes by existing adjacent channel stations would be required to protect this contour on an RSS basis, employing appropriate adjacent channel protection ratio," the report maintained.

The protected station contour would be co-channel RSS computed using the 25%

exclusion method, or the 2 mV/m contour.

The party concluded that this method would not foster an increase in co-channel interference or in adjacent channel interference and that only a single RSS value would be needed.

The report further noted that the recommended procedure would establish protection criteria for wideband service in addition to the existing narrowband service.

Some members of the Technical Subgroup voiced concern that consideration of wideband service may represent a "false hope" on the existing AM band, where interference levels have limited receivers to only narrowband response.

But the consensus was that, like stereo and monaural AM service, the protection needed to be addressed even if it were not widely used, if not for the current AM band, then for the expanded band.

The group also recommended a grandfathering, at the current level, of stations who exceed the permitted signal strength under this new calculation.

The recommendations of the working party would normally be discussed in a full RAC meeting, but since Technical Subgroup members feared that the Commission would take action on the RSS matter before another RAC meeting could be scheduled, it was decided that the plan could be submitted to the Commission directly.

For more information on the RAC call Wally Johnson, of Moffet, Larson & Johnson, at 703-824-5660.

Woman Claims Royalties

(continued from page 12)

received a confusing invoice from Sun, with a clause saying, "If school radio is a non-profit organization, a flat fee is due." The fee was listed as "\$2,00.00(sic)."

"I don't know what to make of it," Stanfill said. "I don't intend to pay it."

In answer to questions regarding how Sun selected the stations in Washington and the other states she had invoiced she replied, "I wanted to start with the 'W's' and get the wrinkles out before moving

onto the 'As'."

Since sending out invoices 3 July, Sun said she has received none of the expected payments. That, however, apparently has not discouraged her.

"There are innumerable songs before the water goes underneath the bridge," she said. "They're going to be hearing from me a lot in the future."

For more information, call Sally Sun at 208-345-6219; or the Boise Better Business Bureau at 208-342-4649.

CCA ELECTRONICS, INC.

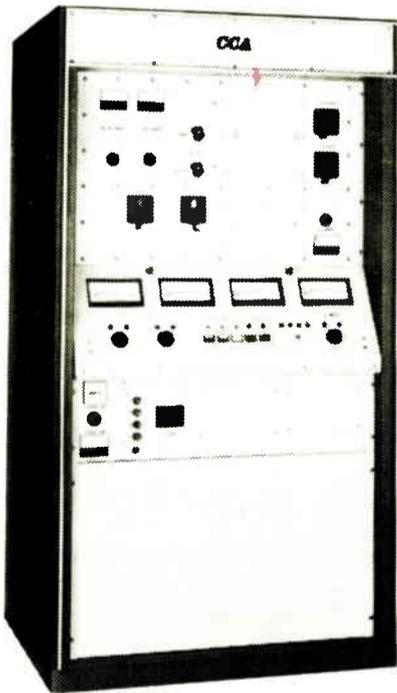
25 Years of Reliable Broadcast Transmitters

For over 25 years, CCA Electronics, Inc. has provided reliability through simplicity. Specializing in simple circuitry and rugged construction, CCA manufactures dependable, longlife AM, FM, Shortwave and Longwave Transmitters.

CCA transmitters deliver durability and reliability to satisfied customers throughout the world. The high quality standards and design simplicity produces the best value of broadcast transmitters in the world.

FEATURES:

- Time Proven Long Life Design
- Rugged Construction with High Quality Components
- Zero bias Triode in DC Grounded Grid Circuit
- Conventional Plate Modulation
- Longest Documented Tube Life
- Designed for FCC, DOC and CCIR Requirements



WE MAKE IT SIMPLE

CCA 360 Bohannon Road/P.O. Box 426, Fairburn, Georgia 30213
Phone: (404) 964-3530 Fax: (404) 964-2222

Circle 48 On Reader Service Card

OFF THE AIR?

ANDREW AND CABLEWAVE CONNECTORS IN STOCK!



Get back on the air fast! These RF Specialties offices now

stock a full assortment of Andrew and Cablewave connectors for immediate delivery. For connectors or any other RF needs, call RF Specialties!

RF Specialties of Florida
PO Box 397
Niceville, FL 32478
Bill Turney
(904) 678-8943

RF Specialties of Texas
PO Box 8316
Amarillo, TX 79114
Don Jones/Tim Hawks
(806) 372-4518

RF Specialties of Washington, Inc.
11721 15th Avenue NE
Seattle, WA 98125
John Schneider
(206) 363-7730

RF Specialties® Group

- System Design •
- Competitive Pricing •

Circle 17 On Reader Service Card

Stereosurround Explores Radio

(continued from page 21)

sound in the radio concert market is skeptical of any surround sound system in today's market.

"It's not the cost, I'm just not impressed with the technology, really," said Richard Kimball, VP of Artist Relations for Westwood One, the largest radio network in the US and a major producer of live concerts for broadcast. "I hate to be blunt about it. But are we interested? No.

"There have been several surround sound concepts in the last 10 years, all of which have gone right into the dumper," said Kimball, whose responsibilities cover all concert remotes.

"We deal with a stereo concept here. It's right, left, center. Surround sound doesn't bring much to the listener. I think the listener just wants to hear the event and not have a lot of electronic gimmickry injected into it."

On the sports side, Tim Maddoux, acting engineer at USA Radio Network of Dallas, said he'd like to have surround sound sports programming but noted his and many other sports feeds are mono and not surround capable.

"My personal feeling is I'd love to have it," Maddoux said. "As a listener, I'd like to hear it. But as far as our network sports is concerned, we are a mono feed."

The surround process

Shure's new surround system—introduced at NAB and slated for late summer delivery—consists of three components: an encoder, a decoder and an

"It implies something different, better and more encompassing than what they are used to."

optional interchannel delay corrector. Per component price is between \$3000 and \$6000.

Stereosurround begins at the production mixing console when an encoder is used to process multichannel information into stereo channels for recording or broadcast. The processed audio is then decoded through the end user's surround decoding equipment.

Ideally, the signal is decoded into four channels: left front, center front, right front and surround. The front soundstage and surround arrangement allow for precise image localization as well as a reproduction of a realistic ambient sound field. The processing scheme is totally compatible with traditional stereo and mono receiving equipment.

Cubs baseball in surround sound

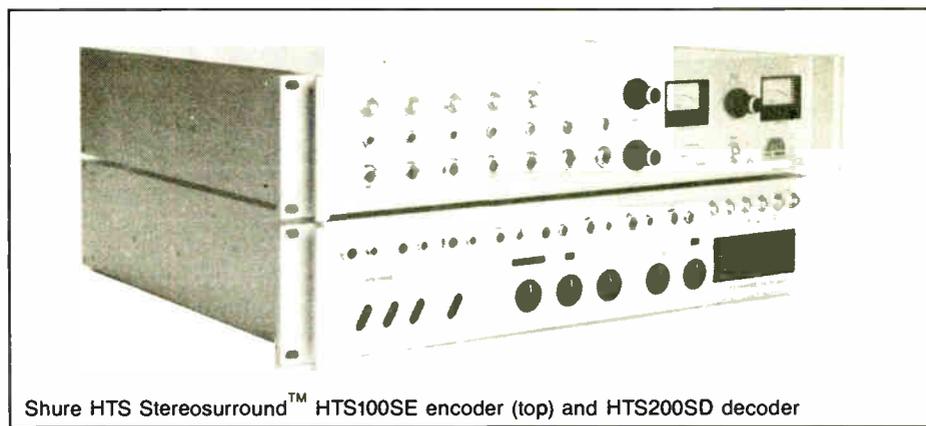
WGN-TV, Chicago, has begun using Stereosurround for satellite-fed telecasts of all Chicago Cubs home baseball games. Cubs game coverage, Shure said, reaches a potential 28 million viewers.

"Such elements as the crack of the bat, the smack of the ball hitting a glove and the announcer's voice are localized in the soundfield while the roar of the crowd, the park organ and the field announcer surround the listener, creating a sense of actually being there," Schulein said.

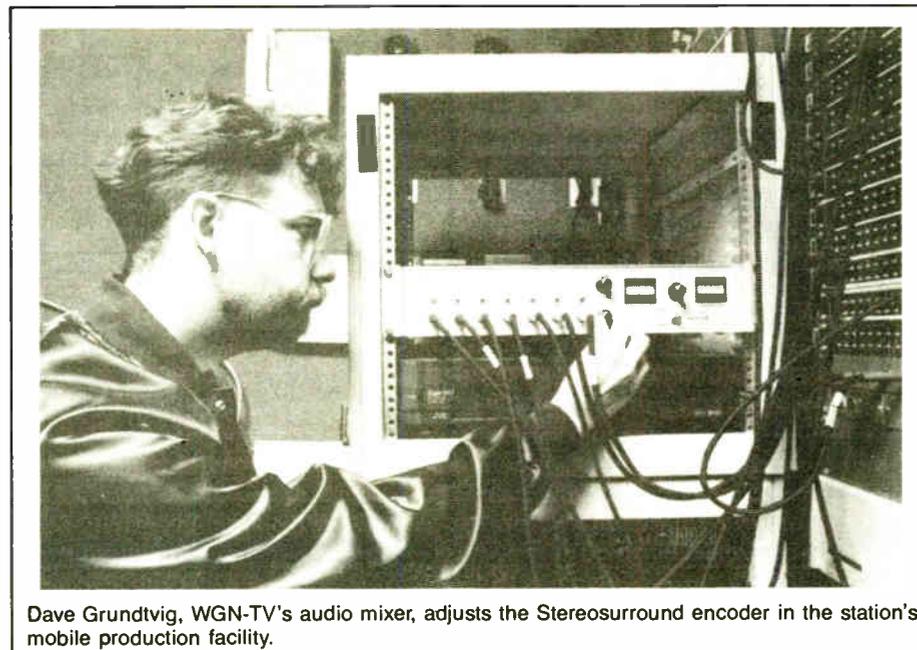
Though the Cubs Stereosurround broadcasts are not being simulcast on radio, Schulein said radio broadcasters can easily and inexpensively use Stereosurround to bring realism to any sports event. The technical set-up for radio and TV remotes is essentially the same, he said.

WGN-TV VP of Engineering Robert Strutzel said viewer response to the Cubs broadcasts has been on a small scale but "very enthusiastic."

As for the miking technique used at Wrigley Field for Cubs baseball, Schulein said separate mono microphones are



Shure HTS Stereosurround™ HTS100SE encoder (top) and HTS200SD decoder



Dave Grundtvig, WGN-TV's audio mixer, adjusts the Stereosurround encoder in the station's mobile production facility.

placed in two seating areas of the park which are always crowded. Another microphone is placed in a bleacher area where the crowd is always energetic and usually chants.

"This gives us three crowd elements we can mix as we wish," Schulein said. "We take the two primary crowd mics and pan them somewhere be-

tween left and surround and right and surround.

Then we take the bleacher area and pan it more between interior and surround, so it tends to be somewhat behind you. Then we take the announce mike and put it dead center (front). We take a direct feed from the organ and put it in front and get a certain amount of

reverb from the crowd mikes. We do the same with the house PA when they are making announcements."

You are there

The mix engineer monitors the Cubs broadcasts in a van outside the park, which is equipped with a Shure encoder and decoder and a monitoring system consisting of three front and two rear speakers.

The result, said Schulein, "is a 'you are there' effect that recreates the drama and intensity of Chicago Cubs baseball at Wrigley Field."

Strutzel, who is pleased with the results of Stereosurround, said the technique has increased the complexity of the Cubs baseball audio mix and has added to the amount of time for pre-game set-up.

In addition to offering the hardware, Shure has trademarked the term "Stereosurround" and is offering it license-free to broadcasters for promotional purposes.

"We feel it is a word the consuming public can identify with" Schulein said. "It picks up on a word they already know: 'Stereo,' and adds a new word: 'Surround.' It implies something different, better and more encompassing than what they are used to."

The Audio Processor Classic: The one that endures.

In the arduous two-year development project that produced the 8100A OPTIMOD-FM, there was always one overriding principle:

While providing competitive loudness where needed, the processor must always have an utterly natural, musical sound that not only attracts an audience, but holds it.

Processing artifacts that cause listener fatigue and tune-outs were simply unacceptable. Loudness at the expense of good sound is never worth the price.

The development project resulted in a classic. The most popular FM processor ever.

Today, OPTIMOD-FM has evolved into a system capable of serving any processing goal, and working perfectly in any STL environment.

As always, OPTIMOD-FM is the smart choice — right today and right tomorrow. It is the processor that endures. Call your Orban Broadcast Dealer for our new OPTIMOD-FM brochure, or call us direct:

orban

a division of AKG Acoustics, Inc.

645 Bryant Street, San Francisco, CA 94107 USA

Telex 17-1480 FAX (415) 957-1070

Telephone (415) 957-1067 or (800) 227-4498

© OPTIMOD-FM is a registered trademark of Orban Associates Inc.

Transistor Circuit Connection

This is the ninth installment in a 12-part series called An Introduction to Active Devices. Readers who have registered with Northern Virginia Community College can receive continuing education credits from the college upon successful completion of an examination administered at the end of this series. To register, contact the Director of Continuing Education, Annandale Campus, 8333 Little River Turnpike, Annandale, VA 22003, or call 703-323-3159. The fee for the course is \$20.

by Ed Montgomery

Part IX of XII

Annandale VA The transistor consists of an emitter, base and collector made up of either PNP or NPN material. Fundamental to its operation is the control of current from the emitter to the collector by changing the current from the emitter to the base.

The transistor can be connected in three arrangements in a circuit that will produce different operating characteristics for the device. They are identified as common emitter, common base and common collector—also known as emitter-follower. The designations indicate what portion of the transistor is used as a reference point for input and output connections. This is illustrated in Figure 1.

In these examples, the load resistance

for the transistor is established at 10,000 ohms. Note that the output resistance of each configuration is quite different.

The common base

The common base configuration provides more voltage gain but less power. The common emitter arrangement offers a high power gain while the common collector's maximum output is current.

In audio circuitry, the primary concern is usually developing considerable power to drive a speaker or telephone line. The common emitter amplifier is often used to perform this function. The common emitter configuration is often considered a universal amplifier, working best in most applications.

The common base circuit offers a very low input resistance combination with a high output resistance. Input can be as low as 30 ohms while the output can reach 1 million ohms. This configuration is a good voltage amplifier. It also offers considerable power gain.

The common base amplifier is often used in radio-frequency amplifiers with its high output impedance corresponding to the impedance of parallel resonant circuits.

The common collector

Common collector or emitter-follower stages are known for their ability to change impedances. Input impedance is usually very high, while the output is

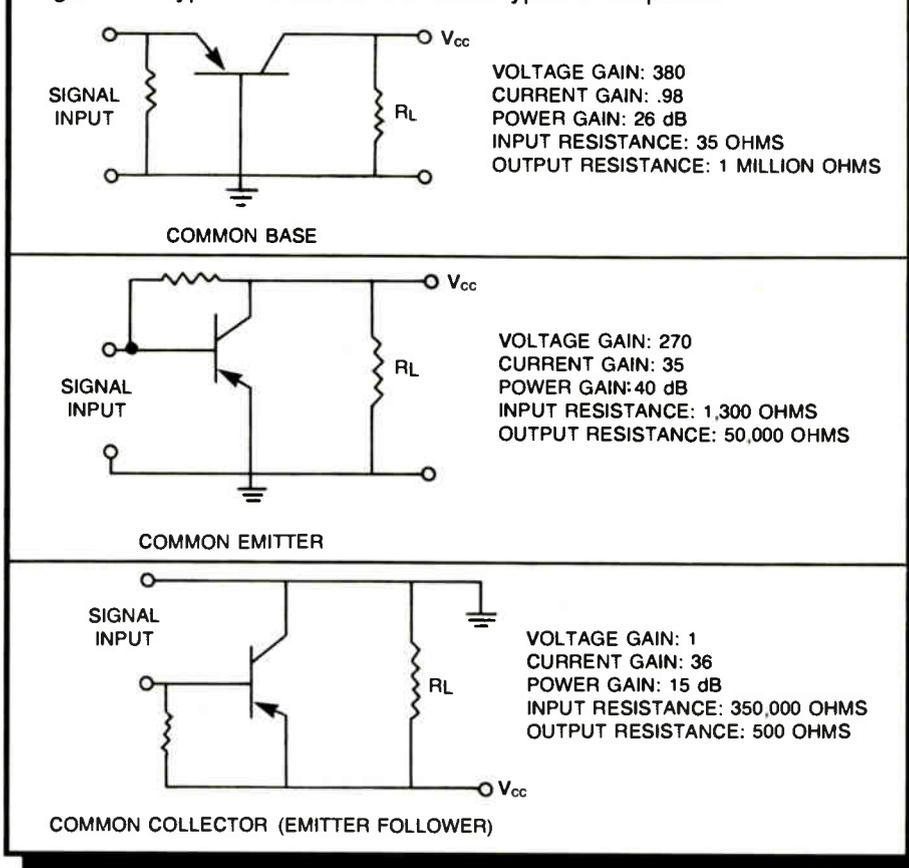
low. This amplifier has no voltage gain, but amplification of current is high. Emitter-followers are often used to supply a signal to a low impedance load

such as a speaker. Other configurations cannot do this.

The common collector amplifier is often known as an isolation or buffer amplifier. The high input impedance does not load down previous circuits.

Over the years, various arrangements of transistors have resulted in numerous (continued on page 35)

Figure 1. Typical values for the three types of amplifiers



THE VIGILANTE
IS GONNA' GET YOU!

...So why not get it first? The "Vigilante" Multiband Limiter from Cutting Edge Technologies lets you capture the edge from your competition with:

- ⚡ Increased competitive loudness
- ⚡ No processing artifacts
- ⚡ No loss of mid-band and presence frequencies
- ⚡ Superior loudness clipper circuitry, virtually distortion free

Don't get left behind.

Call to find out more about the "Vigilante" Multiband Limiter:

(216) 241-EDGE
FAX: (216) 621-2801



Circle 27 On Reader Service Card

NO VENEER OR PLASTIC, PLEASE.



COMPACT DISC
DIGITAL AUDIO

by **ALINE**

Nothing but solid oak or solid walnut will do! 40- and 80-capacity lazy susan compact disc storage cabinets in either solid oak or solid walnut.

40-capacity (D) \$79.95
80-capacity (D) \$99.95

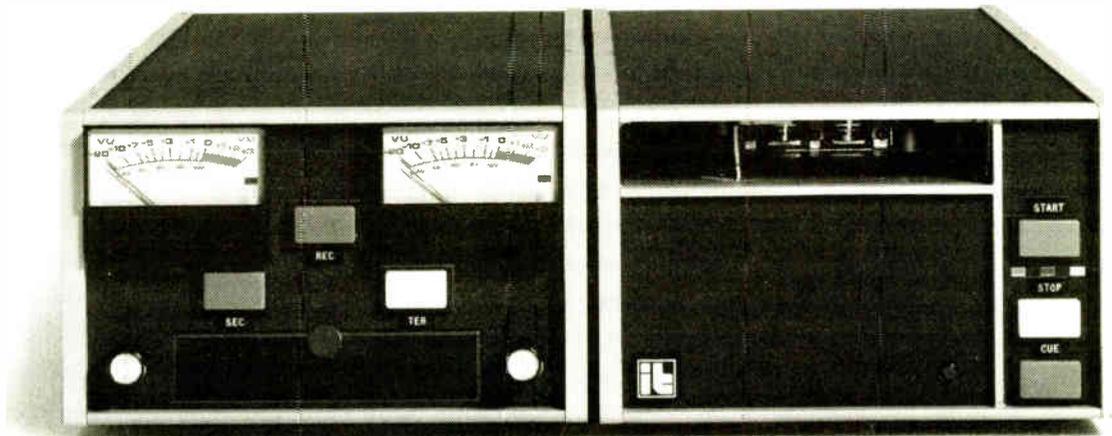
800-622-0022

ATLANTA CHICAGO DALLAS
LOS ANGELES RICHMOND

ALLIED
Broadcast Equipment
— A HARRIS COMPANY

Circle 54 On Reader Service Card

This is one reason we sell more cart machines than anyone else.



The 99B series Master Recorder features a patented erase, splice-locate and azimuth-adjust system (ELSA).

And here are three more.

Our Authorized 3M Dealers

Allied Broadcast
Equipment
800/622-0022

Broadcast
Services Company
919/934-6869

Broadcast
Supply West
800/426-8434

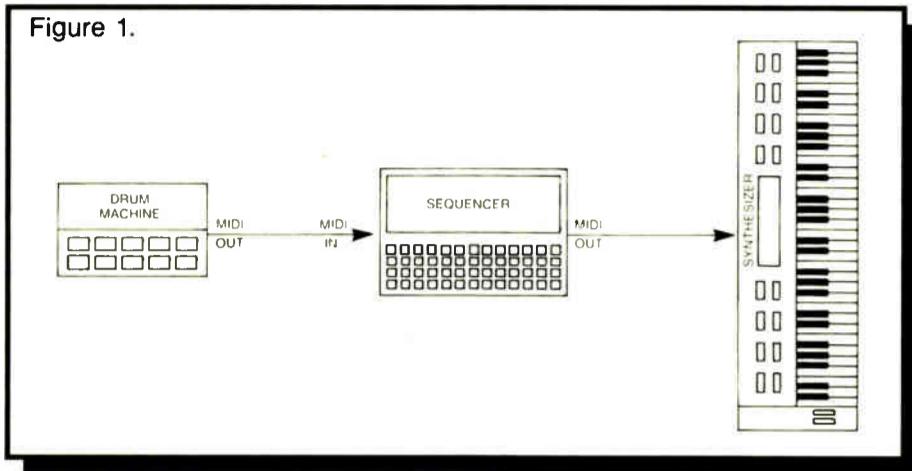
3M International Tapetronics — The World Leader In Cart Machines.

Adding Drums to a MIDI Studio

by Bruce Bartlett

Elkhart IN In my last column, I explained how to connect a synthesizer to a computer MIDI interface to make a simple MIDI studio.

How do you synchronize the drum patterns in the drum machine with a synthesizer melody in an external sequencer? In other words, how do you get the drum machine and synth to play in sync, when both have different patterns recorded in different memories?

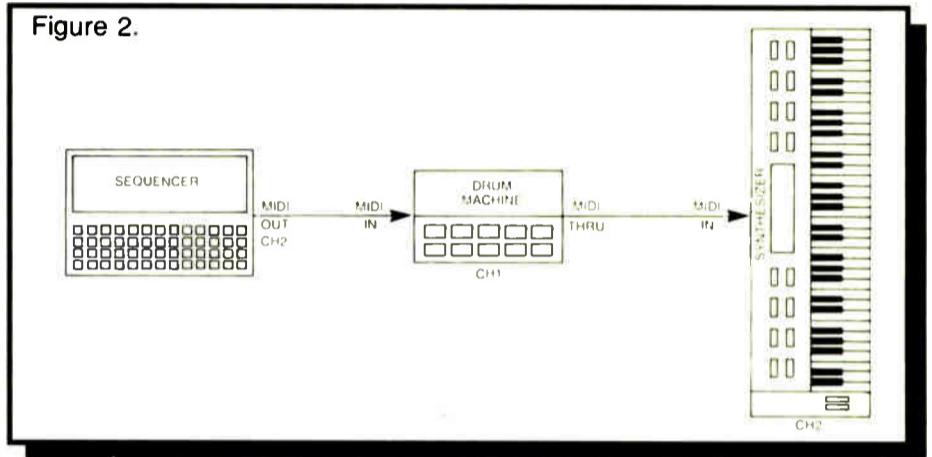


A sequencer or drum machine can send clock pulses from its MIDI OUT connector. It can also receive clock pulses at its MIDI IN connector and can echo (repeat) incoming clock pulses through the MIDI THRU connector.

If a drum machine sends clock pulses, it sets the tempo and other devices follow it. If a drum machine receives clock pulses from a sequencer, the sequencer sets the tempo and the drum machine follows it.

To send clock pulses from a sequencer or drum machine, you set the device to "internal clock" mode. To receive clock pulses, you set it to "external clock" or "MIDI clock" mode.

Transmitting a clock pulse through the MIDI THRU connector is automatic. If



your drum machine has only a MIDI OUT connector, you enable "Echo MIDI IN" so that the incoming pulses are echoed or repeated at the MIDI OUT connector.

Three synchronization methods

There are at least three ways to synchronize the recorded drum performance with the recorded synth performance.

The drum machine's clock can be used to drive the sequencer, which in turn drives the synthesizer in sync with the drum machine.

A second method is to use the sequencer's clock to drive both the drum machine and the synthesizer. The drum machine's internally recorded patterns play in sync with the synthesizer's sequencer-recorded melody.

You could also record the drum machine pattern on one track of the sequencer and the synth melody on another. During playback, the sequencer clock will drive both the drum machine and synthesizer.

In setting up a drum machine to control a sequencer (see Figure 1), the connections to the sequencer are either to a standalone unit or to a MIDI computer interface plugged into a computer running a sequencer program.

The steps are simple. Record a drum pattern with the drum machine's internal sequencer. Next, record a synth melody or chords with an external com-

puter/sequencer.

Connect the drum machine MIDI OUT to the sequencer MIDI IN; connect the sequencer MIDI OUT to the synthesizer MIDI IN.

Set the drum machine to ENABLE CLOCK OUT (or an equivalent position). The sequencer should be set to EXTERNAL CLOCK or MIDI CLOCK.

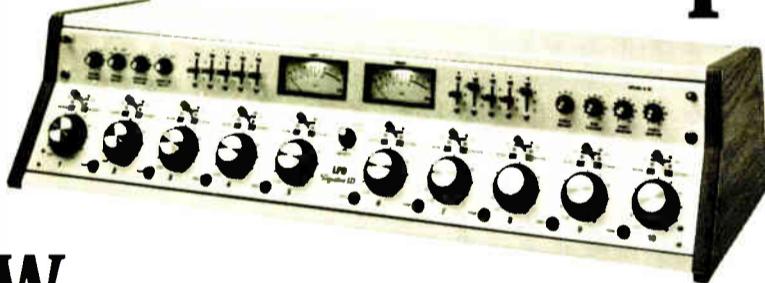
Press the "play" key on the computer/sequencer, then press the "play" key on the drum machine.

As the drum machine plays its internally recorded patterns, its clock pulses drive the sequencer to play the synth melody at the same tempo.

Sequencer driving drums and synth

In setting up the sequencer to play the drum machine and synthesizer (Figure 2),
(continued on page 38)

It's hard to stop.
It's hard to stop.



What is it about the Signature III that keeps so many leading station groups and consulting engineers coming back for another, and another, and...? Is it this console's unparalleled record of reliability and longevity? The LPB Signature III's easily maintained modular electronics? Its excellent RFI immunity? Or is it designed-for-radio features like the following:

- 3 inputs per channel
- Identical Program 1 and Program 2 output busses
- Remote starts on all channels (except channel 1)
- Mono/stereo input switch (on stereo consoles)
- Components and connections clearly labeled for painless installation and easy maintenance

Chances are, it's all of the above. But whatever the reasons, leading stations and engineers across the country demand Signature III's "unstoppable" performance. In fact, they've made it one of the most popular consoles ever built. If you've been spending too much time inside your console lately, contact your broadcast equipment dealer or call LPB for full information and specifications at (215) 644-1123.

LPB Signature III audio consoles are available in 6,8,10 and 12 channel stereo and 6,8 and 10 channel mono configurations.

LPB[®]

28 Bacton Hill Road • Frazer, Pennsylvania 19355
Tel: 215-644-1123 • Fax: 215-644-8651



Noble Broadcast Group

WANTED

DIRECTOR OF ENGINEERING
WBAB AM/FM, L.I., N.Y.

REWARD

All new studios, new building and excellent career path opportunity.

Contact: Dennis Ciapura
VP, Tech Ops
Inquiries Confidential

4891 Pacific Highway
San Diego, California 92110-4082
(619) 291-8510

AN EQUAL OPPORTUNITY EMPLOYER

Affordable Lightning Protection



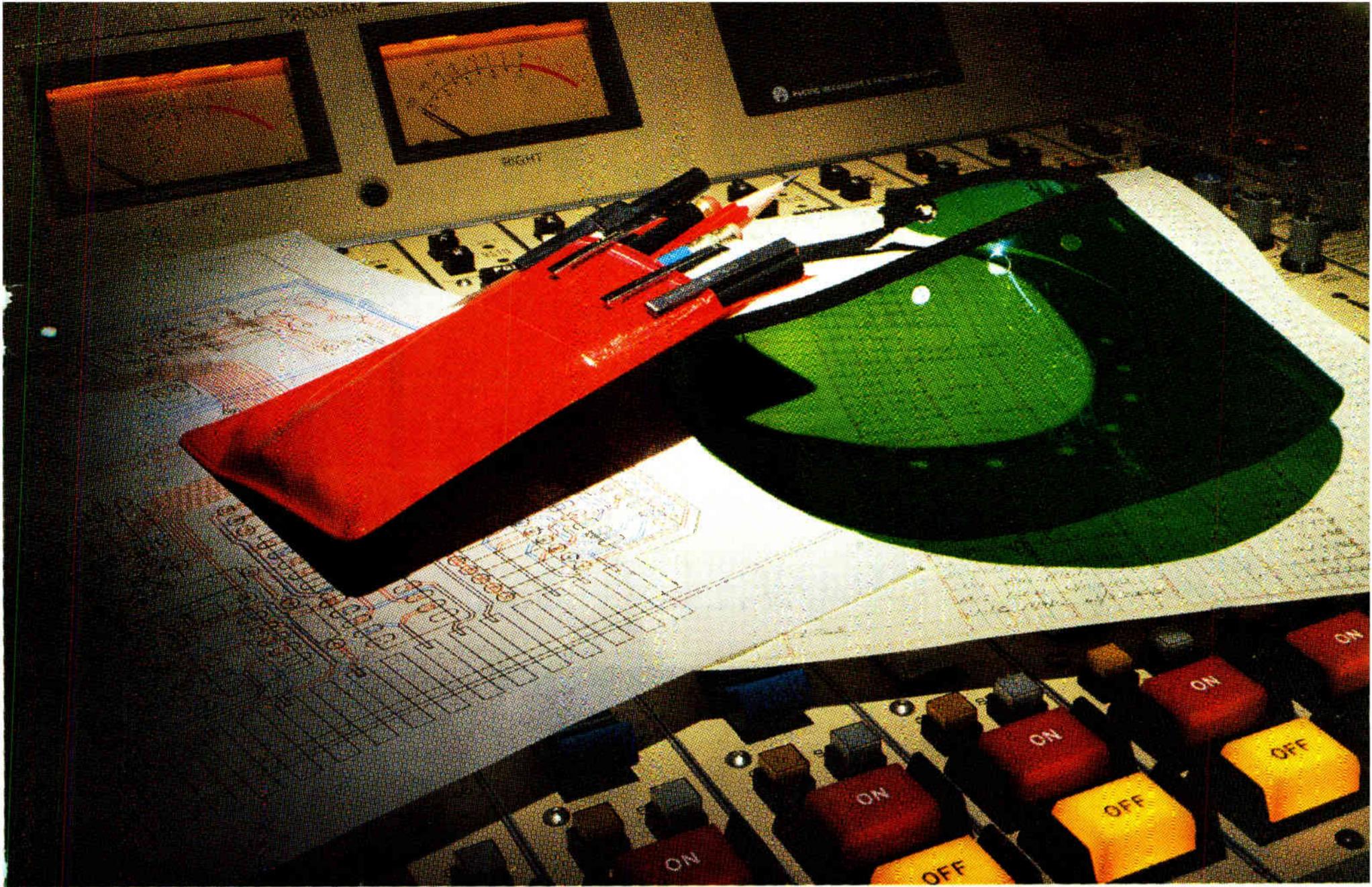
Charge dissipation with 1/8", type 304, stainless steel rods ground to needle sharpness. They won't bend from ice and severe weather. They provide a continuous low-resistance discharge path for the static electric charge on tall structures.

Let us design your system at no cost or obligation!
Write For Free Brochure.

Coran[®]
Corporation

P.O. Box 2548, Farmington, N.M. 87499
(505)325-5336 Fax:(505)326-2337

Mastercard/Visa



Designed. Then priced.

Not vice-versa.

Other manufacturers set price goals, then commit their designers to create products to fit the price. Worse still, their prices must leave room for dealer profits.

Your station works as well as your consoles let it. How do you know whether your consoles have been built to a price, or designed to perform? If they're from Pacific Recorders, you have the assurance that a very real difference in priorities is at work.

The difference:

Our design engineers are in the happy position of being encouraged to choose materials, components, techniques and approaches as they see fit. Their objective is products with uniquely superior attributes: Maximum headroom. Minimum noise and distortion. Total RF immunity. Tough, reliable housings. Massive power supplies. Friendly control panels.

When they're finished, we price it.

And since we don't build in a dealer mark-up, our customers always receive the best price on their equipment. Our published end-user price would be others' "confidential dealer cost". The "negotiation discount" you'd properly expect from their dealers, we invest in superior components.

So the next time you have the chance to order new consoles, maybe you'd be better off to look beyond the price tag and see the value of our approach. Excellence first. All else second.

Please send me a brochure on:

- Air consoles
- Production consoles
- Cart machines
- Dolby SR® for cart
- Everything PR&E offers

NAME _____

STATION _____

ADDRESS _____

Return this coupon to:

Pacific Recorders &
Engineering Corporation
2070 Las Palmas Drive
Carlsbad, CA 92009
(619) 438-3911



**PACIFIC RECORDERS
& ENGINEERING CORPORATION**
The number one choice for
more #1 stations

RW

NEW NEW NEW

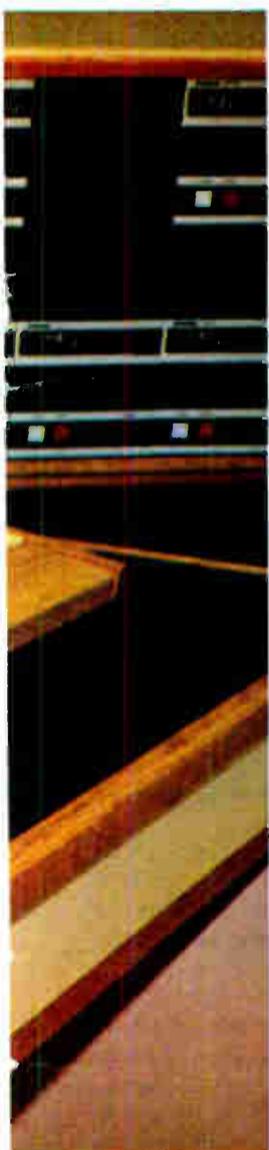
NEW
NEW
NEW
NEW
NEW

SERIES CONSOLES

S - \$5,999 /18 CHANNELS - \$7,999

FEATURES

- Totally Modular Console-Input modules, Output modules, Option modules
 - Ease of Service
 - Ease of Installation
 - Ease of Expansion
- Three Mainframe Sizes-8 channels, 18 channels, 28 channels
 - Full Metering
 - Timer on All models
 - Talkback to "2" studios
- Ultrahigh Quality Construction and design
 - Penny and Giles 3000 Series slide faders
 - VCA's
 - ITT Schadow switches
 - Gold connectors-IC's socketed-regulated power supply
- 3 Stereo Output Buses
- 2 Internal Mix-minus Buses for 'Telephone'
- Option Modules-D.A.'s, Mono Mixes, Remote Selectors, Etc.
- Comprehensive Logic system
 - Start and stop sources by isolated internal reed relays
 - Remote channel On and Off control with Tally lamps for turrets
 - Flashing OFF switches for cart machine status
 - Three muting buses for Control room and two studios
 - Timer reset selectable on each module
 - Monitor DIM function during cue and talkback



224-2248



arrakis
SYSTEMS, INC.

NEW NEW NEW

Why Some Circuit Boards Die

by John "Q" Shepler

Rockford IL Ever wonder why solid state broadcast equipment conks out? Resistors, capacitors and chips have no moving parts. So why do they wear out?

Not all equipment does break down. There are satellites that have been operating in space for 10 years or more without a hitch. So why should your newsroom cart machine blow a playback board every month?

Any time transistors or chips go out you should be suspicious. They weren't designed to do that.

I suppose we've become conditioned to expect equipment to have regular breakdowns. Transmitter tubes have a built-in wear-out mechanism in the form of a tungsten filament. Motors in tape equipment and transmitter blowers don't last forever. Pots are always getting scratchy. Little wonder that

when circuit boards stop working, we just shrug and haul them back to the bench.

Q-TIPS

But if you're blowing parts on circuit boards even after several years of service, something is wrong. Something is stressing those parts beyond their design

limits. If you can find the culprit and fix it, your maintenance headaches will go way down.

The forces of evil

There are a number of evil forces that can knock out even the highest quality parts. Voltage surges are a common stressor, especially in rural areas.

Those millisecond jolts can break down even the highest caliber components. Sometimes equipment gets dropped or

bumped, and that knocks something loose. Maybe moisture is seeping into the connections, corroding them. Then again, maybe the equipment is just too darn hot!

Heat can break down a semiconductor just as surely as a bolt of lightning. In fact, the reason that lightning surges cause so much damage is because of the heating effects that are triggered.

Here's why. Semiconductors have a breakdown voltage that relates to the structure of the materials. You know how a zener diode works. No current flows until the reverse voltage limit is exceeded. Then a lot of current flows. The diode isn't damaged because we design the circuit with a resistance to limit the current.

So, it's not really the voltage breakdown that damages the semiconductors. The damage is caused by the massive current that flows, overheating the junctions and literally burning out the micro-circuits.

Unfortunately, you don't need a catastrophe such as a voltage surge triggering reverse breakdown to knock out your circuit cards. Since heat destroys parts, just raising the temperature of

Any time transistors or chips go out you should be suspicious.

the card will have detrimental effects.

Most transistors and even chips are designed to run at currents that won't cause overheating. Occasionally a manufacturer puts too many chips on a card and they overheat each other. This means a redesign and field retrofit.

Usually, though, the chips and transistors run well within their temperature limits at the factory, but overheat in the field. Why?

Coming up for air

Take a peek in your studios. Are the control boards sitting out in the open, with unrestricted air flow through the cooling vents? How about the cart machines?

If your station is like most, the control board is buried in some fancy furniture and smothered with copy racks and other equipment. The cart machines are stacked three and four high and probably crammed next to the board so the announcers can see the start buttons.

Someone may have thought they were doing the equipment a favor by building a nice wood box to tightly hold the cart machines side by side. Air? Machines don't breathe. Why

(continued on page 33)

Rigid Coaxial Transmission Lines Deliver Low Losses...High Gains.



Cablewave Systems delivers everything you need and expect from Rigid Coaxial Transmission Line performance...superior quality, plus optimum mechanical and electrical specifications.

To achieve this, Cablewave Systems fabricates high conductivity, hard-drawn copper tubing with precision machined, pin-type Teflon dielectric insulators. Standard 50 ohm transmission line is offered in sizes from 7/8" thru 9 3/16"; 75 ohm in 6 1/8" and 9 3/16". All utilize EIA bolt type flanges and inner connectors compatible with EIA

standards, MIL specs and international IEC recommendations. Aluminum outer conductor 50 and 75 ohm transmission lines are available on special order.

To complement our full line of Rigid Coaxial Transmission Lines and accessories, Cablewave Systems also manufactures a complete line of semi-flexible air and foam dielectric coaxial cables and connectors.

For a copy of our 48 page Rigid Coaxial Transmission Line catalog and information on other broadcast and RF communication products, contact Cablewave Systems.

Cablewave Systems

DIVISION OF RADIO FREQUENCY SYSTEMS, INC.
60 Dodge Ave., North Haven, CT 06473 • (203) 239-3311



HELLO PAGES



Ask for your FREE COPY*

This manual puts you in touch with your world. As a **Telemix X** user, you're in control. Place callers on the air quickly and easily with the push of a button. Telemix is the ON-AIR custom talk system that's heard on more talk shows than all the rest. Telemix is modular. Pick the components you need and customize your on-air telephone system.

*We wrote the book on telephone talk interfaces. To get your free copy—and to see how easy your telephone talk can be with Telemix X™—send us a request on your letterhead to: Telemix, Dept. db, P.O. Box 1487, Richmond, IN 47375.

ATLANTA, GA CHICAGO, IL DALLAS, TX
LOS ANGELES, CA RICHMOND, IN

800-622-0022

ALLIED
Broadcast Equipment

— A HARRIS COMPANY

Dr. Brinkley's Story

by George Riggins

Los Angeles CA In the last installment of *Old-Timer* we began the story of Dr. Brinkley and his role—for better or worse—in the pioneering days of radio. We left off with Dr. Brinkley leaving Kansas.

The Doctor was one to always hedge his bets.

It seems that when he saw the handwriting on the wall regarding KFKB—



the station he had launched a few years earlier—he started negotiating with Mexico for a station across the border.

Brinkley went to Mexico City in January 1931 to explore the mutual advantages of a radio station on the other side of the muddy Rio Grande.

Border radio background

Somehow he got the proper documents to build a station in Mexico, thereby starting what we have come to know as "border radio."

The first station to be built in Mexico expressly for the purpose of broadcasting to the large audience in the US was

XED—50,000 watts, 965 kc in Reynosa, Mexico.

Studios and transmitter were built between the Aztec Club and Sam's Place about a quarter-mile south of the bridge connecting Hidalgo, TX and Reynosa. Additional studios were also built in McAllen, TX.

The transmitter for XED was constructed by W.E. Branch from Fort Worth, TX. Although the device was a composite, synonymous with "home brew," Bill Branch was known as a pro. His construction, by some accounts, was thorough and precise.

Next in line

The second station constructed in Mexico for the benefit of the American audience was by Brinkley. Issued the call sign of XER, with power of 75,000 watts, the station was to be located at Villa Acuna, Coahuila Province, Mexico, across the river from Del Rio, TX.

The frequency chosen was 735 kc, between the Canadian Clear channel of 730 and WSB, Atlanta.

KMMJ, Clay Center, NE, was also nearby, but as a daytimer did not really experience interference from XER. Shortly after XER went on the air, Jim Weldon arrived from Milford, KS.

Either Bill Branch, Weldon, or both then built a unique longwire directional antenna.

Jim Weldon wrote that, "the two

57 YEARS AGO

Reprinted from Radio World January 1932

ODDITIES BARED IN STATION TEST

A survey has been made by N. W. Ayer & Son, Inc., a leading advertising agency, of the value of various stations as advertising media. Hyland L. Hodgson, in charge of the broadcasting division said:

"Primarily we wanted to know exactly where each station was heard and to what degree; that is, which was first preference, second, third and fourth. But we have also found out some of the vagaries of radio.

"There is a general belief that all radio is more effective at night than in the daytime. Yet we find some localities where Station A gives perfect broadcasts during the day but cannot be heard at night. Such is the report from a section in the West.

"In North Carolina we find that one section consistently listens in on a Florida station at certain times although there is a good station only 35 miles distant. Atmospheric conditions are said to be responsible.

"From a good territory in Oregon we hear that the best reception is from the South and that a Los Angeles station 1,200 miles away is more effective than another station only 200 miles away.

"In Montana there is a town which finds daylight reception impossible while still another reports that 'a local station

is giving marvelous daytime reception' especially to rural listeners. Other sections of the West and Middle West report certain stations which have widespread rural acceptance, due to the types of programs, weather information, market reports and such. This is particularly true of a number of stations in Wisconsin, Nebraska and the Dakotas.

"We find also that some stations actually 'hop over' one or two counties and then go merrily on with perfect broadcasts; that some are useless in the daytime and others to all intents and purposes dead at night; there are others which are far more effective in summer than in winter and some that are popular or unpopular because of their programs and others because of their 'attitude'. For instance we have this information from a town in Nebraska: 'Station X is one of the least popular, as they have a snooty attitude which doesn't take; people don't have to listen, you know; and they sure won't if they do not like the station's manner'.

"From central Wisconsin we get the information that there is one completely 'dead' spot for a powerful and otherwise effective station; from another section we learn that Station Y is popular because of its children's programs."

towers to the north supported a flattop, and there were cables running from those to a single tower at the southern tip of the equilateral triangle. Between those cables, a quarter-wave behind the front antenna, was a second flattop, which was tuned as a reflector.

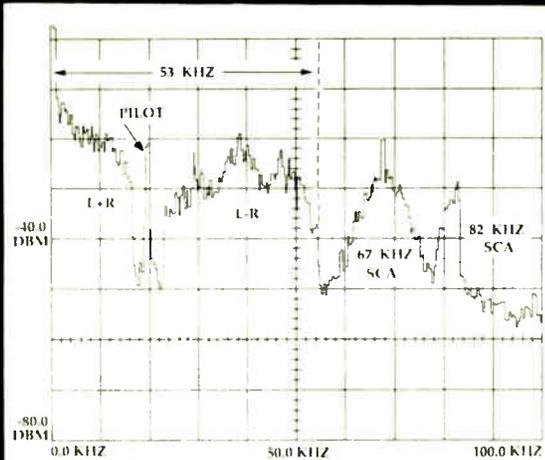
The passive reflector gave roughly a

cardioid pattern to the north." XER and XED operated from about an hour prior to sunset till about an hour after sunrise. Programming was not always continuous in the hours after midnight. The schedule undoubtedly was contingent on time sales.

(continued on page 42)

PUMP IT UP... LEGALLY!

The "DIVIDEND" FM Composite Filter* from Cutting Edge Technologies.



Composite spectrograph of a major market CHR at 110% legal modulation utilizing extreme composite clipping.

*patent pending

The only composite filter available *anywhere*.

The DIVIDEND gives you:

- Full spectral protection to give you the most from your existing composite clipping/processing equipment
- A 5% increase in main channel modulation LEGALLY
- Full signal integrity for your SCA customers
- All of the above with no loss of stereo separation

Call to find out how you can be loud and legal:



216-241-EDGE
FAX: 216-621-2801

Circle 37 On Reader Service Card

ALLIED
EQUIPMENT EXCHANGE
— A HARRIS COMPANY

**BUY!
SELL!
TRADE!**



Allied has been serving the needs of broadcasters for used radio equipment since the late 1960's. Veteran broadcasters are the "heart" of the equipment exchange business at Allied. Call on Jim or Chuck—their expertise is unparalleled.

We accept TRADE-INS, SELL NEW & USED gear & selectively BUY used equipment.

FAX US AT 317-966-6321

P.O. BOX 1487
RICHMOND, IN 47375
317-962-1471

Circle 69 On Reader Service Card

Breathing Room for ICs

(continued from page 30)
do they need air?

The damaging effects of overheating take months and years to show up. The first parts to go are electrolytic capacitors and power transistors.

Electrolytics dry out and lose their capacitance. In the power supply this means more ripple that shows up as more hum, or less margin to handle brown-outs.

In audio circuits, faulty electrolytic caps in coupling and bypass circuits affect frequency response. When a cart machine starts to sound "tinny," you may well have a bad coupling cap.

Power transistors, especially the TO-5 cans, often run nearer their ratings than small signal transistors. When the heat rises,

Don't cram too much hot equipment in any one rack.

the transistor is no longer in a safe operating area of power dissipation. Any small overload will trigger a failure.

A little finned heat sink is no guarantee that the transistor can handle overloads. It might need the sink just to dissipate its normal load.

Integrated circuits are just as vulnerable as discrete transistors. When the plastic packages get too hot outside, they can't get rid of the heat from those dozens or thousands of transistors inside. The heat builds and the transistors conduct more current, which makes more heat, until something opens the circuit. This type of failure is called thermal runaway.

Room to breathe

What can you do? Give your equipment some breathing room. Keep those air vents open.

The main studio is probably air conditioned so the jocks won't melt, but what about the transmitter room? Don't think that equipment racks can take high temperatures any better than you can. If you're comfortable working in an equipment room, then the equipment there will be comfortable, too. That comfortable equipment will be running well within its ratings, a prescription for a long life.

Don't cram too much hot equipment in any one rack. Remember that each piece of gear is generating heat from electricity. Be sure to leave a few blank panels between boxes, so there is room for convection currents to carry away the heat. Even better, add a fan or two at the top of the rack to get that air moving. If you have some real hot-heads in the rack, consider installing a squirrel cage blower.

Moving air is one of the best coolers there is. Fans are easy to install in automation racks or transmitter equipment. But, you have to be more careful in the studio because of noise. The usual fractional horsepower AC motor fan with metal blades whirrs loud enough to be heard on the air.

There are some amazingly quiet fans on the market today. Many have plastic blades and are run on brushless DC motors within the hub. "Muffin Fan" is one trade name. There are lots of others and you can get them for 10 bucks or so surplus.

Also listen to some of the little desk fans in the discount stores.

They're cheap and quiet. The most clever design I've seen lately consists of a piezoelectric crystal that flaps two blades back and forth at 60 Hz. It makes a slight buzz, so don't put one too close to the microphone.

It really doesn't take much of a breeze to greatly extend the life of a board or cart machine. The air is stagnant within this equipment, so any flow at all will carry away the heat and lower the temperature inside dramatically. You don't need a

transmitter blower to cool your control board.

If you have a particularly troublesome machine, try giving it a cool breeze and see if it goes longer between breakdowns. You might just cut your maintenance work load in half by giving the equipment a breath of fresh air.

■ ■ ■

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

AKG's 568EB. Stand Back.

AKG's C568 short shotgun offers you real directivity in a remarkably small and convenient condenser microphone. Only 10" long, the C568's sensitivity, wide frequency response, durable metal housing, and integrated impedance converter/preamp easily meet the demands of live on-air or recording applications. A perfect balance of pressure gradient and interference principles means the C568 can be up to three times as far from a sound source than normal mics and still yield the same ratio of direct to indirect sound. Used close, it reduces indirect sound levels by 8 dB for improved isolation. So whether it's for ENG, film, theatre or church sound reinforcement, or music applications, AKG's C568 means business. And at half the price of the competition. Just stand back and take a listen.



Focusing on new technology.
77 Selleck St. Stamford, CT 06902
(203) 348-2121

© AKG 1988 ■ Akustische und Kino-Geräte GmbH, Austria

A Bit of Channel Status Data

A Basic Overview of Channel Status Data In the AES/EBU Digital Interface Standard

by Mel Lambert

Part II of II

Studio City CA In my last installment, we began a discussion of the AES/EBU digital interface. In this installment, we turn to the issue of channel status information.

As I am beginning to discover, the channel status information carried as part of the AES/EBU and other protocols can form one of the main sources of incompatibilities between the various interfaces.

Presented here is a necessarily brief overview of the channel status differ-

It should also be remembered that, because many devices implement a part of a standard, the transmitted information may not match all points of the published standard.

Where it's carried

For the AES3-1985 interface, channel status information is carried by bit #31 of the 32-bit subframes (four sync bits; four auxiliary bits, 20 data bits per chan-

DIGITAL DOMAIN

nel, and four user bits/flags).

Channel status is decoded by the receiver as data blocks made up of 192 bits. Transmitted over a period of four milliseconds (at a sampling frequency of 48 kHz), these data blocks are subdivided into 24 eight-bit words.

- In bit #5, a "1" implies source sampling frequency unlocked, and a "0" implies sampling frequency locked.

Bytes #4 and #5 are undefined at present. Bytes #6 to #9 show alphanumeric channel origin data, comprising 7-bit

unreliable, and "0" otherwise. Bit #7 is "1" if bytes #18 to #21 are unreliable, and "0" otherwise.

Finally, byte #23 holds the channel status cyclic redundancy check character.

The consumer side

In contrast, the CP-340 Type II ("consumer") interface defines the channel status data format as shown in Figure 2.

The following 21 bytes (i.e., the bal-

Figure 1.

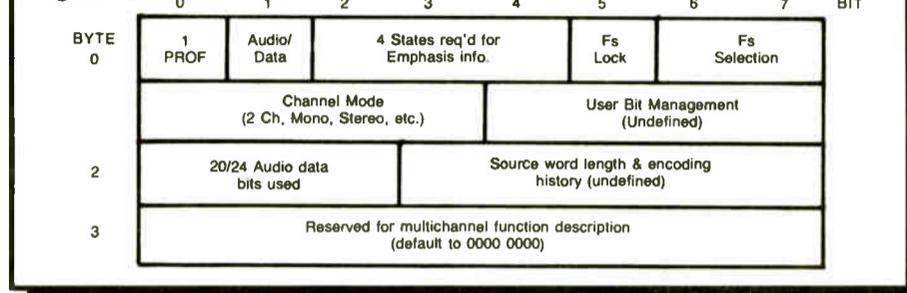
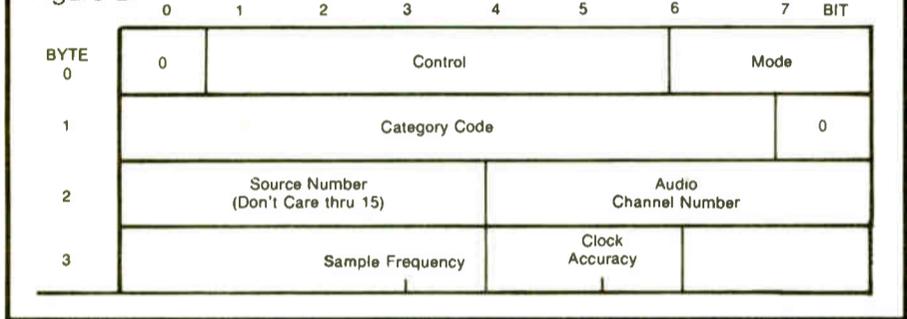


Figure 2.



ences between AES/EBU and CP-340 Type II interfaces found on certain DAT machines and digital processing systems.

Anyone thinking of analyzing the data being transmitted via a specific interface should secure for themselves copies of the latest relevant documentation from the equipment manufacturers, Audio Engineering Society, ANSI, EIA-J and other standards organizations.

The main areas of incompatibility between various channel status formats of different interfaces lie within the first four bytes of this 24-byte block. For the AES/EBU protocol, these four bytes are as shown in Figure 1.

For byte #0 in this figure:

- In bit #0, a "1" implies professional and "0" implies the consumer I/F.
- In bit #1, a "1" implies general data and "0" implies audio information.

ASCII, odd-parity, byte #6 being the first character.

Bytes #10 to #13 give alphanumeric channel destination data, comprising 7-bit ASCII, odd-parity, byte #10 being the first character.

Bytes #14 to #17 contain a local 32-bit binary sample address code, LSB first. This serves as a recording index counter.

Bytes #18 to #21 have a time-of-day 32-bit binary sample address code, LSB first. It refers to the time at which the first sample of the current block was originally recorded and should not be changed.

Byte #22 gives channel status data validity flags.

- Bits #0 to #3 are reserved.

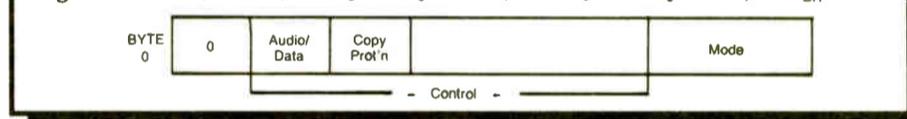
ance of the 24 bytes, or 192 bits) are all set to zero. Let's concentrate upon byte #0, shown in Figure 3.

• Bit #0 is the professional/consumer recognition bit.

• Bits #1 to #5 form a control sequence that only matches the AES-EBU interface format in Bit #1. As can be seen, the Digital Copy Protection bit conflicts with the emphasis information carried in bits #2, #3 and #4 of the pro format; from here on in the differences become even more complex.

Any RW reader who would like further information about the Sub Working Group on Implementation of the AES/EBU Digital Audio Interface should contact Steve Lyman at the Canadian

Figure 3.



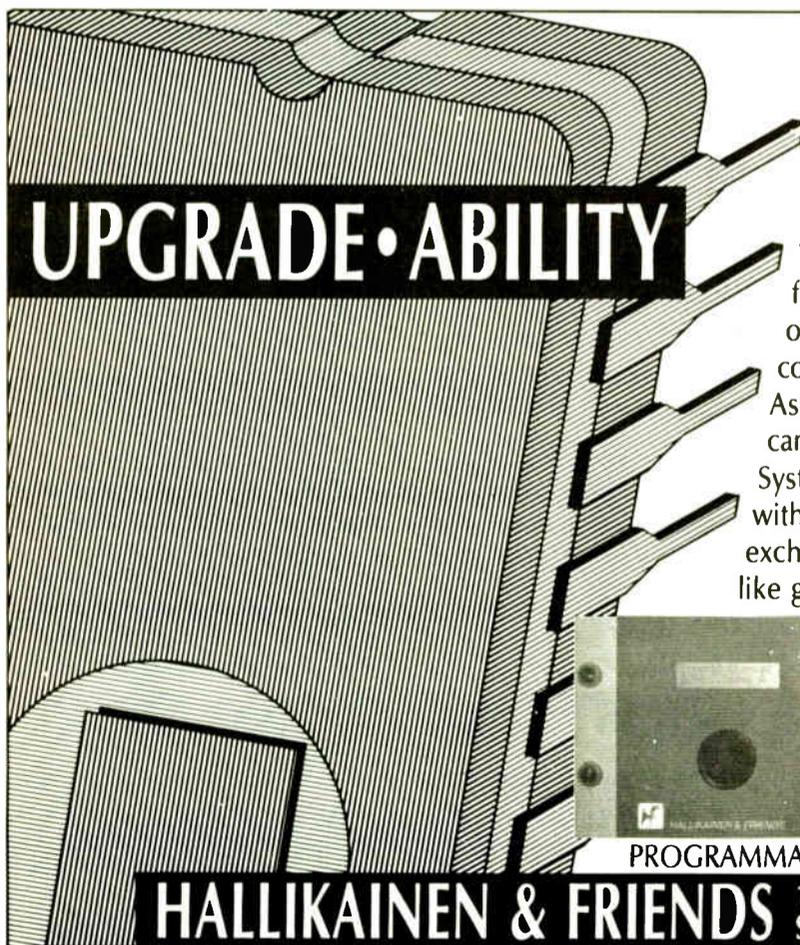
- Bit #4 is "1" if bytes #0 to #5 are unreliable, and "0" otherwise.

- Bit #5 is "1" if bytes #6 to #13 are unreliable, and "0" otherwise.

- Bit #6 is "1" if bytes #14 to #17 are

Broadcasting Corporation (CBC): 514-485-5477.

An electronic mail "conference" on the AES-EBU protocol also exists as part of Advertel Communication System's CONFER II. Regular participants to CONFER II can exchange data with one (continued on page 40)



UPGRADE•ABILITY

U

PGRADEABLE DIGITAL REMOTE CONTROL. The state of the art is yours with the DRC 190 from Hallikainen & Friends. At the heart of our system is the EPROM firmware chip containing the microprocessor instructions. As new features evolve, the old EPROM can be swapped for the latest chip. System update is a relatively painless process, with little risk of freight damage, and all by exchanging the EPROM *at no charge*. It's just like getting a new system for FREE.

PROGRAMMABLE EXPANDABLE AFFORDABLE DRC 190

HALLIKAINEN & FRIENDS 141 SUBURBAN E4 805 / 541-0200
SAN LUIS OBISPO, CA 93401-7590 USA

SX-87

HIGH TECH



LOW PRICE

TELEPHONE HYBRID

Unmatched Performance
Guaranteed 7 Db More
Rejection Than Any
Other Hybrid Device!

DYNAMIC
AUDIO DISTRIBUTION

DA2-12

DOES IT ALL FOR
A LOT LESS!

hnat hinders inc

42 ELAINE STREET - P.R. #1
THOMPSON, CONNECTICUT 06277
(203) 935-9066

Transistor Circuitry

(continued from page 24)

standards-producing outputs that most circuit designers were looking for. Self-contained circuits were developed that would perform numerous functions. These circuits became known as operational amplifiers.

Operational amplifiers were originally designed in the 1940s for computer circuits; the name was derived from the concept of a circuit producing a high gain. By changing the feedback ele-

yond what engineers ever anticipated. Integrated circuits—ICs—replaced the conventional method of discrete device circuitry.

ICs do not need individual components soldered to a circuit board, because all of the components are in the "chip." ICs reduce the number of components required, circuit board size is reduced and generally less power is required to operate the system.

ICs often produce circuits that re-

ICs often produce circuits that require fewer alignment steps, and often increase the reliability of the circuit . . .

ments, different functions could be performed allowing one amplifier to do many things.

Typical characteristics of an operational amplifier include common mode rejection or the ability to reduce hum and noise; high input impedance, eliminating the prospect of "loading down" a previous stage; high gain, and low output impedance.

Advancements in electronics

A further step in electronics beyond opamps came in 1958 with the development of integrated circuits. This development permitted electronics growth be-

quire fewer alignment steps, and often increase the reliability of the circuit because there are fewer components to fail.

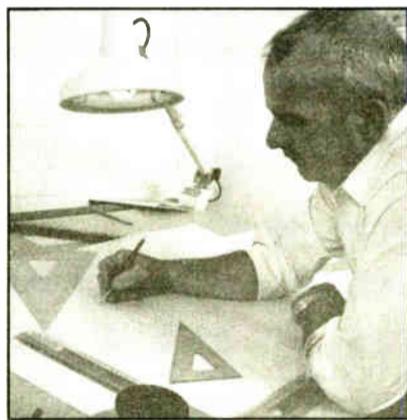
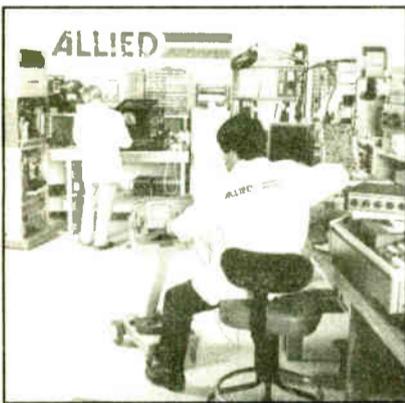
Most recently, in 1989, Intel Corporation announced its development of a microprocessor chip containing 1 million transistors on a space half the size of a postage stamp.

■ ■ ■

Ed Montgomery currently is an electronics teacher at Thomas A. Edison High School in Fairfax County, VA. He has taught broadcast engineering at Northern Virginia Community College and worked as a broadcast engineer for several radio stations.

ALLIED
Broadcast Systems
— A HARRIS COMPANY

Facilities Design and Systems Integration



Full design, engineering, testing, assembly, installation, documentation and training capabilities.

Operating out of Newport Beach, CA, Allied Broadcast Systems is set up to handle everything from planning a single low-cost studio to creating a major turnkey broadcasting complex. Equipped with assembly and test facilities, a specialized staff of experienced professionals are experts in broadcast project design, construction and installation. Allied Broadcast Systems personnel will go in at the very beginning of a project and work out the basic requirements, draw up plans and then orchestrate and manage the entire job. We've got the goods and the reputation.

**Allied Broadcast Systems
Can Do It All!**

Harris/Allied © 1989
4500 CAMPUS DRIVE - SUITE 202
NEWPORT BEACH, CA 92660
714-752-6664

THIS PRODUCTION ASSISTANT WILL NEVER ASK FOR TIME OFF.

Twenty-four hours a day, seven days a week. That's the kind of dedicated service you can expect from the new 3030 quarter inch recorder from Tascam.

The 3030 is a real studio workaholic, designed to do a little of everything, and do it well. At only \$2,299* one of the things it does best is save your budget.

From its proprietary heads, offering extended headroom and quieter recording, to its built-in dbx type I professional noise reduction, the 3030 delivers sound you can count on, time after time.

Whether you're fine-tuning for a particular kind of tape, or just matching previous recordings, you'll appreciate the 3030's choice of on-air or production-quality tape speeds, and the switchable print levels.

Split second cueing decisions are no problem, thanks to micro-touch pushbuttons, while Auto Cue Mark, Duplesync, and Tape-Run-Time counter simplify your spot production. Mic inputs make direct voice-overs a breeze.

And with balanced and unbalanced inputs/outputs, the rack-mountable 3030 slips easily into any existing system.

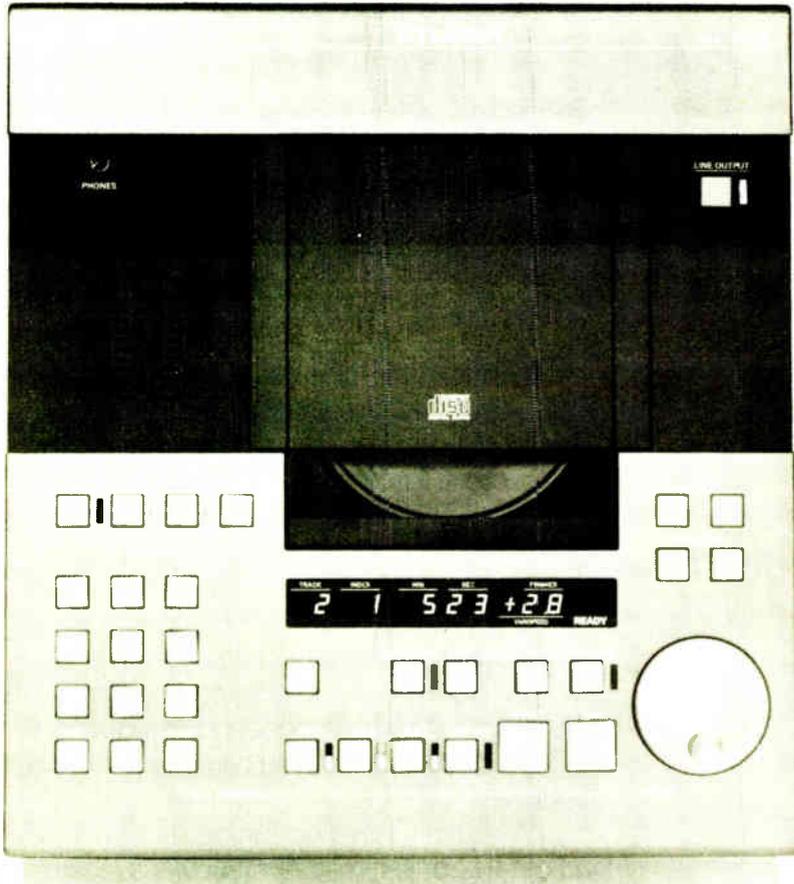
Contact us or visit your Tascam dealer for more information about the 3030. It turns out, good help isn't hard to find after all.

TASCAM



© 1989 TEAC America, Inc., 7733 Telegraph Road, Montebello, CA 90640, 213/726-0303
*Manufacturer's Suggested Retail Price

Beat the high cost of low priced CD players.

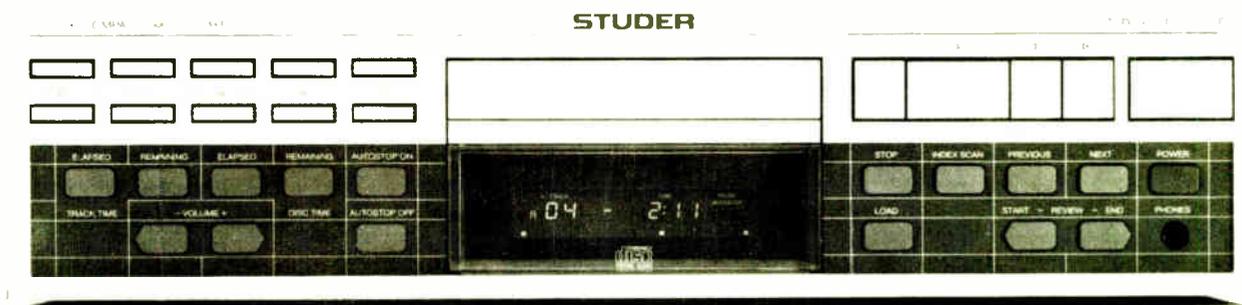
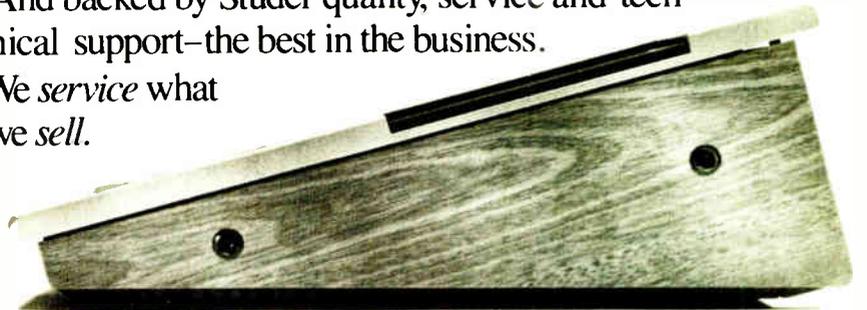


Studer can save you the high cost of finding out why low priced CD players aren't worth the money...

Say you were to buy 3 or 4 of those "less expensive" CD players. You spend time modifying them for remote use—and void your warranty (for whatever that's worth)—and a few months of hard use later, they fail. You can't get them serviced, let alone fixed. So you end up having to pitch those machines and buy 3 or 4 more.

On the other hand, you could buy a Studer CD player—*specifically* designed for rugged everyday use. And backed by Studer quality, service and technical support—the best in the business.

We service what we sell.



Studer costs you less. Figure it out.

In a very short time, a single Studer *more than* pays for itself.

You still want more for your money? How about absolutely unbeatable sound quality too? Studer's got it. With both the rack mount A727—the on-air standard for CD broadcast—and the table-top A730, especially suited for quick, creative production play.

So don't confuse the price tag with the bottom line. You might pay less up front for those amateur decks. And get a *whole lot less* than you bargained for in the end.

Play a Pro instead. Studer. The one built for business.

STUDER REVOX

Studer Revox America, Inc.
1425 Elm Hill Pike • Nashville, TN 37210 • (615)254-5651
New York (212)255-4462 • Los Angeles (818)780-4234
Studer Revox Ltd., Toronto (416)423-2831

Call your Studer Revox Full Line Dealer for more information about the complete line of Studer Revox Professional Products.

Circle 53 On Reader Service Card

Corky Culver Swings on a Star

Editor's note: Once again, RW's inveterate time-traveler Peter Hunn dusts off the station scrapbook for a look back at the simpler days of radio in decades gone by, with another chapter in the misadventures of Corky Culver—part-time assistant chief engineer.

by Peter Hunn

Fulton NY Normally a bucolic 250 watter, nestled in the rolling hills of one of our finest states, wouldn't have seemed a likely candidate for that "new-fangled" Top 40 music.

A series of phone calls from a fellow radio engineer in Omaha, however, had led the station owner, Mr. Myers, to investigate this "wiggly" programming.

Coincidentally, hardly a month had passed since Corky Culver, his youthful, part-time assistant chief engineer, was extolling the virtues of a rock 'n' roll band scheduled to gyrate in the



local high school gymnasium.

Mr. Myers listened politely, but was not enthusiastic enough to allow his protégé to record the "keen sounds" of Irv Ivers and the Imperialistic Pumpernickles on the station's new portable Magnecorder PT-6.

"I'd like to, son," he rationalized parentally, "but all those screaming gals you say will be in the audience could overwork the Maggie's delicate VU meter."

Da-doo-run-run

Well, as it turned out, the Pumpernickles never got to town anyway. Irv Ivers' agent cancelled the concert shortly after a county fair gig in which the group complained of "severe bloating."

It seems that in addition to providing fair-goers with up-tempo tunes, the Pumpernickles' contract mandated they participate in one of those giant "all you can eat" charity contests.

Some chubby kid from a big farm in the next county won. The VFW raised enough money to purchase some new folding chairs. And Irv Ivers' openly cursed the guy who'd been dishing out the event's homemade beans.

"The kids at school," Corkey admitted solemnly, "call it the day the music just started passing away."

"Mr. Myers!" the station receptionist shouted, "Long distance calling from Nebraska."

"Your Hooper Ratings have shot up how much!?" Corky heard his astonished mentor query the caller.

When Mr. Myers hung up the phone,

Corky knew the incredulous look in the wise adult's eyes signaled an impending adventure for the little radio station.

"What is it, sir?"

"Well now, son," came a slow response in Bing Crosby-like tones, "it appears that I need to personally check out this latest Top 40 phenomenon. But before I visit my compatriot's Omaha facility, I'd best get a jump on things and hire one of those fast-talking DJs to do a late afternoon show right here."

"Oh, double-super coolistic!" Corky rejoiced in a voice that made him, briefly, shake all over. "Sir, ... uh ... well, now that you're officially looking for a

Top 40 type DJ ... "

"Yessss?" Mr. Myers slowly enunciated as he puffed on his freshly lit pipe.

"You see, I, uh ... well, I knew you'd want to hire a rock 'n' roll disc jockey someday, so ... uh, I took the liberty of contacting such an individual, who says he's worked with other successful stations, to ... uh ... meet you."

"Oh, I see. When can we schedule an interview with this previously-experienced, electronic pied piper?"

"Uh, anytime, I guess, because he's waiting in his car out in the parking lot."

"Show him in, my boy," the broadcaster motioned, "show him in."

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

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

This increased performance margin means outstanding audio reception on SCPC sub-carrier signals, and digital even in low EIRP areas.

Comtech's leadership in satellite antenna design is no accident. They pioneered the exclusive 3-piece "splice-strap" parabolic reflector with a superior sur-

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

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

Allied Broadcast Equipment distributes Comtech Antenna systems to the radio industry nationwide. Call today for more information.

317-962-8596

ALLIED
Broadcast Equipment

3712 National Road West
P.O. Box 1487
Richmond, IN 47375

Comtech Antenna Corp.—Taking the lead in Satellite Antenna Systems



Radio Station KAIR/JOY, Inc.
Tucson, Arizona
3.8 Meter Antenna Installation

Using a Drum Box

(continued from page 26)

first record a drum pattern with the drum machine's internal sequencer; then record a synth melody or chords with an external computer/sequencer.

Connect the sequencer MIDI OUT to the drum machine MIDI IN. The drum machine MIDI THRU should be connected to the synth MIDI IN.

Alternatively, set the drum machine to echo the MIDI IN signal to the MIDI OUT connector and connect the drum machine MIDI OUT to the synth MIDI IN.

Set the drum machine to receive an EXTERNAL CLOCK or MIDI CLOCK signal; set the sequencer to INTERNAL CLOCK and MIDI DRUM.

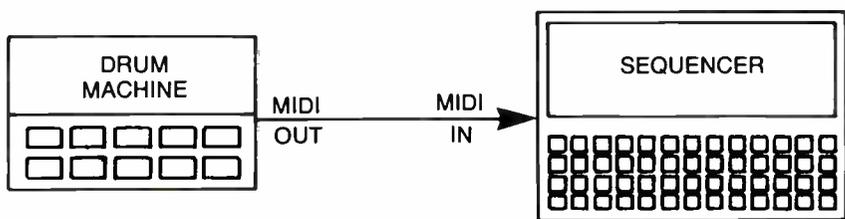
synth melody, the sequencer's clock pulses drive the drum machine and synthesizer at the same tempo. The drum machine plays its internally recorded patterns, while the synth plays the sequencer track.

Recording drums into sequencer

The advantage of recording the drum sequencer is that, if you change the arrangement of sequences in the sequencer, the drum sequences follow those changes. You don't need to reprogram the drum machine every time you change the sequencer arrangement.

Refer to Figure 3A for this setup. After recording a drum pattern with the drum

Figure 3a.



The drum machine is set to MIDI channel 1. Set the sequencer synth track and the synthesizer to MIDI channel 2.

In this way, the sequencer's recorded performance will play only the synthesizer. Alternatively, keep everything on MIDI channel 1, but set the drum machine so that it will *not* respond to MIDI data.

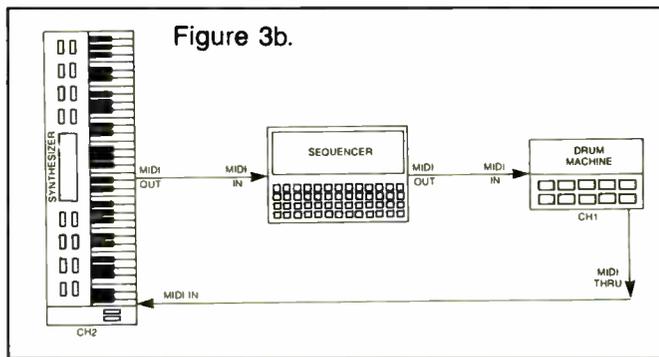
Press the "play" key on the computer/sequencer.

As the sequencer plays its recorded

machine's internal sequencer, connect the drum machine MIDI OUT to the sequencer MIDI IN.

Set the drum machine to ENABLE CLOCK OUT (or an equivalent). Also set the drum machine to enable MIDI data out, or to send MIDI data. Then set the sequencer to EXTERNAL CLOCK or MIDI CLOCK mode, and record track 1.

Hit the "play" key on the drum machine. The sequencer will record the drum pattern on track 1.



Now you're ready to add the synthesizer track. Connect the sequencer MIDI OUT to the drum machine MIDI IN (as in Figure 3B). Connect the synthesizer MIDI OUT to the sequencer MIDI IN. The sequencer should be set to INTERNAL CLOCK.

Start recording on track 2 with the sequencer. You'll hear the drum machine playing the pattern recorded on track 1. While listening to the drum machine, play along on the synthesizer and record it on track 2 of the sequencer.

In setting the equipment up for playback, start by connecting the sequencer MIDI OUT to the drum machine MIDI IN (see Figure 3C).

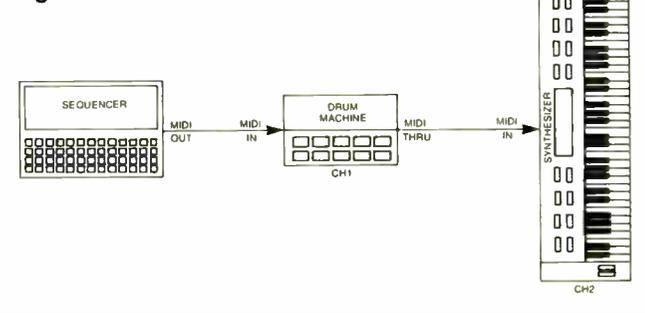
Next, connect the drum machine MIDI THRU to the synth MIDI IN. Alternatively, enable the drum machine to echo the MIDI IN signal at its MIDI OUT con-

nect and connect the drum machine MIDI OUT to the synth MIDI IN.

The sequencer track 1 should be set to MIDI channel 1; set sequencer track 2 to MIDI channel 2. Then set the drum machine to receive MIDI signals on channel 1, and the synth to receive MIDI signals on channel 2.

With an Apple II or Commodore 64 computer running a sequencer program, sync problems might occur with the first two approaches. The baud rate of the

Figure 3c.



computer is faster than that of the drum machine, so the drum machine might gradually lag behind the sequencer playback tempo.

■ ■ ■

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



You can measure...

with the best monitor and the most accurate test set.

The FMM-2/FMS-2 series monitors provide an even greater degree of precision measurement than ever before... You can measure S/N below 90 dB, You can measure crosstalk below 85 dB, You can measure separations of better than 70 dB, You can measure frequency response to better than 0.25 dB, You can measure distortions to lower than 0.01%, and much more... Our uncluttered panels and autoranging voltmeters make these measurements a dream.

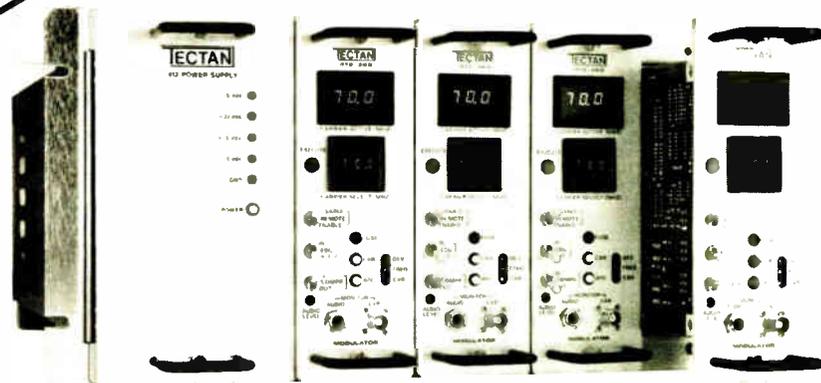
BELAR CALL ARNO MEYER (215) 687-5550
ELECTRONICS LABORATORY, INC.
 LANCASTER AVENUE AT DORSET, DEVON, PENNSYLVANIA 19333
 Call or write for more information on Belar AM, FM, Stereo, SCA and TV monitors.

Circle 2B On Reader Service Card

ALLIED

Satellite Equipment
 - A HARRIS COMPANY

Satellite Transmission & Reception of High Quality Audio or Voice



TECTAN Model 412 Frequency Agile SCPC FM Terminal

FEATURES/PERFORMANCE

- **Frequency Agile.** One terminal does the job of many single channel units. Frequency selection can be made from the front panel or by remote control.
- **Threshold Extension** with TECTAN's patented phase-locked loop detector.
- **Internal Frequency Synthesizer** for excellent frequency stability.
- **Carrier, Level and AFC Alarms.**
- **Two Models** to fit your system needs: 412/Basic and 412/360.

Call the Satellite Experts

3712 NATIONAL RD. WEST • P.O. BOX 1487
 RICHMOND, IN 47375
317-962-8596

Circle 91 On Reader Service Card

Mixing Schemes Aid Mic Woes

by Frank Beacham

Evanston IL From the precarious task of producing the network broadcast audio feed of the Iran-Contra hearings to a radio station wanting an "automatic engineer" for talk shows, broadcasters have quickly adopted voice-activated mixing systems for difficult multiple microphone set-ups.

The audio quality of panel discussions and talk shows can be vastly improved by using automatic mixing methods instead of a large number of open micro-

phones, said Michael Pettersen, director of mixer products for Shure Brothers, manufacturer of an automatic microphone system for broadcasters.

An automatic mixing system keeps unused microphones attenuated and automatically opens them within milliseconds when they are needed.

... the voice-activated system made a "dramatic difference" in the audio quality of the studio ...

phones, said Michael Pettersen, director of mixer products for Shure Brothers, manufacturer of an automatic microphone system for broadcasters.

Comb filtering, ambient noise, reverberation build-up and acoustic feedback can plague remote broadcasts and studio productions when multiple open microphones are employed, Pettersen noted.

"Since these problems cause audio quality to deteriorate as the number of open microphones increases, the remedy is to keep open microphones to a minimum," he said.

In an audio system, Pettersen said, each time the number of open microphones is doubled (i.e. one to two, two to four, four to eight) the overall system gain is raised 3 dB. As a result of this gain change, ambient noise and reverberation also increase.

A Shure circuit called NOMA (Number of Open Microphones Attenuation) compensates for this by lowering overall gain by 3 dB every time the number of open microphones doubles. This keeps the ambient noise and reverberation constant, no matter how many microphones are open.

NOMA also reduces feedback problems, Pettersen said. When a PA system is used in a broadcast remote, feedback or "howling" can occur as system gain increases with the number of open microphones.

Shure pointed to several examples where its system is effective.

Capital Cities/ABC used 35 voice-activated microphones to pick up the congressmen and legal staff at the Iran-Contra hearings in 1987 (the witness mic was always left open).

Chicago's WTMX also uses Shure's system for public affairs programming.

CE Ron Turner designed a public affairs studio that can be operated without the need of an engineer. Turner placed a round table in the studio that can comfortably accommodate a program host and three guests.

Four low-profile boundary microphones were installed every 90 degrees in the center of the table. With this arrangement, if two people are in the stu-

dio, only two microphones will be activated, provided each person stays within his or her microphones' 120° acceptance window. The same occurs with three or four persons as well.

In order to keep all the microphones from shutting off and thus having a loss of studio ambience on the air, the WTMX system was set up to activate the host's microphone if the three guests' microphones turn off. With this arrangement, at least one mic is open at all times.

Engineer Al Byers of WNWS-AM/WLYF-FM in Miami installed a four-

channel system to help reduce the effect of serious acoustical deficiencies in his station's talk show studio. The obstacles Byers faced were a 13 dB bump at 240 Hz and two glass walls.

According to Byers, the voice-activated system made a "dramatic difference" in the audio quality of the studio and the problems of "hollowness" and "loss of articulation" have been solved.

An echo problem resulting from satellite transmission delay was solved with voice-activated microphones at WCAU-AM in Philadelphia.

The station regularly features call-in talk shows originating from remote sites. The cause of the echo problem was an acoustic link that existed at the remote site between the PA system and talent microphones.

If these mics were left open, listeners in Philadelphia would hear an echo. The solution—with the help of an automatic mixer—was to keep the talent microphones off when they were not needed, thus breaking the acoustic link between the PA system and the talent microphones.

Jack Miller, the now-retired technical operations manager for WCAU, is quoted as saying the automatic mixer corrected a major problem and turned call-in remotes into "duck soup."



Ron Gaier, Chief Engineer,
WHIO-AM-FM Dayton, Ohio,
Cox Broadcasting

Newsreader Dawn Matthews on the Audi-
troneics 212 in WHIO-AM news studio.

**"Reliability makes
Auditroneics
boards winners
with us",**

Jim Jones on the Auditroneics 224 in WHIO
production.

says WHIO AM-FM chief engineer Ron Gaier. "Our job in engineering is to keep the station on the air, so our three Auditroneics consoles' record of zero failures makes me very happy."

"When we renovated three years ago, I insisted on enough input capacity so every signal source could have its own channel with no switching or patching. So we bought the 224 for production and on-air, and the 212 for news. This also gives us the flexibility to easily reconfigure the boards as our needs change."

"We got everything we wanted from Auditroneics through our dealer Allied, including timely delivery which was critical to us then."

"Based on our trouble-free experience with the Auditroneics 200 series thus far, I'd buy them again tomorrow."

If you'd like to know more about why Ron Gaier specifies Auditroneics consoles, call toll-free 800-638-0977 or circle reader service number.

 **auditroneics, inc.**
3750 Old Getwell Road, Memphis, TN 38118
901-362-1350

Corky Goes Top 40

(continued from page 37)

"Let's see, what was it now?" the station owner asked, glancing over the handwritten resume.

"Swingin' Chucky Starrrr!" the boy beamed. "Spelled with four Rs, too! The kids will really go for him!"

Mr. Myers couldn't see how an extra trio of silent consonants could possibly draw radio listeners to his dial position, but he let Corky break the good news to the new rock jock.

"My boy, tell him he can start Friday from four 'til sunset sign-off. And remember . . . while I'm in Nebraska, you'll have to keep an eye on the entire

operation and make sure everything is smooth sailing on the air."

"Yes sir!" Corky saluted, "Yes sir!!"

"Son, you should always put down your soldering iron prior to gesturing like that."

What's the buzz?

Shortly after 4 PM Friday, Corky's home phone began ringing. A schoolmate from science class was but one of a dozen callers wondering why Chucky Starrrr's voice was always drowned out by some strange, motorized, humming sound on the radio.

"I guess I heard it too," Corky con-

fessed. Although nervous about making a commitment, he promised to find a solution before Chucky's next program.

Errands for his folks kept Corky Culver from reaching the station before sunset. Upon arrival, he was met by one very animated DJ.

"Listen kid," Swingin' Chucky Starrrr hollered while angrily tossing 45s in a paper bag, "like, you're supposed to be a tech . . . so, get technical and get that hummin' out of the mic before tomorrow's show! And get the old man to spring for an air conditioner or something. My show is HOT, and I need more ventilation in this place!"

The perplexed Corky examined every circuit in the Gates Studioette board but couldn't find a single hum, buzz or weird sound of any kind.

"Maybe it's actually something in the

microphone," he figured while bicycling home. "I hope not, though, because Mr. Myers hasn't taught me much about mics yet."

Saturday afternoon came quickly. Swingin' Chucky Starrrr took off his sunglasses long enough to give Corky the evil eye and say, "the trouble better be absolutely 100% gone!"

Anxiously retreating to the engineering room, the youngster grabbed one of Mr. Myers' colorful Xcelite screwdrivers. The part-time assistant CE then ran back to the air studio trying earnestly to make a decision.

After all, he'd been placed in charge of the entire station. Doing no last minute trouble-shooting could cause the re-emergence of that unusual humming sound. That might make Chucky Starrrr quit, lowering the ratings, resulting in lost advertising revenues for Mr. Myers!

Corky heard the network news come on. Knowing he still had five precious minutes to act, the small yellow screwdriver was put to the facility's sole microphone.

Seconds later, tiny parts showered from the RCA 77-DX, and a large magnet straightened out a tangle of wires as it shot towards the control room's big, 16-inch metal turntable.

In the midst of spraying metal components, the exasperated young engineer thought he heard the sound of his name.

"Corky Culver!" shouted the receptionist. "Mr. Myers just called long distance. Says he wants you to tell our new DJ to be sure to keep the studio window closed whenever he's on the air— especially when the guy next door is out using his new riding lawnmower."

■ ■ ■

Peter Hunn is owner and GM of WZZZ-AM. He can be reached at 315-593-1313.

A Review of the AES/EBU Interface

(continued from page 34)

another, and coordinate activities around the country.

Current participants, in addition to myself include Ted Jensen of Sterling Sound; Bob Ludwig of Masterdisk Corporation (and chairman of New York Section AES); CBC's Steve Lyman; John Nunn, principal manager of special projects, British Broadcasting Corporation, London, England; and Jim Wilkinson, chief consultant engineer, Sony Broadcast, England.

Contact Advertel's Ann Edwards at 313-769-2852 for more information about joining CONFER II; as well as the AES/EBU dialogue it also carries an active conference spotlighting current developments on the ES Bus Serial Control Protocol.

■ ■ ■

Mel Lambert has been intimately involved with the production and broadcast 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.



DAT was invented for your home. Rs DAT is for your studio.

Other DAT machines only take you halfway.

You need more in your studio than just a DAT machine. You need a DAT machine that can interface to your console and automation equipment. You need a machine with remote control and status information. And you need it to perform like a cart machine - - reliably and quickly.

Meet the RS-1000 from Radio Systems.

The RS-1000 is an integration of the Sony DTC-1000 and a special microprocessor-based controller from Radio Systems. Its features include:

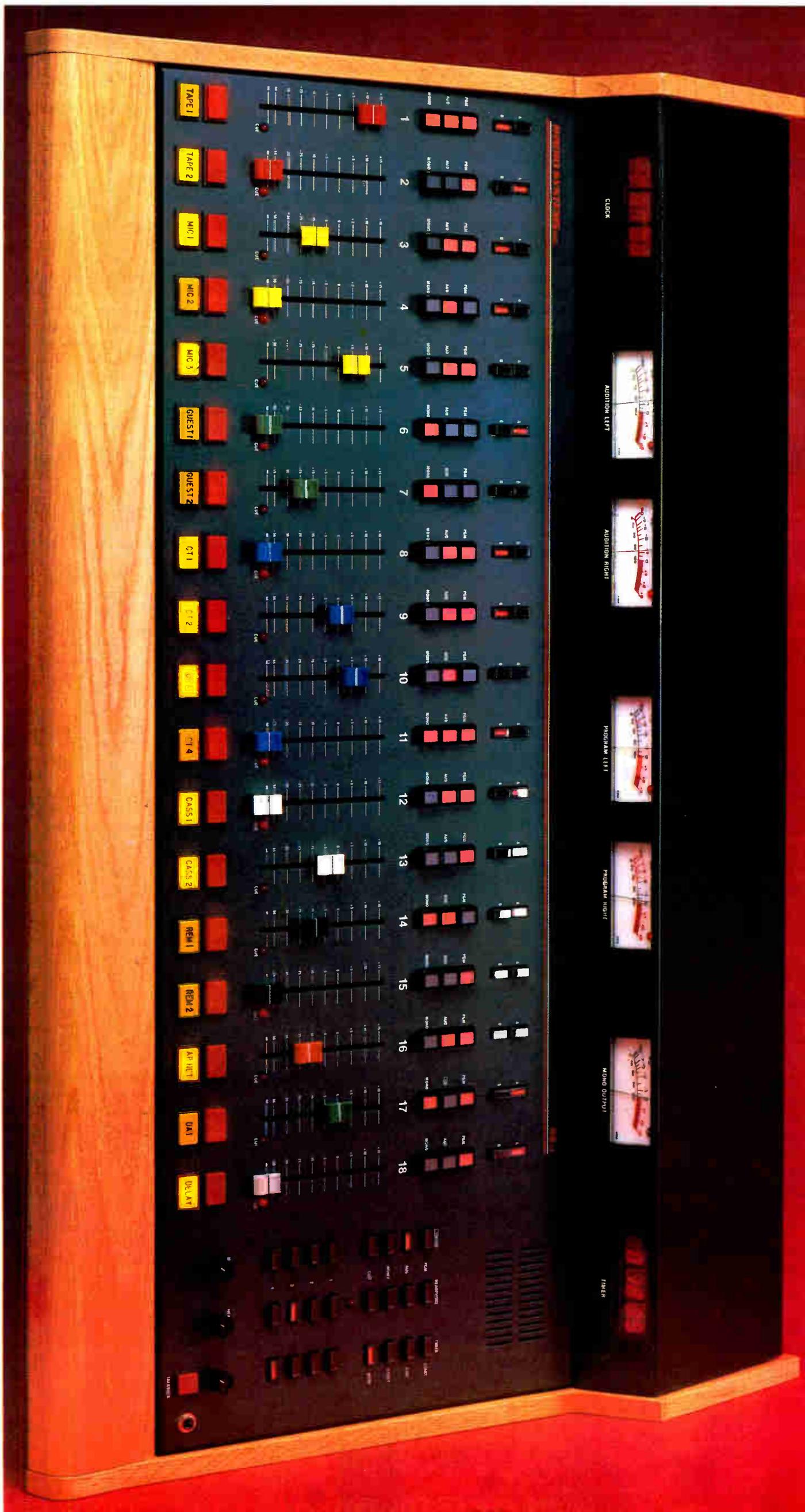
- Full broadcast remote control (not a hard-wired remote, like most other machines).
- Rear-panel ports for automation and serial interface.
- Thirty cut, random access memory.
- EOM signals and relay closures.
- Automatic cue-to-cut.
- Cart machine style buttons and dubbing.
- Sampling rates for recording at 44.1 and 48 kHz.
- Balanced audio inputs and outputs.
- "Next" and "Last" functions for quick cut re-cue.
- Industrial-grade head life.
- 16-bit linear D/A conversion.
- Logging data.
- Total harmonic distortion < .0055%.
- Optional rack mount.

Imagine recordable digital audio in your automation system or as a live source in your air studio. And with DAT archiving, your entire music library can fit into a briefcase.

Call today for more information on radio's hottest DAT machine, the RS-1000 from Radio Systems.

RADIO SYSTEMS INC.

110 High Hill Road • P.O. Box 458 • Bridgeport, NJ 08014-0458
609/467-8000 • 800/523-2133 • FAX 609/467-3044



RS SERIES CONSOLES.

much more,
for
much less.



RADIO SYSTEMS INC.
110 High Hill Road ■ P.O. Box 458
Bridgeport, New Jersey 08014-0458
609/467-8000 ■ FAX 609/467-3044
800/523-2133

Brinkley's Border Broadcasts

(continued from page 32)

XED ran a lottery for a spell until Uncle Sam thought better of it and had the postal service stop the mail that was going to an address in Mexico.

The "scam" landed XED's Will Horowitz—and his American and Mexican announcers—in jail.

For some reason, the Mexican engineer thought better of going across the bridge into the US, so he managed to stay out of the hands of the US justice system.

As a result of Mexican taxes, the station was finally closed and the non-technical equipment sold. During this

time, Branch was constructing a 100,000 watt station at Piedras Negras, across from Eagle Pass, TX. The new station was assigned the call sign of XEPN, with a frequency of 585 kc.

That wavelength put XEPN between WTAG, Worcester, MA; KGFX Pierre, SD; and WSUI, Iowa City at 580 and WEEL, Boston, MA; and KHQ, Spokane, WA at 590 kc. One of the border stations was constructed by Norman Baker, late of Muscatine, IA.

One difference between Baker and Brinkley was the fact that Baker chose to do everything from Mexico. He did not run power across the border or construct

a studio in the US. Everything was powered from a diesel generator on-site. Baker built his home a little way off the Nuevo Laredo highway.

Coming and going

By the summer of 1933 there were four stations on the border and one CP for another station with 500,000 watts. The stations were XER, 735 kc, 100 kW; XENT, 1115 kc, 150 kW; XEPN, 585 kc, 100 kW; XEAW (XED), 960 kc, 5 kW.

However, by April 1934, most of the border stations had been assigned new frequencies along with most of the rest of the Mexican stations: XEAW, 10 kW,

950 kc (originally XED); XENT, 150 kW, 1340 kc; XEPN, 50 kW, 590 kc; XERA (XER), 500 kW, 840kc.

XER had been put off the air in the fall of 1933 by the Mexican government due to non-payment of fines for violations of regulations.

A change of government in Mexico City was somehow the salvation of Brinkley. He was soon back on the air as if nothing had happened.

As mentioned, the Doctor was very good at hedging his bets.

One of the hedges he used was the former VP of the US, Charles Curtis. It is not known whether the Mexican officials were aware of the fact that Curtis was no longer the Vice President, because the former VP seemed to do such a good job of lobbying for the Doctor.

Other locales

Branch, who we mentioned earlier, took a financial interest in XEPN. Eventually, however, XEPN went dark because it violated regulations as set forth by the Mexican government.

The station burned before the problems could be cleared. Shortly thereafter, the station returned to the air. Branch by that time had gone west, and started building XELO in Tijuana, in Baja California (BC).

Other stations already in BC were XERB and XEAE.

One of the associates of Jim Weldon was Nestor Questa. Questa worked with Weldon during the installation and later modifications of XER.

After Doctor (as he was commonly known) gained controlling interest in XEAW in Reynosa, Questa and Weldon were sent down river to work on the smaller 10 kW station.

Now there were two stations for Brinkley to use—one for prostate problems, and the other for rectal troubles, as he continued to push his "cures."

XEAW was reconstructed by Weldon with a six-tower array and a modified transmitter, by some accounts the first Doherty amplifier built. The frequency was the same as WBZ, Boston, MA.

The station caught the attention of officials in Washington, DC, when it put WBZ off the air just north of Boston. How did Weldon come to use the Doherty circuit? He and Bill Doherty were friends and Doherty had just given a paper on an innovative circuit for high-power RF amplification.

This paper coupled with the problems encountered at WLW with high level modulation convinced Weldon that he could use lower B+ voltages and not have to use the large transformers that were required at WLW.

Weldon used the new Western Electric 320 triode. Brinkley purchased nine of the tubes for the new transmitter with pocket change for \$36,000 cash.

In any case, most of the material needed for the installation was manufactured on-site, including transformers and coils.

There are still a lot of stories about radio activities along the US-Mexico border. We will continue to pursue the subject as material can be obtained regarding this on-going "diplomatic interchange" between the two countries.

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

It takes plenty of guts to back our products this solidly.

At QEI, we back our products — and our customers. Our power tubes, for example, carry the best warranty in the industry: 15,000 hours or 2 years. And only QEI includes a FREE comprehensive spare parts kit with every FMQ transmitter, exciter and remote control. Experience shows that you may never use more than 2 or 3 of these "guts". But since we can't be certain which 2 or 3, our kits include ICs, transistors, lamps, diodes, fuses — everything you're unlikely to need.

24 HOUR SERVICE HOTLINE

Giving you the most complete spare parts kits in the industry is just the first step in a customer support program that lasts as long as your QEI transmitter. If you need expert advice on installing a spare whatever, call us any time at 609-728-2020, day or night. And if you ever need factory parts support, we can deliver — fast. We're just 1/2 hour from Philadelphia International Airport, not out in the middle of nowhere.

MAXIMUM EARNING POWER

You can count on it with every QEI transmitter, because we design them to stay on the air. And as a fully integrated company dedicated to RF and transmission products, we're able to build in quality and reliability — and still maintain our value advantage.

No wonder stations in both large and small markets have been using QEI products as long as we've been making them — since 1971. During that time we've put over 1300 exciters, more than 450 transmitters and over 1000 modulation monitors in service.

GET THE FACTS

When it comes to standing behind our products — and our stations — we're way ahead of the competition. That may make other manufacturers nervous, but it makes QEI customers very satisfied.

Call us at 800-334-9154, toll-free, for all the facts on the transmitters that deliver a solid return on your investment: the QEI "New Reliables."



QEI

Quality • Engineering • Innovation

QEI Corporation • One Airport Drive, P.O. Box D
Williamstown, New Jersey 08094
Toll-free 800-334-9154 • Fax 609-629-1751

Becoming More of a "People" Person

by David P. Hebert

Pasco WA An interesting exercise, sometimes, is to ask others within the radio community how they see us as broadcast engineers (I am using this term in the more traditional sense). The answers received can be upsetting, enlightening and, always, useful.

CONTRACT ENGINEER

I have several theories concerning personality components of my fellow technical types and it's fun to sometimes look at those around us as well as ourselves.

It has been observed that engineers deal in "things" rather than people. We deal with inanimate objects that should behave in predictable ways. When they don't, out comes the test gear and instruction book. It's off to the races.

Generally, others at the radio store concern themselves with people. It can be argued that this concern also involves numbers as well; but for now, let's stay with the first argument.

Dealing with people

I have found that most of us tend to be "loners." People, with all their complexities, don't allow for definable behavior. As human beings, normal ways of doing things cover a wide spectrum from one individual to the next. Normal people tend to be random, unpredictable, frustrating and complex as they deal with their own situations as well as those around them.

Those of us who deal in schematics, specifications, and things can find an almost certain irritation in a world of people. The idea of wrestling a point with a person as we have described can make

a padded room look like a week in the country.

I have heard us characterized as opinionated, lazy, arrogant and some unflattering ways as well. Sometimes, however, I think of us as our own worst enemy.

It's really sad to see these conditions existing, when they could be handled the same way any technical problem can be. (I admit, though, sometimes dealing with an upset General Manager would make a quiet evening with my crescent wrench something to look forward to.)

We have all heard the phrase, "Walk a mile in my shoes." We can't lose sight of the fact that we as "thing" people must still deal with "people" people. We are there to serve the needs of those we work with, as part of a team working for the common good.

Our job is really to support the rest of the team and we must take the time to understand the team's needs if we are to perform at maximum effectiveness. (For me, it is useful to work an airshift once in awhile to really understand how a board operator feels as he performs his tasks.)

Understand the problems

It is helpful to really listen as someone is describing a problem of a technical nature. If misunderstandings cloud the issue, be sure that this is not due to words being used incorrectly. If you are unclear as to what is being said, don't hesitate to ask questions.

It is also helpful to interview others on the staff to get other points of view. Just these efforts will allow others to see your concern in solving a problem.

Many of us are so involved in the theoretical performance of our job that we tend to inflict our technical jargon on others. With few exceptions, most electronic problems can be described in non-technical terms.

It's a careful line to walk when the pro-

gram director asks why the station sounds "grungy" and he is met with answers ranging from STL phase shift to low grid bias on the RF power amplifier.

Most people that are assaulted with "technical-ese" are either offended because they have been made to look foolish, or suspect that the engineer has something to hide and can't figure it out, either.

Good PR

All too late we learn that public relations is really part of the job. Even the best among us can leave a crowd of angry campers when we haven't taken the time to let others know

way of handling tension. Others see an occasional joke or two as letting others know that we are also only human. Laughter can be disarming.

Job burnout is easy in the pressure cooker world we live in. This condition can be met head-on by a recommitment to what we are trying to do. It's true that many of us could do better in an "honorable" occupation, but most of us are here because we want to be.

A quiet evening at home with man's best friend can help us define and recommit ourselves to what we consider as something worthwhile. If our role as engineer doesn't seem to be suiting anyone's needs, then maybe it's time for a

We can't lose sight of the fact that we as "thing" people must still deal with "people" people.

that we take our concern for a job well done seriously.

When others feel their needs are important to you, their cooperation comes naturally. A few moments spent making a friend out of a complainer can be the miracle needed in solving his problem (and getting him off your back).

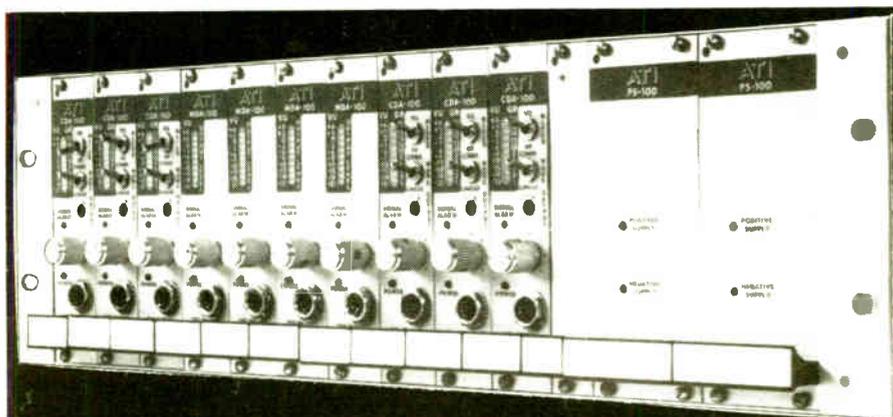
One of the best tools available when it comes to dealing with those around us is a sense of humor. For me, it's a

change. Either way, the time spent can be useful.

Communication and empathy are two tools that we can carry with us wherever we go. Working with only these two resources, many problems can be overcome.

■ ■ ■

David Hebert is president of Dave Hebert & Associates. He is an occasional contributor to RW and can be reached at 509-545-9672.



There are distribution amplifiers and then there are ATI DISTRIBUTION AMPLIFIERS... in a class by themselves.

DON'T SETTLE FOR LESS THAN ATI PERFECTION. TAKE A CLOSER LOOK FOR YOURSELF CALL OR WRITE FOR FREE DETAILED BROCHURES TODAY!



AUDIO TECHNOLOGIES INCORPORATED

328 MAPLE AVE.
HORSHAM, PA. 19044
(215) 443-0330

All the guts you'll ever need

The DYNAMAX CTR100 Series from Fidelipac has the sound, features, flexibility and ruggedness you need for your studio upgrade. Call us now for the cart machines with the guts to solve all your cartridge problems

NORTHEAST BROADCAST LAB, INC.

<p>NEW YORK P.O. Box 1179 S. GLENS FALLS, NY 12803 Tel: 518-793-2181 Fax: 518-793-7423</p>	<p>PENNSYLVANIA P.O. Box 565 SOUTHAMPTON, PA 18966 Tel: 215-322-2227 Fax: 215-953-0523</p>	<p>NEW HAMPSHIRE P.O. Box 406 AUBURN, NH 03032 Tel: 603-483-1002 Fax: 603-483-2352</p>
---	---	---

Ambassadors of Shortwave

by Dee McVicker

Salt Lake City UT From several miles high, where ionosphere and RF meet, a Salt Lake City signal rains down on a small village behind the Iron Curtain.

KUSW, like the pre-industrial merchant, has come a long way over rough terrain to tell about its goods. It is also stretching out over boundaries in what many believe will be the future wave of commercial radio: shortwave.

The global village

The vision for this new commercial medium, however clouded it is at times with atmospheric interference, lies in the perception that the world is becoming a global community.

Visionary Ralph Carlson of Carlson Communications International, which owns KUSW as well as an AM and several FMs, cites a good example: "Thirty-five percent of all the cars going down our streets now have foreign nameplates on them."

Others apparently agree with Carlson's vision. According to a Voice of America formula to water-mark listener level, approximately two million listeners anywhere from Canada to Japan pick up KUSW's signal each day—a cumulative listenership that foretells of a booming future for commercial shortwave.

This isn't the first time shortwave has sparked an interest from the private sec-

tor. Indeed, shortwave already had its moment in the sun as an international arm for major US networks in the '30s and early '40s. Wartime government, however, took over the shortwave medium during World War II to extend its own international arm of propaganda.

More than 40 years later, with rekindled interest that began with the commercial license of WRNO in 1982, KUSW made its entry into international territory on 26 December 1987.

In a true expression of one of the few countries to offer private shortwave licenses, KUSW christened its format American Contemporary Classic with the slogan "From the West to the World."

Goodwill ambassadors

"You could almost call it AOR," said Ralph Carlson. "(But) we play country; and we'll play all the way from rhythm and blues to jazz—and, of course, rock."

OFFBEAT RADIO

Mike McKenzie, director of engineering for the group, had a more patriotic description. "It's a goodwill ambassador," he asserted. "It's like a trip to Utah."

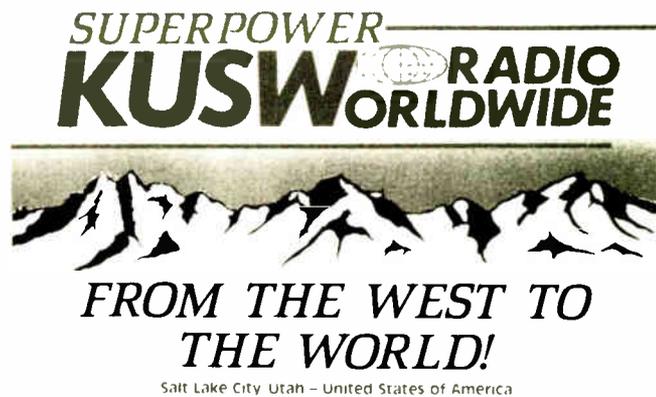
The trip from Utah, however, can at times be rough going.

Since the earth is a spinning carousel of listening audiences, KUSW generally changes frequencies four times or more throughout its 14 hour weekday. The station's carrier frequency varies not only during any given day, but it also varies according to season, when the earth to sun relationship shifts dramatically.

VOA veteran George Jacobs, the sta-

gest engineering machine behind shortwave stations. Although KUSW files seasonal frequency schedules with the FCC, the FCC cannot guarantee that these frequencies will not be available to other stations as well.

Despite this caveat, KUSW manages to launch over 2.5 million watts of ERP from its TCI log periodic antenna every morning. Beam tilted at 70°, the antenna automatically changes the angle of propagation according to each frequency coming on line during the course of a day.



KUSW's "QSL" card verifies the station's ID for "DXers" who receive it.

tion's shortwave consultant, negotiates frequencies based on these natural characteristics as well as other variables.

"The frequencies for shortwave are assigned on a worldwide basis," said Jacobs. "In a sense the licensee is responsible for finding his own frequencies. He's got to make a suggestion to the FCC, who then puts it through the international process."

The coordination of frequencies can be arduous work, and is perhaps the big-

The directive for frequency changes is servo-fed to a Harris SW100B transmitter, which delivers pulse width modulation to the tune of 100 kW. The transmitter's plate supply voltage, at 29 kilovolts, is a constant reminder that shortwave transmission is one giant power leap forward from conventional AM or FM transmissions.

To take the sizzle out of all that power, the PDM and final tubes are vapor mist

(continued on next page)

DBE-1000 DYNAMIC BASEBAND ENHANCER from SOMICH ENGINEERING



The DBE-1000 Dynamic Baseband Enhancer is the product that resulted from Jim Somich's year spent as chief engineer of Z100, number one CHR station in New York. New York has to be the most processing competitive market among those rated. Even though processing at Z100 was heavier than ever, during Jim's tenure there the station sounded better and louder.

The DBE-1000 started as a simple clipper card which was inserted before the station's exciter. Jim then realized what it could do for WHTZ's competitive position in the New York market. At that time he began development of the product which has evolved into the DBE-1000. The Dynamic Baseband Enhancer is now relied upon by a very select group of broadcasters who know quality when they hear it.

The DBE-1000 is not the product of a large company, nor is it assembled in a large factory. Somich Engineering is a small company that handcrafts each unit to the same exacting specifications. The DBE-1000 was designed and is built by working broadcast engineers.

The DBE-1000 was designed for a limited fraternity of broadcast engineers, their station management and their programming departments who desire not only to be the dominant signal in their market, but also to have the best sounding station in their market.

CALL US FOR COMPLETE DETAILS

ATLANTA, GA CHICAGO, IL DALLAS, TX
LOS ANGELES, CA RICHMOND, IN

800-622-0022

ALLIED
Broadcast Equipment

— A HARRIS COMPANY

HARRIS/ALLIED ©1989

(continued from previous page)
cooled with distilled water. The steam is then converted back into water for reuse via a heat exchanger.

Ionospheric selective fading

To shuttle commercial radio from one continent to another, Mother Nature affords a means of transportation that allows broadcasters to reflect RF off the

The result is distortion.

On bad days, when Mother Nature is groaning with electrical storms, highly charged particles, solar winds and even sun spots, shortwave signals can become charged with atmospheric noise and carry these nuances over the air. Suffice to say, Mother Nature's atmosphere can be unfriendly territory for shortwave transmissions.

Another scenario strikes a more familiar chord. It is a story of too many occupants on a given band, and the quest for suitable regulations. The cast, however, is not our own FCC and AM stations, but a much more varied cast with cultural and political differences.

Explained Jacobs, "The problem is that there are three times as many stations on the air as there are channels." While channels can play host to several stations at different time intervals, congestion still remains one of the biggest problems for shortwave stations.

National regulatory bodies, such as our own FCC, grant licensing to would-be shortwave station owners. However, according to Jacobs, even our venerable FCC cannot guarantee carrier frequencies or overshadow diplomatic regulations.

Who, then, is governing shortwave stations? The answer appears to be everyone and no one at all. Some two years ago the International Telecommunication Union, of which the FCC is one signatory member of approximately 166, voted in favor of a standard that would offer some relief from adjacent channel interference.

Spurred by the EBU, a European organization similar in function to our NAB, the standard was turned over to the CCIR (a French acronym for International Radio Consultative Committee) for official study and recommendation to the ITU.

With a stopband specification of 4.5 kHz and a further slope attenuation of 35 dB/kHz, the ITU standard holds promise of harnessing shortwave channel interference.

In the real world of shortwave, however, broadcasts continue to exceed the 4.5 kHz stopband, sometimes at double the ITU recommended bandwidth occupancy.

"Unfortunately," said Jacobs, "because international regulations are harder to monitor and implement than national regulations, a lot of countries don't adhere to them."

On the horizon

That is not to say that KUSW is at the total mercy of international politics and Mother Nature.

In recent years, shortwave has gained noteworthiness among AM and FM broadcasters. And, more importantly, it has gained considerable momentum

which filtering is steeper than that of AM.

Even the NRSC preemphasis, another committee standard extensively scrutinized and tested, has made its way to the shortwave horizon in modified form.

Although shortwave, like AM, has been using preemphasis and filtering to better the intelligibility of audio and contain its signal, never before has this medium been showered with so many alternative solutions to its unique problems.

Shortwave Frequencies for KUSW				
Time				Frequency (kHz)
PT	MT	CT	ET	
8am-3pm	9am-4pm	10am-5pm	11am-6pm	15,650
3pm-6pm	4pm-7pm	5pm-8pm	6pm-9pm	15,580
6pm-10pm	7pm-11pm	8pm-Mid	9pm-1am	11,695
8pm-10pm	9pm-11pm	10pm-Mid	11pm-1am	9,815*
10pm-Mid	11pm-1am	Mid-2am	1am-3am	6,175**
Mid-4am	1am-5am	2am-6am	3am-7am	6,135**
4am-8am	5am-9am	6am-10am	7am-11am	9,850**

* This is an alternate to 11695 kHz, and may be used in its place.
** Saturday Night to Sunday Morning only.

ionosphere, an electrified region of the Earth's upper atmosphere made almost entirely by ultraviolet radiation from the sun.

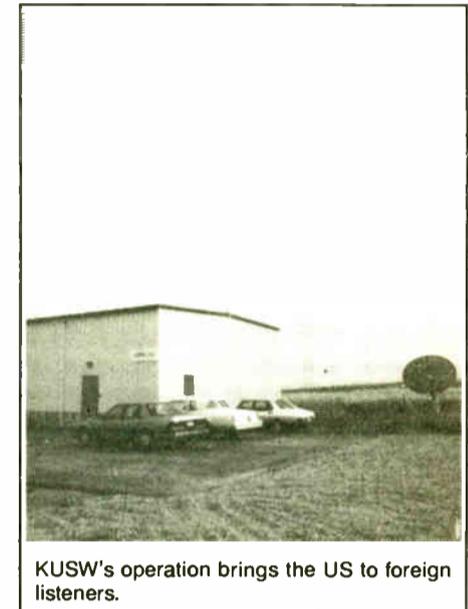
Even so, Nature's constant intervention is what makes poor reception so characteristic of shortwave. And, KUSW—despite its ambassador status—is in constant battle for her favors.

On a good day, Mother Nature will fray shortwave signals as they bounce off the ionosphere. This is because the ionosphere is not a true "brick wall" and will reflect, even retain, signals at different angles and time intervals.

The result is an all too familiar FM problem: signals don't arrive at their destination at the same time.

This out-of-phase condition, referred to as "selective fading," causes an audible nulling that can sweep through the upper and lower sidebands, and even the carrier itself.

A typical null can be a few hundred Hertz wide, or a thousand Hertz. As this phenomenon makes its sweep through the occupied spectrum, it can set off an imbalance between upper and lower sidebands and even cancel all or part of the carrier frequency.



KUSW's operation brings the US to foreign listeners.



The station's former corporate engineer Ken Meyer (left) works on KUSW's transmitter with engineer Rex Carlson (right).

Orban Associates, Circuit Research Labs, Gentner Electronics and Dorough Electronics are companies which have or are introducing shortwave processors based on their experiences with the AM band. For the first time, these American manufacturers and others are taking notice of a medium that could very well bridge cultures.

Shortwave is no FM, most agree, but it does hold a mystique that is far-reaching in listenership—and imagination. "It swishes and swoops and sounds distant," admitted McKenzie, "but that's part of the romance of it."

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



DATAWORLD MAPS®

DO YOU KNOW YOUR MARKET? YOUR COMPETITION DOES!

DATAWORLD MAPS CAN

- Depict your coverage!
- Market orient your sales people!
- Target your ethnic/demographic markets!
- Identify marginal signal areas!
- Plot any special requirements!

MAP OPTIONS

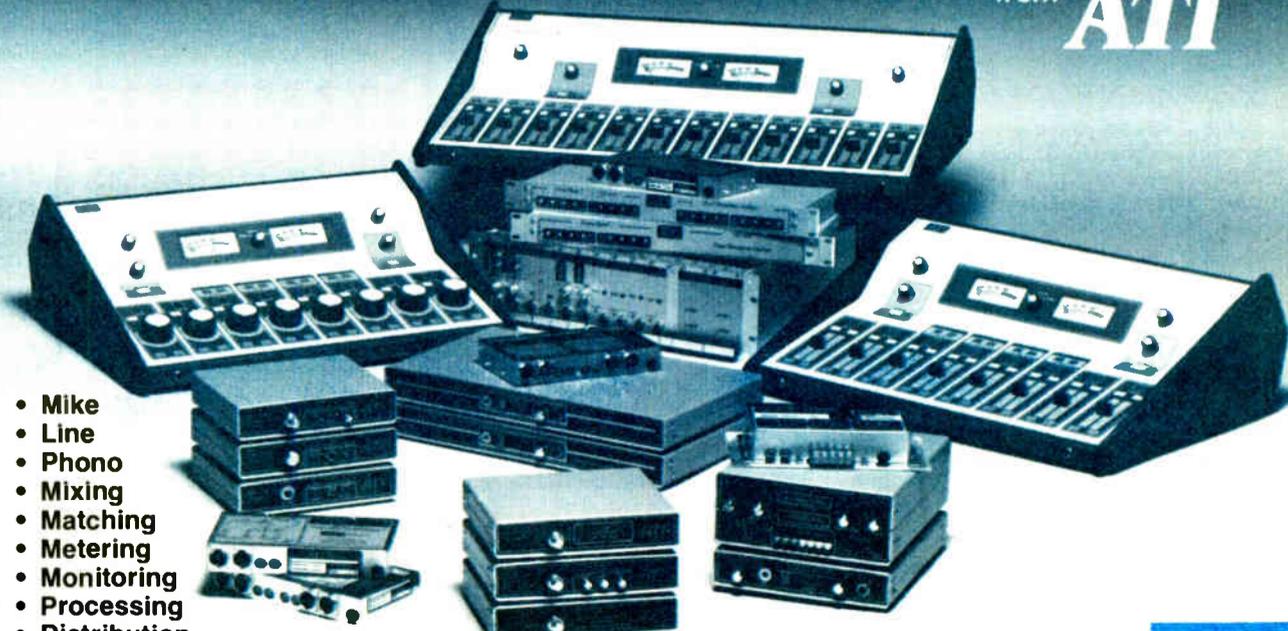
- SHADOWING (TERRAIN SHIELDING)
- POPULATION DENSITY
- CONTOUR COVERAGE
- SPECIALS

dataworld®
A Service of DW, Inc.

Fax (301) 656-5341
(301) 652-8822 (800) 368-5754

Your Problem Solvers

from **ATI**



- Mike
- Line
- Phono
- Mixing
- Matching
- Metering
- Monitoring
- Processing
- Distribution
- Rack Mounting

AUDIO TECHNOLOGIES, INC.

328 W. Maple Ave., Horsham, PA 19044 • (215) 443-0330 • FAX (215) 443-0394



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

Dynaco 70 tube type, 35 w/chan stereo, vgc, \$85/firm. M Kuehl, 1418 N Stevens, Rhinelander WI 54501. 369-4007.

Sparta 1020 program amp for A-15, AS-30, etc. w/Sparta documentation, \$45. M Ferguson, N AZ Bldg, POB 1990, Prescott AZ 86302. 602-776-2810.

Straight Wire Audio UA-2 amp DA cards, \$125 ea. G Wachter, KFRF, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Sigma VDA-100A video dist amp (3), \$145 ea; Sigma ADA-106 audio dist amps (3), \$140 ea. T Zingale, TZ Comm, 213-477-5803.

Ramko DA-6BR/E 1 in 6 out dist amp, mono, working cond, rack mount, \$75/firm. M Patton, WXOK, 6819 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

LPB DA-216 dist amp, 2 chnl operation, separate audio gain controls, works OK, \$100; Robins Fairchild DA 1520 dist amp, one chnl w/VU meter & adjustable gain control, as is, \$75. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

Radio Shack/Realistic MPA 80 high fidelity PA amp, 80 W RMS 4 mic inputs, 2 phono inputs, aux input. P Bailon, KMCM, 1218 Pioneer Bldg, St Paul MN 55101. 612-222-5555.

Crown D75 power amp, excel cond, \$400. G Gilbreath, 702-454-2085.

Yamaha CA810 amp, 85 W per chnl, \$300. B Feinberg, Totaltape Publishing, 800-874-7599 X337.

LEL DA-8, new 8 chnl out mono or 4 chnl out stereo, individual level adjustments (8) avail, \$150. G Walden, KYW, 5th & Market, Philadelphia PA 19106. 215-238-4893.

Yamaha MLA7 8 chnl mic/line preamp, 8 in 8 out, many uses, new cond, \$295; Shure 330 ribbon mic, \$100 ea; Ampex cinema tube amp. F Brufodt, Box 135, Clio MI 48420. 313-686-2473.

McIntosh MC240 stereo power amp, w/custom road case, excel cond, \$180; McIntosh MC30 mono power amp, w/custom road case, excel cond, \$60. M Ashley, SwingStreet Studios, 620 Bercut, Sacramento CA 95814. 916-446-3088.

Crown C-40, mint cond, \$175. C Volpe, 540 Stemmers Run, Essex MD 21221. 301-391-6927.

Crown D-60 low hrs, excel cond. G Fippinger, Rainbow Program, 150 Crossways Pk Dr, Woodbury NY 11797. 516-364-2222.

Gates M5700 pgm amps (2), MS702 pwr supply, w/chassis, gd cond, (4) Gates M4176 pgm amps, (3) MO-3964 preamps, MO-3977 pgm amp, M5000 pwr supply, Altec 9550A pwr supply, BO. T Weeden, WMTV, 6802 Putnam, Madison WI 53711. 608-274-1515.

Straight Wire Audio UA-2 amp DA cards, \$125 ea. G Wachter, KFRF, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Bogen CHB-35A, \$50; Bogen CHB-10A, \$25. B Clark, WFAS, Secor Rd, Hartsdale NY 10530. 914-693-2400.

Carver 1.0t, will sell for \$550 or trade for Peavey CS600 or CS1200. E Nichols, KMCR, POB 189, Montgomery City MO 63361. 314-564-2275.

Symetrix A-220 stereo pwr amp, new, \$200; Teac MH-40B headphone amp, new, \$200. J Pappas, The Pappas Group, 209-523-5248.

Dynaco Stereo 70 tube power amp, clean, original owner, \$100/BO; Dynaco PAT-4 stereo hi-fi preamp, excel cond, \$100/BO. P Keogh, 2511 Memorial, Green Bay WI 54303. 414-499-1336.

Ampro TPS-S stereo turntable preamp w/rack mounts, gd cond, \$50/BO. M Black, WEOS, Geneva NY 14456. 315-789-8970.

Dynaco mono preamp (2) tube type volume treble bass, 6 position sound switch, will sell or swap for other equip. J Roper, Imperial Snd St, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

Want to Buy

Crown D-75 wanted in gd cond for fair price. M Bejarano, Falcon Comm., 6923 Forbes, Seabrook MD 20706. 301-794-5754.

RCA MI-11658B type BA-71C, (2) preamps for RCA type BC-8A dual chnl studio console. R Paolangel, RP Prod, 324 S Geneva, Ithaca NY 14850. 607-273-5773.

ANTENNAS & TOWERS

Want to Sell

VHF 4-bay broadband base station commercial antenna, 15 MHz bandwidth, now center tuned for 151.0 MHz, new, unassembled in box w/all paperwork, \$220/BO. G Pernad, 1510-6 Peachtree, Cocoa FL 32922.

Shivley 6813 3 bay, 92.1 mHz, 14 mos old, \$1500. K Austin, KFXI, POB 433, Lawton OK 73502. 405-658-9292.

RCA BCF 12B 12 bay 100 kW FM; Wegener SMN satellite receiver complete, BO. J Miller, ST Bldg, 908 Frontview, Dodge City KS 67801. 316-227-4444.

Coax switch, 3-1/8", manual, \$900; 3-1/8" coax switch, electric, \$1300. J Mitchell, WJKL-TV, 315-673-9049.

Harris/Gates/ERI FMC-8 8-bay circularly polarized medium power FM, 20 yrs old, currently on air at 99.1 MHz, available shortly. A Chambers, WAWZ, Box 37, Zarephath NJ 08890. 201-469-8022.

Self-supported towers (2) 325'; 12-bay RCA antenna wide-icers. J Stevens, WLAU, Laurel MS 39440. 601-649-1840 or 425-5145.

ERI FMH G5-4 4-bay, high power horizontal only 4 bay antenna tuned to 94.5 MHz +/- 3 MHz. Available in Eugene, OR. Contact Chris Reid Murray, CE, KMGE. 503-484-9400.

Cablewave 1-5/8" air dielectric coax cable, 165', \$1155; Andrew FM antenna fittings for coax cable, call for details. K Crostwait, WTNN, 13206 Buttermilk Rd, Knoxville TN 37932. 615-531-2297.

Phelps Dodge radomes (3) for CP-1000 Series antenna, one new, 2 used, \$600/all. M Black, WEOS, Geneva NY 14456. 315-789-8970.

World Tower 300', solid rod, 18" face, standing, 7 yrs old, gd cond; 18" face side-mounting brackets for ERI 3-bay antenna system. R Miller, WRVI, 815 W Dean, Virden IL 62690. 217-965-3388.

Comark FMHC-6 6 bay FM tuned to 103.7 w/225' of 3" coax. A Kord, WWRX, Box 325, Westerly RI 02891. 401-596-7728.

Shively 6813 8-bay antenna tuned to 89.5 mHz, \$4000. G Gilbreath, 702-454-2085.

Rohn SSV Series 120' or SSV heavy series tower, includes 11N, 12NH, 13NH, 14NH, 15NH & 16NH sections, can go to 320', 2 yrs old, excel cond, \$8000. A Kord, WWRX, Box 325, Westerly RI 02891. 401-596-7728.

Used Towers

200' heavy duty self-supporting and other used guyed and self-supporting towers in stock. We buy, sell and lease tower erection equipment.

Call Southern Tower Service Co., Inc. 804-539-8365

ERI 106.5 12 bay low power antenna, gd cond, on ground, used 1 yr w/bracket, BO. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

ERI Isocoupler 402 10 kW, 1-5/8" in & out w/adapters for 7/8" line, tuned to 93.5 mHz, \$700; Phelps-Dodge SLCC-78-50 300' of 7/8" air dielectric transmission line, gd cond, \$1000. C Gennaro, Roberts Bldg, 1018A E Main, Merrill WI 54452. 715-536-6262.

Rebuilt beacons (glass, wiring, gaskets, hardware, sandblasted). Now 1/2 price of new beacons. FOB Verona, WI. Call Jean, 608-845-6753.

Cablewave 3" air dielectric 50 ohm jacketed, cable over 450', only 5 yrs old, w/3" flange connectors, \$2500. J Littlejohn, WBYR, 347 W Berry Ste 700, Ft Wayne IN 46802. 219-420-9890.

Andrew HJ9-50 5" air helix, 444' w/gas pass connectors attached, 15' w/one gas pass & one gas barrier, (2) 6" miter elbows, hangers included. M Gideon, KIX 104, 111 W Port Plaza Ste 1000, St Louis MO 63146. 314-878-1040.

LC transfer switch, \$200 ea; (6) 18" 50 ohm bullets, \$30 ea; 7/8" Helix, \$1500/1000; Jennings vacuum coax switch 3-1/8" 50 ohm SPDT, \$1200 ea. Dave, 209-467-0317 evenings only.

Phelps-Dodge CFM-LP3 3 bay tuned to 92.7, w/Radomes, excel cond, \$1200; 250' 1-5/8" transmission line w/connectors, \$300. G McCoy, KZEN, 1606-116 16th, Central City NE 68826. 308-946-3816.

RCA-Dielectric BFH 2A 2 bay antenna on 98.3, \$600. JA Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

Rohn 80 tower & 35 acres in Meramec Springs MO, highest point in the area, 3 yrs old, will sell for replacement value & reinstallation of same tower due to relocating FM. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

Stainless G24/25 200', 20' sections, guyed, new sandblast, primer, paint, on ground, 24" face, 2" tubing, BO. J Blodgett, WGTG, 308 Westgate Pkwy, Dothan AL 36303. 205-794-4770.

Andrew LDF5-50A 7/8" foam dielectric 50 ohm transmission line, 200' long w/2 type N connectors, 1 yr old, \$250. G Wilson, WGTG, POB 30, Toledo OH 43692. 419-243-3091.

ERI FMH Series 10 bay centered Rototiller at 92.3 MHz, vgc, \$9950. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Harris (ERI) FM antenna, 10 bay FM HA series, excel cond, \$13,000; Phelps Dodge 3-1/8" rigid transmission line, 21 sections, 20' long, w/spring hangers hardware, excel cond. B Umberger, WNL7, 51 S Main, Clearwater FL 34625. 813-446-0957.

Lightning Elimination MB-60 heavy duty power surge eliminator 120/240V, 60 Amp single phase, in water proof cabinet, like new, \$450; Square D 82254 double throw nonfuse-able 200 Amp, 250V, single phase switch used w/standby power, almost new, \$175. A Fuchs, POB 311, Hobart OK 73651. 405-726-5656.

ERI FMH Series 10 bay centerfed, Rototiller at 92.3 MHz, 8 yrs old, vgc, \$9950. G Wachter, KFRF, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Andrew motorized coax transfer switch, 4 port, 3-1/8", \$1200. M Patton, WXOK, 6819 Cezanne, Baton Rouge LA 70806. 504-292-4189.

Mark P-9A72GRN (2) 6' grid STL dishes, 3 yrs old & 7/8" line, consider trade; Myat, various unused x-mission line elbows, flanges, adapters, both 4" & 3" rigid, consider trade. P Kessler, KHUM, 1237 SE 37th, Topeka KS 66605. 913-267-0960.

Mounting brackets, complete set for 18" tower face, for ERI FML-3E 3-bay CP antennas, \$250. R Miller, WRVI, 815 W Dean, Virden IL 62690. 617-965-3388.

CSP Custom 2 tower 1 kW phasor, excel cond. lots of spares, BO. D Barton, KMTI, POB K, Monti UT 84642. 801-835-7301.

ERI 12 bay 50 kW FM on 106.5, 1 yr old, trade for ERI 4 or more bays on 93.3 or BO. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

RCA BCF 12B 93.9 FM 100 kW ERP, needs cleaning up, BO. J Miller, KGNO, 908 Frontview, Dodge City KS 67801. 316-227-4444.

Gates/Harris 5 kW lighting choke, like new (2), \$20 ea/BO. G Wilson, WGTG, POB 30, Toledo OH 43692. 419-243-3091.

Jampro 2H 2V 2 bays horizontal, 2 bays vertical, w/power divider, tuned to 96.7 MHz, needs one interbay cable & deicer elements, you ship, \$200. B Sauter, WSLU, Payson Hall, SLU, Canton NY 13617. 315-379-5356.

Cablewave FCC 78-50 J Series, 78" helix foam type, approx 1300' in (3) 375' runs & a 350' run, all w/N female connectors attached, \$250/ft. J Kosobucki, KLDA, 5161 Maple, Des Moines IA 50317. 515-266-6060.

US Tower 160' MW 30" face, star mount for 8' dish, 200' elliptical waveguide for 7 GHz. buyer take down & remove, BO. W Ellis, KOZK, MPO Box 21, Spldld MO 65801. 417-865-2100.

Want to Buy

UHF TV translator antennas on old chnl 70-83 band, Bogner B4, B8, B16 or B24, Emcee D-10 corner reflectors. J Powley, 1536 Logan, Altoona PA 16602. 814-944-8571.

AM towers, 210', will arrange shipping to Northern Virginia. P Hahn, WLPY, 769 E Main, Purcellville VA 22132. 703-338-6200.

UHF TV bdc/translator antennas, Scala parapanels, any chnl, Scala SL-8, chnls 19-23, 32-36, 60-64, Bogner B Series, chnls 20-30, 31-42, 55-69, or Bogner LPS 1, 2 & 4. J Powley, 1536 Logan, Altoona PA 16602. 814-944-8571.

Used tower from 800-1100' tall prefer one already on the ground but will consider tower still standing. K Austin, KFXI, POB 433, Lawton OK 73502. 405-658-9292.

FM antenna, 100.1 MHz, low power, 2 or more bays, 350' of 1-5/8" transmission line; Andrews Dehydrator. J Lankenau, Jefferson Comm, 1026 Terrace Rock Circle, Ballwin MO 63011. 314-391-6394.

FM antenna tuned to 96.7. C Froke, POB 811, Deer Lodge MT 59722. 406-846-1221.

ERI 4 or more bay on 93.3 MHz & 550 of feedline 1-5/8" or larger. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

ERI 93.3 antenna 4 or more bays, low or hi power & 1000' of feedline, 1-5/8" or larger, have ERI 12 bay low power antenna on 106.5 to trade. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

AUDIO PRODUCTION

Want to Sell

TTM124/Telcom c4, TTM frame holds & powers 24 Dolby, dbx, or Telcom cards, comes w/16 Telcom c4 cards, \$1500. R Rhodes, POB 1550 Radio City Station, Nyny 10101. 212-245-5045.

Orban 424A stereo compimixer/de-esser/gate, excel vocal processor, \$689/BO; Orban 674A stereo para-graphic cross-EQ, \$899/BO, both in new cond. J Loether, 202-298-9550 voice mail.

\$79 PATCHBAYS

Our Model PB-32 features 32 TRS Switchcraft jacks in a 1U rack space.

Gaines Audio 1237 E Main St. Roch, NY 14609 800-442-0780

JVC VP-101 digital audio processor, allows to record digital audio on the video head of any video deck w/sub-carrier input, in CD quality, \$2500/BO. R Lawrence, Moonshadow Video Prod, 4280 Reston Rd, Roseburg OR 97470. 503-679-8966.

Shure M610 (2) feedback controller, 8 band EQ, BO. G Mundkowsky, WDAF, 3030 Summit, Kansas City MO 64108. 816-966-0731.

Ron Radio Comm, Inc. P.O. Box 201 Brightwaters, NY 11718

NRSC Compliance:
 ■ Energy Onix Add On NRSC Processor \$ 520
 ■ Inovonics AM NRSC Add-On Processor \$ 520
 ■ Hnat Hides NRSC Tri-Maze \$ 1,595
 800-666-3525

Gates LE-2 line EQ, like new w/book, \$150. P Schneider, KPMJ, 1280 S Oxnard, Oxnard CA 93034. 805-985-8346.

Mic Mix TW-1 time warp effects unit w/manual, as is, looks gd, \$75. D Bailey, 3422 Beech, Roulett TX 75088. 214-475-9796.

Orban 245 stereo synth., like new, owners manual, \$250. Chuck, 615-968-9532 aft 6PM.

Orban 111B reverb, like new, \$275. K Thomas, Rebel Recdg, POB 207, Atlantic Beach FL 32233. 904-388-7711.

dbx equipment including (4) dbx pwr supply mainframes, (12) 942 dual chnl decoders, (2) 941 encoders, (3) 904 noise gate units, (3) 903 compressor/limiter units & 906 flanger unit. B Giordano, WODS, 30 Winter, Boston MA 02108. 617-426-2200.

Shure M63 Audiomaster, (2) EQ companion to the M67 remote bdc mixer, gd cond, \$75 ea; Ramko dist amp DA6BR/E mono, 1 by 6; Thomson CSF Labs dual dist amp mdl 1602 1 by 16 or 2 by 8. A Pavao, KYNO, 2125 N Barton, Fresno CA 90703. 209-255-8383.

ATI Disc Patcher DP100 Hi Z to 600 ohms balanced interface, \$100. K Thomas, Rebel Recdg, POB 207, Atlantic Beach FL 32233. 904-388-7711.

BROADCASTERS

Strozier Electronics Inc. is now buying and selling new and used broadcast equipment. Call us TOLL FREE and compare prices and quality. Call Charlie Strozier 1-800-888-5615

UREI 527A 1/3 octave 27 bands, \$200; Ampex 440 & 351's transports, BO; Ampex & MCI's tape heads, new 8 trk heads, MCI 16 trk play head, BO; Ithaco 4302 dual 24dB/electronic filter, \$595. J Price, 2651 Globe, Dallas TX 75228. 214-321-6576.

dbx 222 Type II, 6 mos old, stereo; dbx 222 NR unit, \$100/BO or will swap for EFX unit, 1/2" tape or mics. B Miller, Grapevine Stds, 2525 Imlay City, Lapeer MI 48446. 313-664-1995.

dbx 157 Pro 4 chnls simultaneous play record, rack-mountable, (2) 8 chnls, \$500/4 chnls. H Fenster, Universal Rehearsal Recdg, 17 W 20th St, Nyny 10011. 212-929-3277.

Shure SE-1 phono preamps (2), power supply, \$150/lot; Altec 1592B mixers (3), rack mounted, \$325 ea; CBS 4440A volume leveler, \$225. W Slalen, Audio Intl, 424 Grant, Scotch Plains NJ 07076. 201-322-4466.

UREI 537 1/3 octave band EQ (2), \$500 ea or \$800/both. G Gilbreath, 702-454-2085.

Soundcraft RP-10-12 10 band graphic EQ w/8" API VU meter, 600 ohm in-out, in dark woodgrain cabinet, \$90. L Beigel, On-Cue Recdg, POB 85042, Los Angeles CA 90072. 213-466-3595.

Orban 245F stereo synthesizer, \$200; Shure M67 mixer. G Robinson, 803-722-7611.

Patch bay, 48 DR-TR-AS-XT, complete w/standard 19" EIA rack mount jacks (2 bays) & punch block assembly, \$100. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

Orban 111B dual ch spring reverb, like new. J Auhney, KLCE, POB 699, Blackfoot ID 83221. 208-785-1400.

Peavey Graphic EQ 10 band stereo, balanced input & output, BO. JA Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

Studio Technologies RCU-1, differentiates between stereo & mono programming, normally used w/Studio Tech AN-2 stereo simulator to switch mono programming thru the simulator, stereo programming straight thru, excel cond, \$550. M Byrnes, WAMU, 4400 Mass Ave NW, Wash DC 20016. 202-885-1030.

Orban 111B stereo reverb, in mint cond, \$300. R Bauer, KCPX, 434 Bearcat Dr, Salt Lake City UT 84115. 801-485-6700.

Orban 642B parametric EQ/notch filter, like new w/manual & box, still under warranty, \$800. R Hernandez, FAZ Bldg, 903 E Cortinas, Del Rio TX 78840. 512-775-3544.

Yamaha SPX901 like new, only 8 mos old, \$555. K Thomas, POB 207, Atlantic Beach FL 32233. 904-388-7711.

Eventide DB955 digital delay 6.4 sec 75K mono delay w/catch-up, \$2500. B Gellhaus, WDTV, POB 73, Cheltenham PA 19012. 215-635-4815.

Large quantity of used audio gear, consoles, tape machines, outboard gear, mics, test equip, etc. call for complete list. G Guarino, Sorcerer Snd, 19 Mercer Nyny 10013. 212-226-0480.

Want to Buy

Electro-Voice EVT-4500 reverb. P Parks, KYKR, 27 Sawyer, Beaumont TX 77702. 409-838-3911.

Yamaha REV5 or 7 effects outboard unit. B Ranes, DIR, 32 E 57 St, 6th Fl, Nyny 10022. 212-371-6850.

dbx 904 noise gate. R Burton, Audio Rents, 7237 Santa Monica Blvd, Hollywood CA 90046. 213-874-1000.

Technics

SL-P770 PROGRAMMABLE COMPACT DISC



- CD digital 2-speed cue dial

AUDIO PRODUCTION . . . WTB
Shure M267 wanted in gd cond, for fair price. M Bejarano, Falcon Comm., 6923 Forbes, Seabrook MD 20706. 301-794-5754.

**WANTED
PULTEC EQ'S**

We will pay \$1000.00 for almost any Pultec program EQ models EQP1/EQP1A/EQP1A3. We will pay \$1500.00 for any Fairchild 660 and \$3000.00 for any Fairchild 670.

Also wanted:
EQH2/EQH3/MEQ5/MAVEC/MB1/ITI & SONTEC EQ any S/ tube or ribbon mics and limiting amps.

**CALL OR WRITE TO:
Dan Alexander Audio
2944 San Pablo Ave.
Berkley, CA 94702
(415) 644-2363
FAX: 415-644-1848**

Henry Engineering Logicconverter interface unit, call after 5 PM EDT. 502-459-9488.

AUTOMATION EQUIP

Want to Sell

Complete automation system including (5) Revox PR-99 pb reel machines, stereo, Instacart w/48 cart capacity, (2) IGM Carousels w/48 cart capacity, (2) Audicord stereo cart machine, PC compatible computer w/all software & interfaces, Sentry System, all in excel working cond. B Ferguson, WMMJ, 400 H St NE, Washington DC 20002. 202-675-4800.

SMC SM-25 dual chnl silence sensor, brand new, \$300. A Weiner, Britton Road, Monticello ME 04760. 207-538-9538.

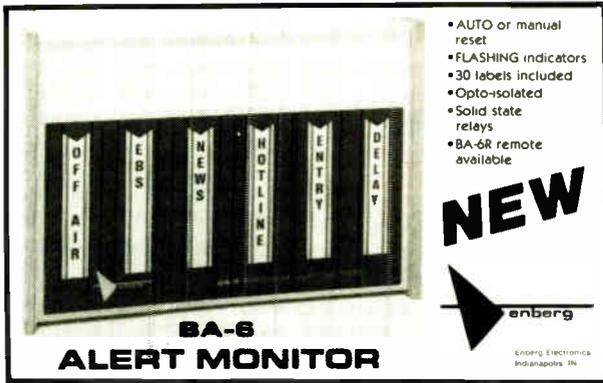
Sonomag (SMC) MSP-1 2000 event satellite automation controller, perfect working cond, manuals, printer & spare parts kit included, currently on-air, \$3500. E Stokes, WCVB, POB 249, Randolph Ctr VT 05061. 802-728-4411.

Cetec 903-E, keyboard, Brain, network source card, (4) Carousels w/source cards, Revox RR, printer & card, power supply, power line conditioner & 3 racks, \$13,500. M Reichert, KLIT, 5565 Carpenteria Ave Ste 24, Carpenteria CA 93031. 805-684-6611.

Control Design CD24R Carousels, (2) 24 tray w/complete manuals, gd cond, \$525 ea. R McDaniel, KOEZ, POB 567, Newton KS 67114. 316-283-5150.

MEI 100 48 event programmer, price includes (4) Revox PR99 1/4" stereo PB R-R machines, complete live assist automation system, \$8000. K Dickson, WRXJ, 8386 Baymeadows #107, Jacksonville FL 32250. 904-636-0507.

SMC Carousels 252RS, (4) random select, excel cond, (2) racks, 2 Carousels, \$500, 3 for \$465, 4 for \$450, all 4 Carousels plus 2 racks, \$2100. J King, WROB, POB 1336, W Point MS 39773. 601-494-1450.



- AUTO or manual reset
- FLASHING indicators
- 30 labels included
- Opto-isolated
- Solid state relays
- BA-6R remote available

NEW

SMC automation system, \$7000. J Denison, Esprit Comm. 4510-A S 14th, Abilene TX 79005. 915-691-9292.

Schafer 800T automation controller, \$1500. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

Sono-Mag SM-25 decoder, w/12 two tape machines, new. BO. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

SMC DT-5 automation system cart encoder w/keyboard & CRT mon, \$500/BO. T Randall, KJJC, Box 790, Brookings SD 57006. 605-692-9102.

SonoMag MSP-1 automation controller w/2000 event random access memory, \$2500. W Hanlon, WKFD, 19 Updike, Wickford RI 02852. 401-295-8808.

IGM 383 time announce control used w/(2) cart machines, advancing them alternately every minute. BO. D Gander, KDUZ, Box 10, Hutchinson MN 55350. 612-587-2140.

Systemation includes controller w/all week memory, (11) Teac decks, (2) computer terminals w/color monitors, Epson printer, all cables, manuals & (3) extra input interfaces, operates full automation, live assist or satellite formats, \$13,000/BO. R Klotz, KKRVI, POB 995, Kernville CA 93238. 619-376-3701.

Harris 9000 Series, clearcut logging package, TI-840 & T-851 printers, live studio/newsroom remote control, RAK-90 autorak cabinet, Otari ARS-1030-DS reproducer, Go-Cart II, stereo, 24 tray, complete wall interface electr & cabling, 11 rack units, BO. T Quartarone, Q-Tone Bdcg, Rt 1 Box 33, Ocean View DE 19970. 302-539-2600.

Gates/Harris older system, w/252-RS Carousel, (2) Scully 270's, SC-48 programmer, ACC-2 audio controller & much more. C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Harris 9000 (2) Instacarts, (2) CRTs, (5) Scully R-R w/(3) back-ups, time announce, printer, complete & running now, \$18,000. B Harmon, WPLA, PO Drawer J, Plant City FL 34209. 813-754-9191.

SMC ESP-1 fully equipped, (4) Carousels, 24 tray Instacart, (4) Revox R-R's, (2) dual cart players, delay recorder for network, 7 day clock, color monitor, spare parts, complete manuals. R Monroe, KKTx, Kilgore, Kilgore TX 214-984-2001

MEI Satmaster 1000 event automation controller w/(2) go-carts & cabinet, mint cond. See at KLSZ, Van Buren, Ark. Contact Don Jones 501-474-3422 for app./info, \$8000 cash.

Harris System 90 automation unit, w/(5) 750 Series R-R, (4) 24 bay Carousel cart machines, 48 bay Insta-cart machine, encoder, logger, printer & control panel, (4) racks w/dooors. Bill Burt, 505-434-1414.

IGM 700 automation system w/network joiner, time & temp announcer, program logger, 4 stack instacart, includes 3 equip racks, you pick up. BO. M Meyer, KLPQ, POB 70, Madison MN 56256. 612-599-7301.

BE 16X w/(4) Revox PR99's, (2) Carousels, (2) time announce, triple deck, delay, recorder, live assist & more, 2 yrs old. D Remy, KKKL, POB 17360, Colorado Springs CO 80935. 719-636-1000

SMC ESP-1 (4) 352 RSB Carousels, (2) 722 dual cart decks, net delay machine, 20 chnl of audio, (4) Revox A77 reels. R Monroe, KKTx, Box 192, Kilgore TX 75662. 214-984-2001.

Schafer 903, (4) R-R, (2) 78 tray stereo Go-Carts, full logging, time announce, BO; Broadcast Products AR2000B, (4) Revox R-R, (3) stereo Carousels, single play, full logging & schedule load, BO; SMC 352RS stereo Carousel, excel cond, BO. R Mayhugh, KLOA, Box 938, Ridgecrest CA 93555. 619-375-8888.

Harris System 90 logger, decoder, monitor, Brain, etc. BO; IGM Instacart, 48 tray, stereo, excel cond, mounted in equip rack w/all cards, \$7000 S Cohen, KFNN, 65 E First Ave, Mesa AZ 85210. 602-644-1510.

IGM Instacart 48 tray stereo w/Harris automation interface, \$6000 or trades. D Roden, WAHR, 1701 Monte Sand Blvd, Huntsville AL 35801. 205-533-3676.

Schafer 7000GLS brain, power sup., Esprit cont., (2) Audiofiles, mono, ster., cables & lots of spare parts. E Nichols, KMCR, POB 189, Montgomery City MO 63381. 314-564-2275.

Harris System 90, (2) full sys., (2) Brains w/conn., (4) ITC, (5) Revoxs, (9) Carousels, (2) printers, cur. in op., \$20,000. D Maybar'y, WOXO, POB 72, Norway ME 04268. 207-743-5911.

Want to Buy

SMC 350 Carousel's & parts, Instacarts, ITC triple decks. B Romeijn, KJNO, 3161 Chanell Dr, Juneau AK 99801. 907-586-3630.

SMC Carousel 250 random, fixer uppers; Metro-Tech 500 Series parts for Metro Tech 10.5 PB deck. D Kohn, KESM, 200 Radio La, El Dorado Spgs MO 64744. 417-876-2741.

25 Hz tone sensor & relay to start cart machine & 25 Hz tone sensor to stop R-R machine. G Dow, WBKN, POB 711, Brookhaven MS 39601. 601-833-6221.

Instacart or Go-Cart mono, any tray size, one or more, will consider units needing service. L Maierhofer, WTGC, 101 Army Blvd, Lewisburg PA 17837. 717-523-3271.

Entire set-up for Transtar Country format, buy or trade for Harris system w/5 Scully reels, 2 Instacarts, time announce, 2 CRT's, etc. Harris on air now. B Harmon, WPLA, POD J, Plant City FL 34289. 812-754-9191.

SMC Mini-Pro automation controller. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

Tone encoder 25 Hz, for reel production needed. D Davis, KMBA, 1217 Valencia Dr NE, Albuquerque NM 87110. 505-255-2431.

Ampex CC500-03 3 tube color w/lens, CCU & viewfinder; Hitachi FP1011BU 3 tube color w/CCU & remote paint box, \$1000/both; (5) Norelco PC70 3 tube color studio cameras, all w/CCU's, \$400 ea. J Krepol, RNDL, 6147 Walker, Phila PA 19135. 215-624-1050.

Panasonic WV-3800 w/RCU & cable, zoom lens, & full ENG package w/carrying case, needs work, BO. J Garvey, Video Yesteryear, Box C, Sandy Hook CT 06482. 203-744-2476.

Want to Buy

Miller Pro/Pro Jr fluid heads or similar quality heads. R Lawrence, Moonshadow Video Prod, 4280 Reston Rd, Roseburg OR 97470. 503-679-8966.

RCA TK1, 10, 30 camera chains, tripods, wood or metal, heads, etc; also TM-5, TM-10 monitors & gd 15GP22 CRT. A Weiner, Britton Road, Monticello ME 04760. 207-538-9538.

Sony CCU-1800; Sony CMA-6 (2). F Haynes, 1718 N 79 Terr, Kansas City KS 66112. 816-654-2407.

RCA TK-10, TK-30, TK-1, TK-41 camera chains, any cond plus matching tripods & heads; also any Dumont camera chains in any cond. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

MCI/SONY PARTS
New and Used... Your Best & Oldest Source in the U.S.A.

Custom mike panels, cue boxes, Sony and DIC DAT tape. DAT Recorders. Connectors, patchbays, cable for all Studio Construction needs. Full line Professional Audio equipment and Accessories.

In the Big Apple they Call Us First
audiotechniques
1619 Broadway, NYC, NY 10019
(212) 586-5989 FAX (212) 489-4936

SMC DF-1 with a memory retention #218 card from SMC DP-1 Brain. K Klaas, KEZJ, POB 346, Twin Falls ID 83303. 208-733-7512.

CART MACHINES

Want to Sell

BE 3300, \$750; BE 5502, \$1200; Harris C90, \$500; RFI filter Sprague F-1135/G JN17-3300B1 250 VAC, 100 A single or 3 phase, use on 208 or 240V, 3 pole 100 A, \$600; (4) pole 100 A, \$700. Dave, 209-467-0317 evenings only.

BE 2000 RPS R/P, (2) 2000 PS PB Spotmasters, vgc. BO. I Baron, IVCUA FM, 200 UCIV Catholic Univ, Wash DC 20064. 202-635-5106.

Sparta portable, AC/battery, runs gd, \$50; ATC 8 kHz cue amp, \$10. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

ITC 3D mono, gd cond, \$1000. B Mountjoy, WIDD, 610-1/2 Hattie, Elizabethton TN 37643. 615-543-5849.

Panasonic WV 200CLE 3CCD chip cameras (3), less than 30 hrs, 12:1 lens, mic, case, \$5000 ea; Thomson MC301 camera, excel cond, 14:1 Fuji lens, shipping case w/RS2000 CCU, \$2000 pkg; Norelco PC72 cameras (3), 15:1 Angenieux lens, gd cond, fair tubes, spare CCU, lots of parts, Sr video remote controls, various Norelco PC70, PCP70, PCP90 modules, yokes, parts, BO. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Panasonic WV32408A camera w/8:1 autofocus zoom, stereo snd, title gen & Panasonic AG2400 portable recorder w/remote control, battery charger/AC adapter, cable-ready programmable tuner, fluid head tripod, padded carrying case & manuals, mint cond, \$2400/BO. Mark Bainer, 207-784-9181.

RCA TK-710 w/14:1 lens & 12:1 lens, AC adapter, batteries, case w/wheels, new studio view finder, Bogen tripod w/fluid head, all in gd cond; (2) VCR cables & one VTR cable, \$2400. R Shaffer, Lobb & Shaffer Videos, 1613 Washington, Prospect Park PA 19076. 215-532-7010.

JVC BY-110 3-tube ENG/EFP camera w/10X servo-zoom lens, battery, AC adapter/charger, hard case & cable, 10 pin, for Panasonic NV 8420 prof VHS VCR w/battery, AC adapter/charger & case, all in excel cond, camera for \$1900, VCR for \$700 or all for \$2500/neg. J Loether, 202-298-9550 voice mail.

Studio camera zoom lenses (4) Rank, Taylor Hobson Varotal RM 10:1 zoom w/1.75 & 3X range ext w/zoom & focus controls & pan head arms in flight cases, \$500 ea. J Krepol, RNDL, 6147 Walker, Phila PA 19135. 215-624-1050.

Sony DXC-M3A 3 tube saticon, Fujinon 12/1 w/2X ext zoom, ENG VF, 5" VF, rem lens/200 ohm control kit, AC-PS, 6' cable, \$6500. S Christian, Masterpiece Video Prod, 715 Cornwall, Silver Spring MD 20901. 301-439-5731.

HEAD RECONDITIONING

Restore your worn heads to original (new) performance specifications at a fraction of the replacement cost. Our laboratory services include:

- Digital/Optical & Electrical inspection
- Precision recontouring of heads
- Complete digital/optical alignment of assembly
- Exclusive "Audio Magnetic Head Test Report"™ & Data Sheets

We also carry a full line of replacement heads and parts. Our 25 years of experience and reputation are unmatched in the industry.

GARA
MAGNETIC SCIENCES
249 Kennedy Road
P.O. Box 121 • Greendell, NJ 07839
Tel (201) 579-5773
Fax (201) 579-6021

DIGITAL DIGITAL DIGITAL DIGITAL DIGITAL DIGITAL

Schafer

means

AUTOMATION

... Always has

... Always will.

Schafer World Comm. parts dept. supports new & previously manufactured Schafer automation & consoles, Sparta audio, Cetec 7000 systems & Consoles

Schafer World Communications Corporation
World Radio Bldg., PO Box 31, Marion, VA, 24354 USA
Phone: 703-783-2000 FAX: 703-783-2064

DIGITAL DIGITAL DIGITAL DIGITAL DIGITAL DIGITAL

World Radio History

CART MACHINES ... WTS

Tapescaster 700RP, \$300; Tapescaster 700P, \$200; BE cartwinder, \$50. J Clarke, WRKU, 4531 Belmont Ave Ste C, Youngstown OH 44505. 216-759-0579.

Tapescaster 700 RP recorders in gd cond (2), in use, w/manual, \$250; Tapescaster 700P players in gd cond (2), in use, w/manual, \$150 ea. D Davis, KMBA, 1217 Valencia Dr, NE, Albuquerque NM 87110. 505-255-2431.

Want to Buy

ITC PD-II top cover, will pay new price. K Austin, KFXX, POB 433, Lawton OK 73502. 405-658-9292.

ITC or other make, triple deck in gd cond. R Larson, 509-453-6296.

R/P 3-deck stereo, gd working cond, all considered, no junk, will pay cash. G Gardner, 801-673-1546.

Collins 642E-1 Twintape, need cue tone cards/cart deck/parts to make 3 decks into 4 w/rip start from deck to deck. G Dow, WBNK, POB 711, Brookhaven MS 39601. 601-833-6221.

ITC 99, Omega, Premium line, gd used mono or stereo recorder. T Murray, WROI, 100 W 9th, Ste 306, Rochester IN 46975. 219-223-6059.

ITC 3 deck mono, all tones, working cond. R Yaw, KQJM, Box 7000, Havre MT 59501. 406-265-7841.

RCA RT-126 VU meter; RCA RT-126 60 Hz motor in exchange for 50 Hz motor. M Anderson, 1469 3rd Ave, New Brighton PA 15066. 412-847-0111.

Teac X1000-R 10.5" 1/4 trk 7.5-375 ips, dbx, rack mountable, stereo auto-reverse, remote capable, \$500. L Domnitz, 754-46th Ave, San Francisco CA 94121. 415-750-0431.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Pentagon 1100 high speed duplicator, R-R & cassette, (2) cassette master units, mdl CM1140, (2) dual position slave units, mdl CS1140, R-R master unit, mdl RM1140, R-R slave unit, mdl RS1140, manuals & spare parts, \$2100/BO. M Gellos, Pensacola Christian College, 904-478-8480 X5041.

M.C.I. RECORDER P.C.B. REPAIR Fast Turnaround K.E.I. FT. LAUDERDALE, FL. 305-771-2947

Technics RS-1506 1/4 trk R/P, 1/2 trk PB, 3.75-75-15 ips, wireless remote unit, owners manual, vgc, \$795 pls shpg; Nakamichi RM1000 wired remote for 480/480Z series, excel cond, \$25 pls shpg. S Hofmann, Cameron Univ Theater, 2800 W Gore, Lawton OK 73505. 405-581-2428.

STUDER REVOX FACTORY AUTHORIZED SERVICE CENTER "SUPERLATIVE SERVICE"

Swiss trained in servicing A77, B77, A700, PR99, A67, B67, A810, A807, B710, A710 & C270. Fast 48-72 hour service w/90 day warranty. Huge parts inventory. VISA/MC. New & used machines available.

STUDIO-SONICS CORP.
2246 N. Palmer Dr. #100
Schaumburg, IL 60173
(312) 843-7400

Remote recording trailer 16' w/Quad 8 console, isolation xlfomer, will run on 110/220 VAC, 24 trk ready, \$5700/BO. B Petruzzi, Rouse St Prod, 804 E Old Hickory Blvd, Madison TN 37115. 615-868-8516.

Uher 4000 Report L, in great shape, \$150. P Andrus, POB 261, Chincago WA 98325. 206-732-4085.

Revox floor stand for Revox PR-99, in box, never used, \$150. E Welch, WKCL, POB 809, Ladson SC 29456. 803-553-5420.

Akai GX-280D 1/4" R-R stereo, parts machine, \$20. P Russell, Bowdoin College, Sills Hall, Brunswick ME 08011. 207-725-3066.

Crown 722/724 1/2 or 1/4 trks, new heads w/light case, mint cond, \$800; Otari 5050-III 8 trk, mint cond, \$3000. C Volpe, 540 Stemmers Run, Essex MD 21221. 301-391-6927.

Tascam 480B 8 trk 1/2" deck w/autolocator, carton & manuals, immaculate cond, \$3500/both. R Cannata, Cantrax Recorders, 2119 Fidler, Long Beach CA 90815. 213-4986492.

Ampex AG-440/B in vgc, \$500/BO. J Davis, WWQM, 5024 E Lacy, Madison WI 53711. 608-271-6611.

Revox A700 stereo 2 trk, \$800; Pioneer 2022 & 2024 2 trk & 4 trk, \$850; Onkyo TARW99 dual cassette, \$200; Technics M227X cassette w/dbx NR, \$100. G Ernst, Bayside Studios, POB 166, Linda City OR 97367. 503-996-6020.

METROTECH DICTAPHONE LOGGERS

—PARTS— and Service

SEQUOIA ELECTRONICS

1131 Virginia Ave
Campbell CA 95008
(408) 866-8434

Scully 280B 200-466 AV-F black front w/slide out racks, cracked VU glass, \$100. L Beigel, On-Cue Recdg, POB 85042, Los Angeles CA 90072. 213-466-3595.

Tascam Portal, 2 yrs old, excel cond, but FF & RW do stick, \$450. B Howard, KOFO, Box 16, Ottawa KS 66067. 913-242-1220.

Otari MX 5050-4 4 trk 1/4" recorder in portable case/configuration, vgc, \$1200. B Petruzzi, Rouse St Prod, 804 E Old Hickory Blvd, Madison TN 37115. 615-868-8516.

Revox PR 99 (2) gd cond w/tone sensor E.O.M.'s, PB only, \$1500/pair. B May, KVIN, Box 419, Vinita OK 74301. 918-256-7224.

Ampex 440 mono (2) in Russling roll-around cabinets, gd cond, \$750 ea; Telex 6120 R-R module, like new, BO. D Flynn, Continental Recordings, 1 Thompson Sq Ste 501, Boston MA 02129. 617-241-5150.

Telefunken M15A 24/32 trk w/autolocator, both heads, all documentation & varispeed, \$25,000; Teac 80-8 8 trk w/dbx, rack mount, \$1100; Telefunken 15A 2 trk, 75/15, in console, \$3,000; Revox A77 14" 1/2 trk, make offer. R Rhodes, POB 1550 Radio City Station, NYYNY 10101. 212-245-5045.

Ampex 440-C FT recently re-cond, w/variable speed osc, mounted in roll-around cabinet, \$1295. W Hanlon, WKFD, 19 Udpkie, Wickford RI 02852. 401-295-8808.

Otari MK III/4 1/2" 4 trk, never used, BO. D Day, WQXY, 1001 Howard 42-F, New Orleans LA 70113. 504-525-9600.

CLEAN PATCH BAYS NO DOWN TIME



VERTIGO BURNISHERS AND INJECTORS RESTORE ORIGINAL PERFORMANCE TO YOUR PATCH BAYS

\$29.95 Ea. Includes 1/2" for 1/2" and 1/4" for 1/4" and 1/8" for 1/8"
VERTIGO RECORDING SERVICES
12115 Magnolia Blvd #116
North Hollywood, CA 91607 818-907-5161

Ampex 600 (3) for parts, BO. B Oostenburg, KCKY, POB 6, Coolidge AZ 85728. 602-963-9390.

Sony DTC-1000ES DAT machine, top half of PCM-2500, BO, call after 2PM. R Kaufman, Pams Prod, POB 462247, Garland TX 75046. 214-277-7625.

Ampex AG-440B 2 trk (3), 10.5" rack mount prof, vgc, \$700 ea plus shpg; Scully 280 4 trk 1/2" in Russling console, late mdl w/motion sensing, spare cards & capstan motor, low hrs, gd cond, \$1600 plus shpg; Denon DH-510 2 trk 10.5" reels, 75-15 ips, excel cond, \$900; Teac 2300X stereo 1/4 trk, 7" reels, excel cond, \$250. K Peckham, 2737 Florann, Madison WI 53711. 608-271-8763.

Wollensak 3M 1520AV portable 3.5 & 7 ips, excel cond, no AC cord, \$75. P Salois, KPCR, POB 1, Bowling Green MO 63334. 314-324-2283.

Teac/Tascam 235 4 trk, excel cond, 6 mos old, \$450. B Brinizer, WDCG, POB 2126, Durham NC 27702. 919-682-0318.

Telex M235-42 1/4" tape duplicating system, 4 trk 2 chnl, one master w/spare & 4 slaves w/electronics & cables, \$700; Sony TC-854-4S 1/4" 4 ch, 4 trk w/simul-sync, 75-15 ips, Canon inputs w/dbx 154 type 1 NR system, \$900. J Krepol, RNDL, 6147 Walker, Phila PA 19135. 215-624-1050.

Tascam 122 (10) cassette decks, excel cond, \$350; Otari 5050B 1/4 trk, excel cond, \$950; Otari 4 trk 5050B, 1/2" & 1/4" decks, the 1/2" has an extra transport, \$1500 ea. M Zook, Masterworks, 4024 Williamsburg Ct, Fairfax VA 22032. 703-385-1780.

THE HALL Electronics
THE BEST DEALS ON QUALITY REBUILT & BRAND NEW BROADCAST EQUIPMENT
We BUY & TRADE equipment too!
Please phone or send for our latest flyer.
804-977-1100 1712 Allied St.
10:00AM-6:00PM EST Charlottesville, VA 22901

Otari MX-5050 10" 1/2 trk recorder, 75 & 15 ips, gd cond, w/manual, \$900; Revox A-77 10" stereo recorder, excel cond, w/manual, \$400. B Mounjloy, WIDD, 610-1/2 Hattie, Elizabethton TN 37643. 615-543-5849.

Scully M100 16 trk, 2" in console (2), one has great remote/counter, both in vgc w/gd heads, \$7000 & \$8000. R York, Jewel Records, 1594 Kinney Ave, Cincinnati OH 45231. 513-522-9336.

Scully 280B (2) FT unmounted, very clean, \$450 ea or \$850/both. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Revox A-77 (3) rack mount 2 portable, 2 gd transports, one needs capstan motor & heads, \$500/for two, \$200/other; Dokorder 1140 4 trk 1/4", gd transport & PB, records poorly, gd heads, you ship, no service info, \$200. B Sauter, WSLU, Payson Hall, SLU, Canton NY 13617. 315-379-5356.

Ampex and Scully Spare Parts, Accessories, Motor Remanufacturing.

VIF INTERNATIONAL
PO Box 1555
Mtn. View
CA 94042

Direct order line(800) 848-4428
in CA Dial (408) 739-9740
Telex 62922869 ESL UD
FAX: 1-408-739-0809

Scully 280B, brand new cond, w/spare head stack & parts kit, \$1700; Sony PCM F-1 digital processor, portable, used 3x's, \$1300. D Kocher, 1901 Hanover, Allentown PA 18103. 215-432-0520.

Scully 280 (2), excel cond, some extra parts. R Fess, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Sony stereo cassette deck, needs work but repairable, \$60. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

Soundscribe 24 hr recorder, needs work, \$100; NEC music on hold w/50 pin plug, \$40. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

MCI, Otari, Scully, Ampex various 2 trks & multitracks, all in gd to excel cond, call for complete list. G Guarino, Sorcerer Snd, 19 Mercer, NYYNY 10013. 212-226-0480.

Ampex 350-351 or AG440 or MR 70 tape machines w/both record & PB functions, 75 & 15 ips, mono. P Hons, Mainline Comm, 100 Poplar St, Portage PA 15946. 814-736-3883. 612-598-7301.

Ampex 351 tube elect (2) modified for Sel-Sync, \$100; MCI solid state JH5 (4), excel cond, \$400; Ampex 300 deck w/2" capstan & strobe idler, 1" 7 trk head assy, extra large reel motors for handling 2" tape, 2" reel hubs, locks, rebuilt capstan motor; Infonics 200 Series cassette duplicator reel master, 10" reels, mono, excel cond (2), \$1200 ea. T Boddie, 12202 Union, Cleveland OH 44106. 216-752-3440.

Ampex AG-440 (2) PB deck w/PB amps, stereo rack mounted, avail July 1, 1989, \$600 ea or BO. T Hill, KCRV, Box 909, Caruthersville MO 63830. 314-333-1370.

Tascam EM-1542 reel motor for Tascam Series 30 tape decks, new, \$90 or swap for a Sony TC-850 or TC-854-4S head block. J Roper, Imperial Snd Sld, RR31, Box 405, Terre Haute IN 47803. 812-877-2663.

Teac 222 1/2 trk, new, \$800; Teac 224 1/4 trk, new, \$1400. J Pappas, The Pappas Group, 209-523-5248.

Nakamichi MR2, used approx 150 hrs, rack mount, variable bias & pitch, Dolby B&C, superb cond. H Carter, 509-328-5729.

ITC 750 PB only (5), \$250 ea or \$1000/all. S Cohen, KFNN, 65 E First Ave, Mesa AZ 85210. 602-644-1510.

Otari ARS-1000 (3) in excel cond. V Clough, WZFX, 225 Green, Fayetteville NC 28302. 919-486-4991.

Magnecord 1024 (2), one in excel cond & one in decent shape. BO. R Fess, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Telex Mdl 235 (3), Mdl 300 high-speed mono cassette duplicators, 3.75 & 75 ips, includes (2) bias oscillators, (3) record amps, & equip rack, needs work, BO. J Garvey, Vid-eo Yesteryear, Box C, Sandy Hook CT 06482. 203-744-2476.

Ampex 440C 1" deck, no heads but has guides, includes power supplies & manual, \$450. R York, Jewel Records, 1594 Kinney, Cincinnati OH 45231. 513-522-9336.

Otari MX 5050 (2) in fair cond w/one remote, \$800 ea. J Super, WVAM, Box 1827, Altoona PA 16602. 814-944-9456.

Scully 280B-4, 280B-FT, mint, 4 trk \$3000, the FT \$1500; Ampex AG354-2 in perfect cond, \$1000/BO. R Bruce, UAR Slds, 8535 Fairhaven, San Antonio TX 78229. 512-690-8888.

Teac A-2300-S 7" w/full function wired remote, original manuals, cables, etc, stereo 1/4 trk, \$285. E Kovacs, 14269 Jackson, Taylor MI 48180. 313-285-9710.

Sansui DM-350 cassette player, recorder rack mountable, gd cond, \$200/BO; Lazy Susan type cart rack, holds 96 carts, \$75/BO. R Price, KWIK, 259 E Center St, Pocatello ID 83204. 208-233-1133.

Motor Services

Professional overhauling of most AC & DC capstan and reel motors. Fastest turnaround, all work guaranteed.
New MCI ceramic shafts
Any metal capstan shaft resurfaced — \$50

AMP SERVICES
800 826 0601 • in FL (305) 659-4805
224 Datura Street #614
West Palm Beach, FL 33401

Ampex 4020150-03 reproduce only elect w/factory rack mount, BO. C Kimbrough, WRXO, POB 1176, Roxboro NC 27573. 919-599-0266 alt 6PM.

Teac 6010 4 trk w/auto reverse, 4 heads, 2 chnl erase, record, forward PB & reverse PB, access include dust cover, remote time control, pause control, etc. FOB Chicago, \$400/BO. 312-444-2066.

Studer A80 Mark I 1" 8 trk, 75-15 ips, \$7500. Call 212-645-6319.

Scully 270 reproducers (2), gd cond, \$200 ea. M Meyer, KLOP, POB 70, Madison MN 56256. 612-598-7301.

Ampex 440 stereo in walnut console & remote w/(2) 375 Inovonics electronics, \$1500; Ampex 354-2 stereo, gd cond, \$495; MCI JH110B stereo w/remote walnut console, \$2500; MCI JH110A stereo remote in walnut console, BO. J Price, 2651 Globe, Dallas TX 75228. 214-321-6576.

Pioneer RT-1050 (2) gd cond w/manuals, \$350 ea. L Vollmar, WOBT, POB 738, Rhinelander WI 54501. 715-362-6140.

Revox A700 rack mount or table, 3 speeds stereo 2 trk, gd cond, \$550. G Ernst, Bayside Snd Sld, POB 166, Lincoln City OR 97367. 503-996-6020.

Ampex 440B, \$500. K Thomas, POB 207, Atlantic Beach FL 32233. 904-388-7711.

Revox A-77 R/P, Crown 800 R/P, Ampex 612 PB, all OK motors, used, repairable cond, BO pls shpg. M Ferguson, N AZ Bdc, POB 1990, Prescott AZ 86302. 602-776-2810.

Metrotech 543R stereo Rec/repro (2); Metrotech 531R mono rec/repro (2). C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Ampex AG-440 mono R-R (2), \$500 ea. J Cannaday, 919-473-1993.

Ampex 602-2 w/manual, portable case, operates but needs some work, looks gd, BO, plus shpg. S Delahoyde, Box 33063, Phoenix AZ 85067. 602-937-9088.

Otari MX 5050-B 8 trk, like new, less than 15 hrs, w/full factory remote control, roll around rack & all manuals, \$4000. J Belik, KIKX, Colorado Springs. 719-632-5800.

Pioneer RT701 2 trk, has speed problem, BO. B Keaton, WGEZ, POB 416, Beloit WI 53511. 608-365-8865.

Otari MX 5050 excel cond, 1/2 trk stereo R/P & 1/4 trk play utility, \$2000. T O'Malley, Citynet, POB 29341, Oakland CA 94604. 415-223-6757.

Pioneer RT701 3 motors, 3.75-75 ips 1/4 trk stereo, very low hrs, excel cond w/manuals, \$250 ea. D Davis, KMBA, 1217 Valencia Dr NE, Albuquerque NM 87110. 505-255-2431.

Rack mount adaptor for Ampex AG600 stereo. F Konwinski, WSOY, 1100 E Pershing Rd, Decatur IL 62526. 217-877-5371.

Want to Buy

Revox 725 or 727 CD player, gd cond for prod room. M Hoskins, KMDN, No 210 Rainbow Motel, Great Falls MT 59401. 406-761-1000.

Tascam 388 8 trk recorder/mixer in gd cond. M Sokol, JMS Prod, 121 E Baltimore, Hagerstown MD 21740.

Magnefax bin loop recorder, mono or stereo 1/4" in any cond. T Boddie, 12202 Union, Cleveland OH 44106. 216-752-3440.

Magnecord 728/748 or 1028/1048 for parts or to make one of ours into parts. NE Stephany, WACK, POB 1420, Newark NJ 14513. 315-331-7100.

Inovonics 355 & 900 pwr supply. L Beigel, On-Cue Recdg, POB 85042, Los Angeles CA 90072. 213-466-3595.

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

Ampex 350-351 or AG440 or MR 70 w/both record & plaback functions, 75 & 15 ips, mono. P Hons, Mainline Comm, 100 Poplar, Portage PA 15946. 814-736-3883.

MCI/Sony capstan & reel motors, any cond., recdg heads, most mfgs, machines, new, used. Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-826-0601, in FL 305-659-4805.

CONSOLES

Want to Sell

Harris Stereo-5 modified w/5534's, no documentation, \$600/BO. J Claybrook, WMJJ, 530 Beacon Pkwy, Birmingham AL 35209. 205-943-9600.

Sparta Centurion II 8 chnl, 3 inputs ea, stereo, 3 output busses, monitor amp, gd cond, \$110/BO. R McDaniel, KJRG, Box 567, Newton KS 67114. 316-283-5150.

Russco 505 5 pots w/Q & push on-off switches, 2 internal TT PQ's & pwr supply, pot 5 has 5 inputs, mono 19x5x8, \$600. L Beigel, On-Cue Recdg, POB 85042, Los Angeles CA 90072. 213-466-3595.

Gates Stereo Statesman currently in use, avail in mid July, \$1200/BO. B Anderson, WTGY, POB 9, Marshall Rd, Charleston MS 38921. 601-647-5600.

Ramko DC8MS 8 chnl 20 input stereo board w/2 LC4 remote control accessory, excel cond, \$5500. R Trumbo, KNLF, POB 117, Quincy CA 95971. 916-283-4144.

Interface 104L 16x8 monitor mix console, 3 band, 3 freq EQ, gd cond; Yamaha PM-700, 12 in stereo out prod console, 3 band EQ on ea input & output, snake avail, \$900. B Petruzzi, Rouse St Prod, 804 E Old Hickory Blvd, Madison TN 37115. 615-868-8516.

Ampro AC8S 32 input, 8 chnl stereo, BO; McMartin B-802-51 stereo, 28 input, 8 chnl, BO. M Black, WEOS, Geneva NY 14456. 315-789-8970.

Soundworkshop 1280-B 12 in stereo w/super EQ, mint cond, low hrs, \$2000. C Volpe, 540 Stemmers Run, Essex MD 21221. 301-391-6927.

Gates Yard II audio console, \$500. J Cannaday, 919-473-1993.

McMartin B-801 mono 8 chnl, minor power supply problem, \$250. B Keaton, WGEZ, POB 416, Beloit WI 53511. 608-365-8865.

Gates Dualux dual chnl mono, 20+ inputs, power supply needs work, BO, you ship. 9-5 EDT. 717-489-0005.

DISCO . . . WTS

JBL/AGK D16R2405/R-25 16 ohm, replacement diaphragm for JBL 2405 tweeter in unopened box, \$50; AKG R-25 remote control unit for AKG BX-25 reverb unit, \$50 or swap for a Revox A-77 remote control, J Roper, Imperial Snd Std, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

Klipsch La Scalla's speakers (2) \$800/pr pls shpg; (2) Nak MRI's, \$700 ea; Tandberg 320 cassette deck, \$300. B Feinberg, Totaltape Publishing, 800-874-7599 X337.

EV Sentry 500 time coherent studio monitors, \$700. G Ernst, Bayside Studios, POB 166, Linda City OR 97367. 503-996-6020.

Ampex MM1000 2" 16 trk w/VSO, dbx NR, Biamp 16x8x16 console, 128 point patch bays, looms & remote, \$105K/all. G Ernst, Bayside Studios, POB 166, Linda City OR 97367. 503-996-6020.

dbx NR system, 24 chnls, mdl 310D modules in (2) mdl 216 main frames, \$1900/BO; dbx NR, 310D modules in 216 main frame, as is, 24 chnls, \$500 or \$2300 for all 48 chnls or trade. R York, Jewel Records, 1594 Kinney, Cincinnati OH 45231. 513-522-9336.

Eventide Harmonizer H949 w/DeGitch, mint cond, \$1500/BO. S Cronen, Starbeat Redcg, 9 E Larkdale, Deerfield IL 60015. 312-945-3555.

Liquidating complete studio, everything for sale: Ampex 2" multi-track, Biamp console, dbx NR, patch bays, 2 mastering decks, 2 cassette decks, reverbs, gates, compressors, gd mics, time aligned monitors, furnishings, etc, call for complete list, \$18,500. G Ernst, Bayside Sound, POB 166, Lincoln City OR 97367. 503-996-6020.

Various Eventide, Lexicon, Valley People outboard gear, call for complete list. G Guarino, Sorcerer Snd, 19 Mercer, Nyny 10013. 212-226-0480.

Want to Buy

Fairchild 670 or 660's, in working or repairable cond. Mike, Morning Star Recd, 155 Saunders Ferry Rd, Nashville TN 37875. 615-824-9434.

dbx 904 noise gate. R Burton, Audio Rents Inc, 7237 Santa Monica Blvd, Hollywood CA 90046. 213-874-1000.

RCA/WE tube equip, speakers, pickups, literature. R Van Dyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

LIMITERS

Want to Sell

Orban 8100A XT2, 6 band limiter chassis, brand new, \$1500. A Pavao, KYNO, 2125 N Barton, Fresno CA 90703. 209-255-8383.

Inovonics 221/MAP II AM processing system w/mdl 215 AGC limiter, excel cond, \$400/BO; Marti CLA-40H, excel cond, \$150/BO; UREI LA-4, \$400/BO. T Randall, KJJQ, Box 790, Brookings SD 57006. 605-692-9102.

Ron Radio Comm, Inc
P.O. Box 201
Brightwaters, NY 11718
We specialize in High Schools & Colleges...
Hnat Hindes
CP-2013 Composite AGC Processor "The Hottest Audio Processor On the Market" \$ 895
Call Ron Radio For All Your Equipment Needs
800-666-3525

Orban FM Optimod 8000A, vgc, \$1500. J Denison, Espri Comm, 4510-A S 14th, Abilene TX 79005. 915-691-9292.

RCA MI-34654 older style neg peak limiter, gd cond, \$25 pls shpg. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Gregg Labs 2542 2 chnl audio processor, \$300. T DeCapua, WLKK, 18 W 9th, Erie PA 16501. 814-456-7034.

Mod Sciences Stereo Max, like new, works great, will trade for Optimod XT chassis or BO. J Aughney, KLCE, POB 699, Blackfoot ID 83221. 208-785-1400.

Wilkinson LGC-1 AGC/limiter, w/manual, perfect for export, gd spare, \$275 pls shpg. L Spivey, WLLS, Hwy 231 South, Hartford KY 42347. 502-298-3268.

Orban Optimod 8000A stereo generators (2), \$1500/ea; various CBS Labs 444 Audimax III (2), \$100 ea; CBS 400 Volumax, \$75; CBS Audimax II, tube, BO; Harris Solid Statesman, \$175; Gates Sta-Level, tube, BO. M Hurst, WCO, POB 909, Salisbury MD 21801. 301-742-3212.

EASY NRSC
A "post-processor" for REAL AM improvement! Simply connect it between your existing limiter and the transmitter for "protected" pre-emphasis and overshoot-controlled lowpass filtering to NRSC specs.
Inovonics
SANTA CRUZ, CA (408) 458-0552

Texas/Gentner Audio Prism w/PR-1, new, \$1500; Summit Audio dual tube pre-amp for mic or line, new cond, \$850. R Hull, 8238 E 71st Ste 133, Tulsa OK 74133. 918-254-0464.

EXR Corp EX-IV exciter in gd cond, \$500/BO; Valley People Dyna-Mite mic processor, dual, desk top case, excel cond, \$500/BO. J Claybrook, WMJJ, 530 Beacon Pkwy, Birmingham AL 35209. 205-942-9600.

Orban Optimod 8000A recently removed from service, clean in gd cond, \$1500. C Genaro, Roberts Bldg, 1018A E Main, Merrill WI 54452. 715-536-6262.

Optimod 8000A just factory redone, \$2000/firm; Optimod 8100A, \$4000; XT-2 6 band, \$1800; Studio Chassis for 8100A, \$500. B Watson, KCHZ, 1551 Amar, W Covina CA 91792. 714-946-6249.

Ron Radio Comm, Inc
P.O. Box 201
Brightwaters, NY 11718
Authorized dealers for:
Inovonics Digital FMX Generator \$1,595
AM NRSC Add-On Processor-\$ 520
800-666-3525

CBS Volumax 4000A, working when removed, has manual. \$150. B Oostenburg, KKKY, POB 6, Coolidge AZ 85728. 602-963-9390.

CBS 410 FM peak limiters (2), BO. M Saady, First City Recdg, 141-60 84 Rd 3E, Briarwood NY 11435. 718-846-2062.

Orban 8000A Optimod, excel cond, on-air now, \$1500. G McCoy, KZEN, 1606-1/2 16th, Central City NE 68826. 308-946-3816.

CRL FM 3 SEP400 (2) SPP800, excel cond, fully operational, will sell separately, \$1250. B Brinitzer, WDCG, POB 2126, Durham NC 27702. 919-682-0318.

Harris MSP-90 gd cond, single band w/manual, \$495; Dorrough DAP-310 Discriminate Audio Processor, gd cond, w/manual, \$395; CBS 4450A Audiomax FM stereo, automatic level control w/manual, \$295. L Vollmar, WOBT, POB 738, Rhineland WI 54501. 715-362-6140.

CBS Audimax 444 AGC, \$200/BO. M Patton, WXOK, 6819 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

Thomson-CSF 4500 Presence EQ, new, \$595; Ramko portable mixer PM-42, \$450; Thomson-CSF ES-214 audio level meter, \$1250. H.M. Dyer Electronics, 2982 Wixom Rd, Milford MI 48042. 313-685-2560.

CRL FM-4 System SPP-800, SEP-800, SMP-800 & SG-800 w/manuals & original perf. measurements, \$4000. K George, WUSY, POB 8799, Chattanooga TN. 615-892-3333, Fax: 615-899-7224.

CRL APP-300 audio preparation processor, \$400; CRL SEP-400 spectral energy processor, \$400; CRL PMC-300 peak mod controller, \$400 or all for \$1000. L DeCapua, WLKK, 18 W 9th, Erie PA 16501. 814-456-7034.

CBS/Thompson CFS 4300 AM peak limiter, new, \$525. G Landau, WSMO, 3300 Jaybird, Bessemer AL 35020. 205-428-0146.

Want to Buy

Texas Audio Prisms (2) & RCF5 card. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

MICROPHONES

Want to Sell

EV RE16 microphone, \$185; AGK D-1000E, \$70. G Robinson. 803-722-7611.

EV RE-20, new in box, \$315. K Thomas, POB 207, Atlantic Beach FL 32233. 904-388-7711.

AKG, Calrec, Sennheiser, and more, call for complete list. G Guarino, Sorcerer Snd, 19 Mercer, Nyny 10013. 212-226-0480.

RCA 77, \$350; HME, Telex, Cetec Vega wireless mics, BO. J Price, 2651 Globe, Dallas TX 75228. 214-321-6576.

Sony C37A tube condensers (2) w/cases & power supplies, mint cond, \$500 ea. G Ernst, Bayside Snd Std, POB 166, Lincoln City OR 97367. 503-996-6020.

RCA 50A, BK1A, 88A, WE 633A, working cond mics; 6 RCA 19605 equip catalogs, BO. E Rider, Box 1405, Rancho Santa Fe CA 92067. 619-756-4523.

RCA 44 classic ribbon, \$750. R Rhodes, POB 1550 Radio City Station, Nyny 10101. 212-245-5045.

EV RE50, like new, no case, includes clip, \$75. H Carter, 509-328-5729.

RCA 77DX vintage ribbon mic, in excel cond, BO; RCA 44BX vintage ribbon mic, excel cond, BO, call after 2PM. R Kaufman, Pams Prod, POB 462247, Garland TX 75046. 214-271-7625.

RCA 77D or 77DX original shock mount, silver, \$150. E Kovach, 14269 Jackson, Taylor MI 48180. 313-285-9710.

Telefunken M221A tube-type, supply & cable, excel cond, will swap for a Neumann U47let, other trades considered. E O'Brien, Imperial Snd Std, RR 31 Box 405, Terre Haute IN 47803. 812-877-2663.

TOA/Neumann J-1 & U-64, like new, windscreen & cable, \$60/firm, \$250 for Neumann. M Kuehl, 1418 N Stevens, Rhineland WI 54501. 715-369-4007.

Bruel & Kjaer 2801 condenser mic power supply for B&K tube type mics, will trade for a Sony C-37A power supply or Sony AC 148 supply. J Roper, Imperial Snd Std, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

Sennheiser MD-421 w/case & cable, excel cond, \$75; EV 642 Shotgun w/case, excel cond, \$100. M Ashley, SwingStreet Studios, 620 Bercut, Sacramento CA 95814. 916-446-3088.

Neumann N-80GL 2-mic phantom power supplies, new (2), \$50 ea. M Ashley, SwingStreet Studios, 620 Bercut, Sacramento CA 95814. 916-446-3088.

Sennheiser MD-421, new (2), \$195 ea. J Pappas, The Pappas Group, 209-523-5248.

WE & Altec 633A dynamic Saltshaker mic on stand, mint cond, (2) \$60, (4) \$100; EV 627 dynamic, \$25/BO. M Saady, First City Recdg, 151-60 84 Rd 3E, Briarwood NY 11435. 718-846-2062.

RCA-77 DX, clevite brush headset. E Esserman, WFOX, Atlanta GA. 404-953-9369.

Want to Buy

EV 666 w/matching desk stand, C-clamp & connector, paying \$50. D Sites, 5809-K Cambridge, Springfield VA 22152.

Good used mics for recording purposes, esp. EV, Shure, Sennheiser, AKG. B Miller, Grapevine Stds, 2525 Imlay City, Lapeer MI 48446. 313-664-1995.

Serious Collector will buy or trade for a RCA 4AA, BK-10, 30A lapel ribbon, 6225A carbon, PD-31, SK-39, BK6A model only, American D-44 & DR330. J Webb, 15117 Hamlin, Van Nuys CA 91411. 818-769-6738.

RCA 44 or other old ribbon or condenser mic, have RCA 77 to trade. R Van Dyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

Pre 1960 ribbon or condenser mic. R Van Dyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

Neumann U87's, U47, U67 or any kind of Neumann's or commercial mics, any cond. J Price, 2651 Globe, Dallas TX 75228. 214-321-6576.

WE 373, 600A carbon mic in the 1A, B brass case. A Weiner, Britton Road, Monticello ME 04760. 207-538-9538.

RCA 77DX ribbon mics; RCA 44BX ribbon mics. R Kaufman, PAMS Prod, POB 462247, Garland TX 75046. 214-271-7625.

Neumann, Telefunken, etc, vintage tube mics, also RCA 44 & 77's. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

MISCELLANEOUS

Want to Sell

Unique collection of used bdct equip, for sale or trade, list to large to publish but includes: Gates xmtrs, Sparta console, Revox 77's, cart machines, turntables, EQ, racks, unipole tower, and much more all items being used at present in Class IV AM stations in N Central FL, station gear & property wirensidence also available. E.A. Slimak, POB 1195, Hawthorne FL 32640. 904-481-2310.

Comprehensive Video production library, 8 music discs, \$300. A McPeck, POB 444, Rogersville TN 37875. 615-272-4827.

Tandy 1000 20 meg hard drive, CM-11 color monitor, lots of software, \$1850. C Springer, KLMR, POB 890, Lamar CO 81052. 719-336-2206.

Munchhausen sound proof hardwood doors w/frames, 7' by 3', \$500/BO. D Finton, WBAI, 505 8th, Nyny 10018.

IGM equip racks, 19" w/AC strip & removable rack-rail, 22x25x70, two side panels, one door, black, \$300. L Vidoli, WEEI, Schraffts Cir, Boston MA 02124. 617-242-5900.

Free 3-bay relay rack cabinet, excel cond, pick up only. P Schneider, KPMJ, 1280 S Oxnard, Oxnard CA 93034. 805-985-8346.

TRS-80 Mod-1, expansion interface, (2) B/W mon, (3) disk drives, 5 meg hard disk, 14" wide printer, billing software, vidtex & mod-em, eng software & more, \$600/BO. F Vobbe, GNBC, POB 5031, Lima OH 45802. 419-228-4199.

Staco 291 variable auto-transformer 0-120 V at 3 A, panel mount, new, \$20. M Kuehl, Passage Prod, 1418 N Stevens, Rhineland WI 54501. 715-369-4007.

Alphone NEM-40A intercom master, 40 station pwr sply, handset, BGM adp, 10 W amp, \$650/lot. W Slaten, Audio Intl, 424 Grant, Scotch Plains NJ 07076. 201-322-4466.

Gates V-22 volume indicator panel, like new w/book, \$150; Atlas MS-25 floor stands, new in boxes (2), \$50 ea; Gates BC1J high voltage transformer, like new, \$250; Collins 20V2 modulation transformer, like new, \$150. P Schneider, KPMJ, 1280 S Oxnard, Oxnard CA 93034. 805-985-8346.

Custom studio furniture, (2) pedestals & top to form console, in walnut & black laminate, \$100; various headsets (3), all work, \$10. D Bailey, 3422 Beech, Roulett TX 75088. 214-475-9796.

Broadcast operators handbook by Harold Ennes, original 1947 copy from Flider Publishing, BO. P Keogh, 2511 Memorial, Green Bay WI 54303. 414-499-1336.

Luxo mic arm 1/12" rise, new, \$40. G Robinson, 803-722-7611.

ADC BJF-2033 (3) Ultra Patch bay w/3' to rear interconnect panel, \$500 ea; also spare parts for Rust remote control, spare parts for ATC cart machines, univ sound outdoor paging speakers, GE sodium vapor lamp, call for prices and details. B Gellhaus, WDTV, POB 73, Cheltenham PA 19012. 215-635-4815.

Radio Shack 100 lap top computer, virtually unused, mint cond, 24K RAM, \$300; Extel Teletype printer AH11R, \$50. B Umberger, 51 S Main, Clearwater FL 34625. 813-446-0957.

Keith Monks Mark II record cleaning system. C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Tandy-Radio Shack TRS 80 model II line printer V, 2 disk drive, full manuals, 4 programs, \$425/package. P Mueller, KUTA, Hwy 191 N, Blanning UT 84511. 801-678-1161.

UPI spooled paper, (4) boxes, excel cond; (2) Extel printers, perfect cond w/manuals, BO on both. R Fess, WLRB, POB 250, Macomb IL 61455. 309-833-5561.

Paradyne 4951-02 equipment rack, 78" tall, 30" deep, fully enclosed, super cond, pick up in Kent WA, \$175. B Lord, 13313 SE 208th, Kent WA 98042. 206-631-2374.

WE 2565 HKM telephones (4), new, \$20 ea/BO. R Price, KWIK, 259 E Center St, Pocatello ID 83204. 208-233-1133.

Tandy TRS-4P computer w/2 disk drives, software & manuals, now in use on automation system, ready to sell, \$350/BO. C Springer, KLMR, POB 890, Lamar CO 81052. 719-330-2206.

Older tube equipment, AM freq & phase monitors, amps, etc, gd source for parts, make offer for lot. B Burnham, WHBT, 1293 Floyd, Jackson MI 49203. 517-782-1510.

Kepeco PRM48-6 48 volt pwr supply, 0-6 amps max, new in box, \$150. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

DISTRIBUTOR DIRECTORY

The following distributors serving the broadcast industry would be glad to help you with any of your requirements.

SPENCER
Broadcast & Communications
AUDIO—VIDEO—RF
Where Service is #1
Now in our 10th year
CALL 602-242-2211
FAX 843-2860

Kidd
COMMUNICATIONS
CALL US FOR... Audi-Cord Cart Machines & Audiopac Carts
• Bogner TV Antennas • Cablewave Transmission Line
• CRL Audio Processing • Eventide Digital Effects • Gentner Patch Bays
• Jampro FM & TV Antennas • JBL Speakers • M/A Comm Video STL's
• Mark Antennas • Orban Optimod's • Scala Antennas
• Soundolier Equipment Racks • Studer-Revov Tape Recorders/Disc Players • Technics Turntables/Disc Players
• TTC FM/TV Translators/Transmitters
CALL US TODAY! KIDD COMMUNICATIONS
4096 Bridge Street • Suite 4
Fair Oaks CA 95628
916-961-KIDD(5433)

We have the knowledge and ability to provide you the best suited broadcast for your project... always at competitive prices!
THE SOURCE
CALL US FOR ALL YOUR EQUIPMENT NEEDS
Toll free: 800-223-8202
In Florida: 305-651-5752
ELECTREX COMPANY

THIS SPACE AVAILABLE
Call 1-800-336-3045
More than 500 radio stations serving exclusively all Central America. We would like to represent your company, your product.
CONTACT: CENTRAL AMERICA BROADCAST DISTRIBUTOR
C A B D
Final 41 Ave. Norte Condomino Maya Apt. #12 San Salvador, El Salvador Centro America
Fax 503-28-12-18

SANGAMO-ACUSHNET MICA CAPACITORS
PLASTIC CORP.—NON-PCB OIL FILLED CAPACITORS
RF-ANTENNA AMMETERS
RCA-RAYTHEON-AEL TRANSMITTER PARTS
TRANSFORMERS & CHOKES 250 WATT THRU 50 KW
COMMERCIAL RADIO COMPANY
BOX 43, CAVENDISH VT 05142
802-226-7582

CORNELL-DUBILIER MICA CAPACITORS
FROM STOCK
JENNINGS VACUUM CAPACITORS
FROM STOCK
JENNINGS VACUUM RELAYS
SURCOM ASSOCIATES, INC.
2215 Faraday Ave., Suite A Carlsbad, California 92008
(619) 438-4420

FCC's Engineering FM and TV Data Bases
for your P.C.
Call today to request a free sample.
Communications Data Services
6105 E Arlington Blvd Falls Church VA 22044
(703) 534-0034

CASSETTES - CARTS - REELS
J & I AUDIO/VIDEO
A wholesaler in the Radio and Television market.
Now running SPECIALS on audio and video:
BASF CASSETTES - AMPEX R-R's AUDIOPAK, FIDELIPAC & 3M CARTS
For more information call person-to-person collect: **Kris Elliot at 818-992-4288** or write to: **J&I Audio/Video 20899 Kelvin Pl., Woodland Hills, CA 91367**

American Media Services
Authorized Distributor for **Scotch Cart II Broadcast Tape Cartridge & Scotch Open Reel Tape**
NAT'L: (800) 345-1953
TEXAS: (800) 521-1953
LOCAL: (817) 535-1953
FAX: (817) 536-1953

MISCELLANEOUS . . . WTS

Sonex One natural white, unopened boxes, \$150 ea plus UPS. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Advent 1000 videobeam TV projector, complete as is, \$150, pick-up only located in NYC area, \$150. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

Pole contactors (3), 120 V coil, 80 A, \$50; 160 A, \$100. Dave, 209-467-0317 evenings only.

Radio Shack TRS-80 computer monitor, keyboard, expansion interface, quick printer, as is, \$20. P Russell, Bowdoin College, Sills Hall, Brunswick ME 08011. 207-725-3066.

Extel teleprinter AF-11, BO. M Cramer, WGBA, 1391 N Road, Green Bay WI 54307. 414-494-2626.

NCR 7900 VDT's (2), \$75 ea; NCR line printer w/stand, \$1000; (2) Applied Digital Data System VDT's, \$50 ea; (2) Data Comm line printers, \$75 ea; Western Union Telex TTY-style terminal w/stand, \$50; (9) removable hard disks, \$100 ea. T Weeden, WMTV, 6802 Putnam, Madison WI 53711. 608-274-1515.

ATT Merlin 410 phone system w/4 lines in & 10 stations, includes wires & 8 phones, 35 yrs old. M Hendee, KUNQ, POB 30, Houston MO 65483. 417-967-3353.

Sparta tech manuals for xmtrs & audio products. Write for list. D Peluso, KFM Radio, POB 15223, Las Vegas NV 89114.

Tec attenuators mono pots for RCA BC7A board, gd cond, some w/cue, \$40 ea; Shalco attenuators, stereo pots in gd cond w/cue. B Arnold, 700 Productions, 105 Dorado Court So, Middle Island NY 11953. 516-924-9020.

Canon female chassis mount, used 3 pin XLR female on right angle bracket, 60 pcs will sell entire lot only, \$30. R Nimitz, Univ of Notre Dame, POB 1088, Notre Dame IN 46556. 219-239-6423.

Reliant 16 computer phone system w/16 complete stations, built in intercom system & 6 line capability, excel cond, \$1000; also Telrad phone system w/3 stations, can expand to 8 stations, \$450. V Clough, WZFX, 225 Green, Fayetteville NC 28302. 919-486-4991.

Cushman Trackster small two-man snow cat modified for deep powder snow, excel cond, w/trailer & spares, \$3500/BO. D Barton, KMTI, POB K, Monti UT 84642. 801-835-7301.

Want to Buy

Manuals for RCA TK-10, 30, 31 & any other gd old vacuum tube gear. A Weiner, Britton Road, Monticello ME 04760. 207-538-9538.

Crystal or synthesized UHF or VHF mobile 2-way radios or handhelds. Units need not work; also want programmable scanner. G Pernad, 1510-6 Peachtree, Cocoa FL 32922.

Brush Cleveite headphones, smaller black hard plastic cans, & cords etc. J Taylor, WGBA, Box 467, Quincy IL 62306. 217-223-7700.

RCA CT-100, CTC-5 color TV monitors or home sets, early vintage or early studio monitors. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

Schematics for Beaucart R/P model 2 tape cart unit, also rear terminal ID connections, photo copy greatly appreciated. D Peluso, KFM, POB 15223, Las Vegas NV 89114. 702-732-7753.

Ron Radio Comm. Inc
P.O. Box 201
Brightwaters, NY 11718

Authorized dealers for

- Audicord Cart Machines
- Audisar Products
- Belar Electronics
- Broadcast Electronics
- Crushcraft Antennas
- Delta Electronics
- Energy Onix FM Transmitters 100w to 60KW
- Hnat Hindes Audio Processing
- Inovonics FMX & NRSC
- Jampro FM Antennas
- Kintronic Phasors & Antenna Tuning Units
- L. P. B. Consoles
- Micro Controls Inc. (Composite STL) \$5,795
- MAXRAD-Antennas
- Valley People Audio Processing
- Scalla Antennas

CALL RON RADIO
FOR: Frequency Searches,
License Applications,
Construction Permit
Applications. Leasing thru
DACOM Financial Services

800-666-3525

Jazz record collections, 10" LP/12" LP bebop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, NYNY 10003. 212-674-3060.

MONITORS

Want to Sell

McMartin TBM-4500A FM stereo mod mon, \$800. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Belar RF amp for AM, \$75. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

FM receiver module for TFT-760 EBS unit, tuned to 102.9 MHz, BO. M Patton, WXOK, 6819 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

TFT 730A SCA mod mon, 2.5 yrs old, including 67 kHz SCA gen for Harris TE3 exciter, both in excel cond, \$1000. D Starkey, WVHF, 350 W Main, Clarksburg WV 26301. 304-624-5525.

Belar SCM-1 subcarrier monitor crystalized for 67 kHz & 92 kHz, \$990; Belar RFA-2 AM RF amp tuned to 1340 kHz, \$300. M Hurst, WICO, POB 909, Salisbury MD 21801. 301-742-3212.

Nema Clarke 8 tower directional antenna monitor, BO or trade for AM or FM mod mon. F Vobbe, GNBC, POB 5031, Lima OH 45802. 419-228-4199.

Want to Buy

FM monitor w/RF amp. D Van Zandt, WJLU, 2596 S.R. 44, New Smyrna FL 32069.

Belar FM mod mon for xmttr site. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-7787.

FM stereo mod mon, any brand in gd cond. C Froke, POB 811, Deer Ledge MT 59722. 406-846-1221.

RCA BW-50, Belar AM-1, or AM monitor capable of measuring 100% neg/125% pos, will consider others, also looking for an FM monitor rod. F Vobbe, GNBC, POB 5031, Lima OH 45802. 419-228-4199.

McMartin TBM4500A, any cond, older type monitor either blue or beige. Goodrich Enterprises, 402-493-1886.

MOVIE PROD EQUIP

Want to Sell

Kodak Marc 300 16mm pageant film projectors in working order w/spare lamps (2), \$75 ea. P Russell, Bowdoin College, Sills Hall, Brunswick ME 08011. 207-725-3066.

Model 1036 5 Gang Ediquipt; Model 816 portable hot splicer, 16mm, Maier Hancock; Beaulieu crystal sync; Guillotine splicer, 16mm; Craig editor viewer, 16mm, KE-16; Duplikin III & IV; (2) Arion Omni-Mate, 2-Arion dissolve units; Beaulieu R-16 w/17 to 68mm lens; B&H wide angle w/case, filters, battery & charger; Singer Graflex 16mm, items are all in gd cond & are offered on a BO price, singly or all items. M Fiedler, 5346 Dupont Ave So, Minneapolis MN 55419. 612-822-0013.

RCA 35mm film recorder, excel cond, \$3500; Moviola 35mm upright (1) Moviola (1) Pix sound head, \$5000. J Gaffney, Ross-Gaffney, 21 W 46th, NYNY 10036. 212-719-2744.

Kem 8 plate film editor w/16/35mm heads, \$20,000. J Workman, Maritz Comm, 600 W Lafayette, Detroit MI 48226. 313-963-1200 X501.

RCA 400 Senior portable 16mm projector, (2) cases, optical & magnetic sound, BO pls shpg. R Norman, RNP, 11 Glenwood, Toms River NJ 08753. 201-349-8569.

B&H 1545 16mm sound movie projector, gd cond, \$125; B&H 1585 late mdl 16mm sound movie projector, excel cond, \$165; Neumade motorized 16mm film rewind w/foot control, includes one non motorized rewind, \$40. G Ormrod, GFO Prod, 432 E. X St, Turmwater WA 98501. 206-352-8028.

Want to Buy

Mitchell 16 & 35mm cameras & access; Zeiss 9.5mm distagon, reasonable, need not mint. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

RECEIVERS & TRANSCEIVERS

Want to Sell

McIntosh MX110 FM tuner/preamp, w/custom road case, excel cond, \$150. M Ashley, Swing-Street Studios, 620 Bercut, Sacramento CA 95814. 916-446-3088.

Bearcat BC140 10 chnl programmable scanner, \$50. P Russell, Bowdoin College, Sills Hall, Brunswick ME 08011. 207-725-3066.

RCA Tac Tec (2) UHF 2 chnl handhelds, one has blown RF PA, w/leather holsters & drop in charger, \$100/both. G Wilson, WGTG, POB 30, Toledo OH 43692. 419-243-3091.

McKay/Dymek AM-10 wideband AM tuner, \$195. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Motorola Maxar 80 w/MRT I, 55 watt VHF high band base station w/CTCSS on 151.775 w/Motorola radio telephone interconnect, like new cond w/manuals & schematics, \$1800. C Kimbrough, WRXO, POB 1176, Roxboro NC 27573. 919-599-0266 aft 6PM.

Johnson ST4, like new, 91.1 67 kHz, 92 kHz, \$75. C Peterson, Showsound, 5405-A Southern Comfort Blvd, Tampa FL 33614. 813-884-1462.

WE'VE DONE THE HARD PART

Our new program computes TV & FM Field Strength for you. It uses the FCC algorithm to determine distance to contour, field strength at distance, and bearings between coordinate pairs. It runs on any IBM-PC compatible and incorporates FCC Docket 88-56 rules. Only \$95.00

Jeremy Lansman
Spectrum Resources
POB 240-467
Anchorage AK 99524
(907) 345-2630

Want to Buy

KLH Model 21 small FM mono table radio, working or not wanted for parts unit. J Roper, Imperial Snd Sld, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

REMOTE & MICROWAVE EQUIP

Want to Sell

Microdyne 1100-PCDR(S) demodulator/receiver, EC, analog rec w/manuals, only 3 yrs old, \$1300. J Mabb, WHUC, Hudson NY 12534. 518-828-3341.

Comrex PLX-R single line freq extension receive unit, \$200. M Black, WEOS, Geneva NY 14456. 315-789-8970.

FOR SALE

Ku-Band Earth Station
26' highway trailer, environmentally controlled shelter, 4.5m dish, dual 300W TWT amps, 25kw diesel generator, monitoring and test equipment. Write or phone: Mr. Seaberg, 715 N. Wheaton Ave., Wheaton IL 60187. (312)-653-2421.

Microdyne 1100-FCC(X1)R(DC)L satellite/TV receiver, EC, analog rec w/manuals, 3 yrs old, \$1200. J Mabb, WHVC, Box 123, Hudson NY 12534. 518-828-3341.

Moseley MRC-1600 remote control, 4 yrs old in working cond, wireline, \$2500. A Pavao, KY-NO, 2125 N Barton, Fresno CA 90703. 209-255-8383.

Moseley DRS-1 20 chnl expandable digital remote control system w/extra spare parts & boards, \$1250; Comrex single line PLX II transmit & RLX receive unit, \$1250/system. G Wachter, KKFR, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Harris 10' dish w/stand; Harris SCPC receiver, BO. D Agnew, 5601 So 27th, Lincoln NE 68512. 402-421-2223.

Moseley PCL-303 STL-xmttr & receiver, in gd cond, \$1000. R Bauer, KCPX, 434 Bearcat Dr, Salt Lake City UT 84115. 801-485-6700.

Marti MR-30 tube receiver on 161.84 MHz w/manual, \$250; Moseley WRC 10T phone line remote control, 10 chnl w/manuals & at least 5 relays, \$250. B Keaton, WGEZ, POB 416, Beloit WI 53511. 608-365-8865.

Enterprise Elec WR-100-5 color weather radar w/NTSC output, 550 kW/8' parabolic antenna in fiberglass dome, BO with or without 80' self support tower. D Roden, WHNT, 1701 Monte Sand Blvd, Huntsville AL 35801. 205-533-3676.

Merrimac MS-1 satellite tracking controller, Z-80 based micro processor, call for info, \$1500; Realistic 32-1221 complete 2 piece FM wireless mic system, \$40 ea. P Russell, Bowdoin College, Sills Halls, Brunswick ME 04011. 207-725-3066.

M/A Com 23 GHz video microwave system, one audio ch & video 2 ch capability, rebuilt by M/A Com 10/88, \$4250/BO. K61CU TV, 941 'O', Ste 902, Lincoln NE 68508. 402-476-6115.

Advanced Micro Dynamics TC-8 w/speech dialup option, \$2600/BO. M Black, WEOS, Geneva NY 14456. 315-789-8970.

Modulation Associates BP72 includes main chassis, pwr supply & (2) demods, one is switchable between 76.7 & 77.9 MHz, the other 64 & 76.7 MHz, does not have the down-converter, BO. D Gander, KDUZ, Box 10, Hutchinson MN 55350. 612-587-2140.

Marti STL-10 dual system, 4 yrs old, \$2995. T Mensendiek, KSSC, POB 409, Carthage MO 64836. 417-358-4049.

Drake ESR 2240 satellite rcvr. P Baillon, KMCM, 1218 Pioneer Bldg, St Paul MN 55101. 612-222-5555.

TFT 7610 digital remote control system, configured for 4 wire operation, 5 yrs old. P Baillon, KMCM, 1218 Pioneer Bldg, St Paul MN 55101. 612-222-5555.

Comtech RCV-360 satellite receiver, \$1000. W Hanlon, WKFD, 19 Updike, Wickford RI 02852. 401-295-8808.

Wegener 1601 tuned to Transtar's AM only, comp. pkg ready to go, 18 mos old, no dish or LNA, \$3295. T Mensendiek, KSSC, POB 409, Carthage MO 64838. 417-358-4049.

Moseley SCG-8 subcarrier generators one tuned to 67 kHz, one tuned to 92 kHz, \$595 ea. M Hurst, WICO, POB 909, Salisbury MD 21801. 301-742-3212.

Moseley MRC-1600 (2), \$1500/ea. A Kord, WVRX, Box 325, Westerly RI 02891. 401-596-7728.

Moseley PCL-505C composite STL system, excel cond, tuned to 947 MHz, \$3600. G McCoy, KZEN, 1606-1/2 16th, Central City NE 68826. 308-946-3816.

Moseley MRC-15 studio end of MRC-15 unit, sell or trade for Moseley PCL-505C receiver. P Parks, KYKR, 27 Sawyer, BMT TX 77702. 409-838-3911.

TFT 7610-C remote control, 3 yrs old, clean, works perfectly, \$2400/BO. R Koltz, KKRK, POB 995, Kernville CA 93238. 619-376-3701.

CONSULTANTS

R.L. HOOVER
Consulting Telecommunications Engineer
11704 Seven Locks Road
Potomac MD 20854
301-983-0054
Member AFCEE

R.J. GRANDMAISON, P.E.
CONSULTING ENGINEER
Applications and Rulemakings
11213 Split Rail Lane
Fairfax Station, VA 22039
(703) 764-0513
Member AFCEE

RADIO SYSTEMS ENGINEERING
FCC Applications • Design
• Installation • Field Service
Experienced & Affordable
4250 East Powell Avenue
Las Vegas, Nevada 89121
24 Hr: (702) 454-2085

FM STUDY for YOUR PC
Fast, precise, and cost effective!
Monthly data base updates available
Call today to request a free sample.
Communications Data Services
6105 E Arlington Blvd
Falls Church VA 22044
(703) 534-0034

★ ★ ★ ★ TOWER NETWORK SERVICES
Tower Inspections & Maintenance
Pressure Vat Guy Treating
Digital Tension Measurements
Structural Design Modifications
Service like you've never seen
We do high volume at LOW PRICES
214-891-0555 DALLAS
404-699-2620 ATLANTA

AUDIO CONCEPTS & ENGINEERING SERVICES
Broadcast Audio
• Consultation
• Installation
• Optimization
P.O. Box 459
Mechanicsville, VA 23111
(804) 730-0671 (804) 356-8364 Mobile
JEFFREY P. LOUGHRIDGE

SPENCER BROADCAST
The Radio Station Specialists
Chuck Spencer
Phoenix, AZ
602-242-2211

EVANS ASSOCIATES
Consulting Communications Engineers
FCC Applications, Design & Field Engineering
Broadcast Engineering Software
216 N. Green Bay Rd.
Thiensville, WI 53092
(414) 242-6000
Member AFCEE

W. LEE SIMMONS & ASSOC., INC.
BROADCAST TELECOMMUNICATIONS CONSULTANTS
5 Gracefield Road
Hilton Head Is., SC 29928
(803) 785-4445

SOFTWARE FM CHANNEL SEARCH
FM Database pool
MSDOS
EGA Graphics-Color
Broadcast Technical Consulting
Doug Vernier
Broadcast Consultant
1600 Picturesque Drive
Cedar Falls, IA 50613
319-266-7435

BRENTLINGER BROADCAST ENGINEERING INC.
Charles Jayson Brentlinger
President
COMPUTERIZED ENGINEERING
REPORTS/ALLLOCATION STUDIES
AM*FM
DIRECTIONALS*AUDIO*STL
*SATELLITE COMMUNICATIONS
4338 East Acoma Drive
Phoenix, Arizona 85032
(602)867-0181

Consulting Communications Engineers
• FCC Data Bases
• FCC Applications and Field Engineering
• Frequency Searches and Coordination
• AM-FM-CATV-ITFS-LPTV
OWL ENGINEERING, INC.
1306 W. County Road. F,
St. Paul, MN 55112
(612)831-1338 "Member AFCEE"

TOWER SERVICES
Light Replacement
Routine Maintenance
Ground Systems
Painting
20 years Experience
John Nix
PO Box 13244 Salem, OR 97309
503-581-4056

MAGRILL ENGINEERING
(904) 591-3005
APPLICATIONS—CONSTRUCTION
UTILITY PROBLEMS SOLVED
FAIRFIELD, FLORIDA

SPECIALIZING IN ERECTION,
REPAIRING, PAINTING
AND MAINTENANCE
RADIO, TWO-WAY, T.V. TOWERS
AND FLAG POLES
A STEEPLEJACK CO.
PAINTING AND STEEPLEJACK CONTRACTORS
FULLY INSURED FOR YOUR PROTECTION
DON HIGLEY 462-6105 3722 ROMA HOUSTON, TEXAS 77080

Moffet, Larson & Johnson, Inc.
Consulting Telecommunications Engineers
Two Skyline Place
5203 Leesburg Pike #800
Falls Church VA 22041
703-824-5660
800-523-3117
Member AFCEE

MIRKWOOD ENGINEERING
Rural & Remote Site
Field Engineering
50 Park Ave.
Claremont, NH 03743
603/542-6784

Use The ActionGram for Immediate Action!

REMOTE . . . WTS

Moseley DRS-1 20 chnl expandable digital system w/extra spare parts & boards, \$1250; Comrex single line PLX II transmit & RLX receive unit, \$1250/system. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Fairchild Dart 384 to trade for a 7.5 kHz card, will consider purchase if price is right. G Dow, WBKN, POB 711, Brookhaven MS 39601. 601-833-6221.

Symetrix 108, only used a few weeks, extra control unit for screening, \$2000. T Kuhl, Programmed Comm, POB 738, Syracuse NY 13214. 800-553-5688.

Wegener 1601 mainframe, complete system for SMN country coast to coast including power supply 1683-08, 1606-02, 1645, 1646, 1622 cards & on board downconverter. Less than 1 yr & in excel cond. \$1800/BO. T Randall, KJJO, Box 790, Brookings SD 57006. 605-692-9102.

M/A Com 23VFM microwave system, video plus 1 audio chnl, 2 chnl capability, rebuilt by M/A Com 1/89, 23.925 GHz, \$4250/BO. S Kafka, K61CU-TV, Ste 902, 941 O St, Lincoln NE 68508. 402-476-6115.

Moseley PCL505 composite stereo microwave system on 945.0 MHz, gd cond, just removed from service, \$2500. B McCann, KKWY, 5 Triad Ctr, Ste 480, SLC UT 84180. 801-328-9800.

Moseley TRC-15A studio end of remote control, BO cash or trade for Moseley PCL-505C receiver. P Parks, KYKR, 27 Sawyer, Beaumont TX 77702. 409-838-3911.

Gentner TEI-9 telephone interface dual buss 9 & 5 line opt 1A2 keyset system, \$2500. B Gellhaus, WDVTV, POB 73, Cheltenham PA 19012. 215-635-4815.

Catel CA-2000 FM modulator & stereo gen for cable systems, like new, manuals, \$800. J Corcoran, KWWW, POB 638, Wenatchee WA 98807. 509-662-7135.

Marti RR 30/150 161.70 MHz, rack mount or counter top, was working when replaced, \$550. M Hendee, KUNQ, POB 30, Houston MO 65483. 417-967-3353.

Moseley SCG8 (3), one 185 kHz, two 67 kHz, never used, \$2500/all or BO; Moseley PCL-606, used 3.5 yrs, like new, \$10,000 firm. J Evann, KNTI, 75 4th St, Lakeport CA 95453. 707-263-1551.

MCI STL system, composite used only one month. 945.5 MHz. Use \$5995, used price \$3400. One system only! Call Dan 713-774-3314.

Want to Buy

Macom MA-2B or 6B, working, repairable or for parts. Also consider other 2 & 6-7 GHz, all solid state gear, sub-carrier modules also wanted. R LaFrance, WTVS, 216 Broad, New London CT 06320. 203-444-2626.

Marti RPT-15 or RPT-30 for sports bdcts, prefer UHF. P Bailon, KMCM, 1218 Pioneer Bldg, St Paul MN 55101. 612-222-5555.

Marti RMC-15S, high speed, whole or studio unit, used or new. F Bonnet Jr, WOYE, POB 1718, Mayaguez PR 00709. 809-834-4384.

Moseley 606/C STL. WVIS, POB 467, Frederiksted, St Croix VI 00840. 809-778-778-.

Marti RPU receiver tuned to 161.760, but will consider anything. R Fess, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Moseley TR-1S remote control head, studio unit only. J Kennedy, Bond Bldg, 309 W Main, Greenville IL 62246. 618-664-3300.

SA 7300/Dart 380 digital satellite rcvr w/15 kHz dual audio card & one cue card for satellite network reception. M Hoskins, KMON, No 210 Rainbow Motel, Great Falls MT 59401. 406-761-1000.

Satellite automation system w/manuals, complete system. B Carr, WRED, 1201 Fremont Pk, Woodville OH 43469. 419-836-9696.

Marti, RMC, 2AX to include: studio unit RMC-2 AXS xmt, RMC 2 AXT (A), RMC 2 AXT (10) or RMC-2 AXT (25). D Staats, WADC, 703 Market St, Parkersburg WV 26101. 304-485-7354.

RCA TTR-1 remote microwave rcvr & xmt link. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

STATIONS

Want to Sell

SW MO 1 KW AM/3 KW FM in Joplin, excel real estate & equip. Will consider selling stations together or separate, stations are dark, serious inquiries to Great Radio Group, Keven Checkit, POB 409, Carthage MO 64836. 417-358-4049.

All remaining radio station assets for sale. Transmitter, lower, air studio console, TT's, cart decks, R-R's & more. All working order, sold as package, min \$7500. For list write RLJ, 7711 Wessex Ln, Columbia SC 29223. 803-788-6465.

6th Anniversary SPECIAL

FREE: '99 Money \$Saving Idea\$ for Your Station'' with 13 weeks of

SMALL MARKET RADIO NEWSLETTER

Send Just \$33.00
275 19th Street
Otsego, MI - 49078

Will sell 40% of profitable Am in Lubbock TX, valuable real estate, two tracts included, owner retiring, liberal terms. D Ballard, KLF, 4410 10th St, Lubbock TX 79416. 806-791-1747.

FM Class A & AM 1.000. Retiring, priced to sell, Real Estate available. P Robillard, 1803 N 1st East, Haynesville LA 71038. 318-623-0105.

AM station for sale, small market nice start up, living quarters, gd fishing & hunting, studio tower all on the same land making money, 125 miles from Seattle or Portland. E Kazmark, KAZZ, POB 1369, Deer Park WA 99006. 509-276-8817.

Will sell up to 45% of 10 kW AM under construction in SW Montana. Station will serve Bozeman, Butte, Helena, Dillon & Livingston, plus NE Idaho & Yellowstone Natl Park. Also unopposed FM application for Class C now before FCC. Golden Empire Bldg, POB 710, Ennis MT 59729.

Want to Buy

LPTV stations in GA, AL or FL, will purchase w/100% owner financing. N Davis, POB 5180, Defuniak Springs FL 32433. 904-892-4038.

Looking for AM, FM or CP in east for right price/terms. H Kozlowski, 703-631-0197.

FM CP's WANTED

Clients seek CP's any size market. Small, medium, large. Will consider FM upgrades, too!

Media Market Brokers

Don Nahay
404-561-5400

STEREO GENERATORS

Want to Sell

Wilkinson SG1E stereo gen, \$800/BO; Col-lins 27-M stereo gen, \$250. WVIS, POB 467, Frederiksted, St Croix VI 00840. 809-778-5199.

Motorola 1300 C-Quam exciter & Motorola 1310 C-Quam mod mon, \$5500/both. T DeCapua, WLKK, 18 W 9th, Erie PA 16501. 814-456-7034.

Gates M-6146, matches M-6095, gd working cond, \$350/neg. S Neumann, WRPS, POB 5343, Rocky Point NY 11778. 516-744-3704.

Want to Buy

FM stereo gens any kind reasonable, with or without exciters. Joe, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

American Electronic Lab 2213 operators & service manual needed. D Willey, Life Bldg, POB 96, John Day OR 97845. 503-575-1840.

SWITCHERS (VIDEO)

Want to Sell

Grass Valley 1600-4S master control switcher, stereo, machine control, excel. BO R Rickly, WUAB, 8443 Day Dr, Parma OH 44129. 216-845-6043.

Crosspoint Latch 6139BK 16 input video switcher w/model 7239 automated controller, \$17,000/BO. E Martin, Maxwell Prod, 2208 Terrace View Dr, Louisville TN 37777. 615-970-2192.

Crosspoint Latch 6112, 8 inputs plus black/colorizer, (2) full ME's chromakeyer, DSK, gd cond, \$3100. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Want to Buy

Telemation TSE-200VS service manual & operators manual. W Steinbrecher, USBP, Fletc, Bldg 64, Glynco GA 31524. 912-287-1862.

TAPES, CARTS & REELS

Want to Sell

Audiopak A-2 carts (50), some need to be re-wound, BO. Brian, WEZQ. 205-467-3261.

14" reels, (30) IGM big band music 2T stereo, 7.5 ips, never played, can be split for 10" reels, \$30 ea delivered. F Anderson, KANR, 3801 S Ave So, Freat Falls MT 59405. 406-452-2810.

Betacam 20 min & 30 min tapes, Sony, Fuji, 3M, Ampex, also Betacam metal SP tape; 3/4" videotape, 5, 10, 15, 30, 60 min. J Workman, Maritz, 600 W Lafayette Bl, Detroit MI 48226. 313-963-1200.

Videotape, 3/4", 15 min, \$4; 30 min, \$5; 60 min, \$7, gd cond. J Workman, Maritz Comm, 600 W Lafayette, Detroit MI 48226. 313-963-1200 X501.

Fidelipac Mastercart, approx 1100, various lengths, but mostly 2.5 to 4.5 minutes, w/Hot Tape & AC stereo music, gd cond, \$2.25 ea or \$1895/all. C Shelenberger, Specter Bldg, POB 2347, Ft Walton Bch FL 32549. 904-243-7676.

Ampex 456 1", (3) NAB 1" reels, 406 1" 4-NAB reels, 407 1" 3-NAB reels, 456 1/4" 20-bulk hubs. S Cronen, 312-945-3555.

Fuji 621 1" 60 min plus 30M, 3/4" 5 min, 10 min, 15 min, 30M, 60M, gd cond. J Workman, Maritz, 600 W Lafayette, Detroit MI 48226. 313-963-1200.

Betacam tape, 20 min & 30 min, also metal SP Betacam, 20 min. J Workman, Maritz, 600 W Lafayette, Detroit MI 48226. 313-963-1200.

Audiopak AA-3 carts, hundreds, music lengths, some only one pass thru, others unopened, call for details, \$1.25 ea. D Solinsky, WWRM, POB 22000, St Petersburg FL 33702. 813-576-1073.

Want to Buy

Beautiful Music/Big Band/Nostalgia bldt tape library on 10" reels, mono OK, stereo preferred. K Hill, WHCB, POB 2061, Bristol TN 37621. 615-878-6279.

Transcriptions, 16", 7" to 10" blank recording discs, per 1960 bldt equip magazines, catalogs, instruction manuals. R Van Dyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

Old Programatic audio tapes, also seeking a Programatic system, Model RA-1, & 25 Hz generator. SS Wray, POB 422, Ashley IN 46705. 219-665-6427.

Top 100/200 of ea yr from 1950-1980 on record, tape. Also copy of History of Rock & Roll, Drake Chanault & Chum. S Stevenson, POB 735, Blaine WA 98230. 604-531-4576.

TAX DEDUCT EQUIP

Eng student desiring donation of old bldt equip (anything) in repairable cond, will pay all shipping charges. EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Computer equipment available. Will donate for tax deduction Data General Nova/4 System w/2 tape drives, Wang computer w/2 terminals, (2) Hazeltine 1500 terminals, J Davis or D Green, KJOI, 6430 Sunset Blvd, Los Angeles CA 90028. 213-469-9968.

Expressive Comm Inc a non-profit educ corp seeks new/used bldt equip, tower, xmt, studio. M Scheurman, WAPN, 904-677-4272.

Amateur radio club seeking TV equip to be used in ATV projects. Need any type of TV equip, working or not, will pay shipping & give tax deduction certificate. Gene Kirby, Union County ARC, 13613 US 36, Marysville OH 43040. 614-261-8871.

A&D Cartridge Rebuilding Service

We clean, load & pack. Serviced within 10 work days! Work guaranteed!
3380 Blakeley Ave., Eau Claire, WI 54701
(715) 835-7347

Group home working w/troubled teenagers looking for video equipment. R Scott, ISOT Inc, Box 35, Canby CA 96015. 916-233-4601.

Nonprofit missionary station in El Salvador needs 8008's in any cond so long as the bases, pins & plate caps are gd, will pay shipping; also need 892R's for xmt, will pay shipping. J Counter, YSLE, 5484 San Patricio Dr, Santa Barbara CA 93111. 805-967-6410.

Bauer Mdl 660, FM exciter, for spare parts, need spare xtal, 89.9415 kHz, power supply, RF amp & FM exciter modules for the Granger/Bauer mdl 660, working or not; also needed are 1-5/8" flange connectors, 90 degree elbow, 1-5/8" to 3-1/8" flange adaptor, N to 1-5/8" flange adaptor EIA 3-1/8" -1-5/8" EIA reducer. B Rathman, KRVM, 200 N Monroe, Eugene OR 97402. 503-687-3370.

Any FM under 1500 W & AM under 250 W for new school FM station, any equip to get on the air; also carts, consoles, TTs, etc. fax receipt given. S Neumann, WRPS, POB 5343, Rocky Point NY 11778. 516-744-3704.

Christian College in Utah is looking for equip for small NCE FM station. Need 1 or 2 KW FM xmt, antenna, tower, about 100', console, cart machines, mics, EBS, processing equip, etc. Also test & office equip along w/easy listening & Gospel music tapes & LPs. Will pay shipping or pick up. Salt Lake Baptist College, 3769 W 4700 South, Kearns UT 84118.

Marti stereo/dual STL system, 950 MHz band, excite station needs 2 complete systems w/combiners & antennas, prefer recent. Marti STL-10 xmt's & R-10 rcvr units. Scala Paraflector antennas, but will consider any comparable system. B Rathman, KRVM, 200 N Monroe, Eugene OR 97402. 503-687-3370.

Non-Commercial Christian FM station seeks 25 kW FM xmt, high power antenna & coax. E Welch, WKCL, POB 809, Lapson SC 29456.

Christian broadcasting company needs mod mon, stereo mon, SCA mon, 500 watt xmt, w/exciter, mono R/P & P/B carts, 78" transmission line, prefer solid state equip, will give receipt for tax write off. D Willey, Life Bldg, POB 96, John Day OR 97845. 503-575-1840.

Non-profit station w/501C status seeks donations of all equip necessary to start up new FM. CSRA Public Radio, 1518 Tara Ct, Augusta GA 30906. 404-796-2865.

Non-profit educ sta needs donation of STL system & cart machines. R Moughton WNLE, Rt 2 Box 705A, Yulee FL 32097. 904-261-7841.

High School FM station is in need of carts & EBS monitor, will pay shipping. S Tressor, Kearns H.S., 5525 S 4800 W, Kearns UT 84118. 801-964-7500.

Non-profit Radio Reading Service for the blind & print-handicapped in Connecticut needs (2) R-R's & (2) cart machines in gd cond, will pay for ship or pick-up. Cynthia Clark, CRIS Radio, 589 Jordan, Wethersfield CT 06109. 203-246-3579.

FM xmt's needed for charitable organization, will pay for transportation & give receipt for fair market value. T Hunt, SOS Radio Network, 702-731-5452.

Equipment rack, studio furniture, tone generator, mic arm needed. K Haas, Penna Public Radio, POB 224, Uwchland PA 19480. 215-458-0780.

Christian Bdctrs seek donation of any radio equip, in working cond. MTD Comm, POB 2083, Ashland KY 41105.

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: _____

HELP WANTED

CE, AM/FM. Background in multidirectional antennas a must. Provide resume w/work history & brief description of your experience with AM directional & all FM related information. Working knowledge of FCC rules necessary. Include industry references & salary requirements to: Ray Worth, Genesis Broadcasting, 1750 Howe Ave Ste 500, Sacramento CA 95825. E.O.E.

Immediate opening in Wisconsin. Send resume, references to Jerry Brown, VP/Engineering, Joyner Communications, POB 1125, Cary NC 27512. EOE, no phone calls please.

POSITIONS WANTED

Young, bright, humorous, eager music director & talent w/5 yrs exper, seeks position anywhere, prefer Top 40 or AC format. J Tirey, 212-1/2 S Third, Richmond KY 40475. 606-464-3151.

Program Director w/16 yrs exper, gd promotional & people skills avail, CHRA/OR/AC. Paul Wilson, 801-566-2144.

Tampa Bay engineer, 21 yrs FCC, SBE, Naber, presently employed, looking for contract. Write: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 89-08-02RW.

Announcer in 13th market seeks PD position in smaller market, South preferred, college degree w/exp to back it up. Matthew, 813-381-4875.

Program Director, assistant engineer, announcer, board Op/AT, 4 yrs exper in mid market station. B.S. in communication, minor in business administration, very creative, willing to relocate. Write: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 89-08-01RW.

CE w/big prod voice, over 10 yrs hands-on eng exper seeks CE position w/prod in a top 100 market. G Morgan, 704-563-8676.

18+ year pro radio Director of Engineering looking for group or large market station. Have license will travel, reply to Radio World, POB 1214, Falls Church VA 22041. Attn: Box 7-1-89RW.

FT position, traffic, continuity, airshift or production, 11 yrs FT & PT, desire Northern AL area. C Calvert, POB 1408, Cullman AL 35056. 205-942-7800, days, 205-739-3866, nights.

Engineer/Announcer, young, ready to work FT, weekends, late late shift, etc, will go anywhere for radio. M McKenna, 312-636-0119.

Engineer w/17 yrs in radio, 10 yrs Chief, NARTE, FCC, AM/FM, currently employed in California medium market, looking. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 89-08-04RW.

Innovative young programmer looking to successfully pilot your CHR station into the 1990's & beyond, call Jim, 304-233-8937.

Assistant Mgr in medium mkt. AM looking to move on to more challenges, hands on all operations. Write to Radio World, POB 1214, Falls Church VA 22041. Attn: Box 7-3-89RW.

Former owner/GM w/major mkt exper, SF Bay area, seeks mgmt position w/mid to large mkt station(s), prefer West Coast, exper in all phases, incl turnaround. M Seeber, 408-371-8819.

Male broadcast school grad seeks DJ position, over 3 yrs exper in music & sports, will relocate. P Rappaport, 24380 Summerhill Ave, Los Altos Hills CA 94022. 415-948-9250.

Degreed eng (BSEE) w/5 yrs RF exper, seeks position. Experienced w/AM/FM shortwave. Willing to relocate, US/Internat. Write to Al Muick, POB 306, Fogelsville PA 18051.

Personality, or other position, with creative freedom, desire fun, promotionally active employer, no stale situations. Call Mike, 414-257-0940 or 602-721-7263.

For more information on a 7 yr exper announcer, w/show prep, copywriting & production skills write: S.C.S., 312 Robertson, Sulphur Springs TX 75482.

Mature, topical, witty, 7 yrs in business seeking AOR gig, smooth pipes, will relocate. Sky King, 1783 Lancer Pl NW, Wash DC 20009. 202-265-5383.

PD, Sales, announcer looking to get back into radio. BS in communications & business, K Robel, 2141 N Lakewood, Chicago IL 60614. 312-929-4991.

Newcomer willing to learn radio, Ham & some tech exper, willing to start from bottom. S Neumann, 3 Pearl Rd, Rocky Point NY 11778. 516-744-3704.

Morning drive personality looking for new opportunity. Adult communicator, A/C & CHR background. John, 619-240-9264.

AOR/CHR air talents seeks employment in West states area. For resume write N Adams, 674 Floyd Dr, Sandy UT 84070. 801-571-8365.

Available July 1, 7 yr professional seeks OM/PD for startup or turnaround FM or combo. Prefer Midwest, but will relocate anywhere for progressive management. For T/R: POB 201, Pratt KS 67124, by June 15. 316-672-6959.

OPPORTUNITY KNOCKS!! BROADCAST EQUIPMENT SALES

One of America's leading bldt equip distributors is growing! If you can sell bldt equip, we need your help to maintain personal contact with thousands of broadcasters who purchase equip from us every year. Want to apply your knowledge and exper., work in your local area & earn top commissions, don't wait...join our nat'l sales rep organization now! We still need reps in a number of regions of the country. Send your resume to: Roy Laurence, RADIO RESOURCES, 7483 Candlewood Road, Hanover, MD 21076

SALES DEPARTMENT OPENINGS

Full line, well established, broadcast equipment distributor has two openings in the sales department with positions based in the Northeastern United States.

SALES ENGINEER

Must have in depth radio engineering background and possess good communication skills. We are looking for someone who knows radio engineering well, and who can SELL engineers and managers rather than just take orders. Must be a self starter who can generate leads and close sales. RF experience required. Salary plus commission and benefits package. Excellent opportunity for the "right" person.

SALES ASSISTANT



Position involves liaison between salesman, customers, and suppliers. Technical background and good communication skills required. Advertising and promotional experience helpful. Salaried position with good benefit package.

If you are interested in either of these positions and would like a job with a future, please reply in writing to: Radio World PO Box 1214, Falls Church, VA 22041 attn: Box 7-2-89 RW.

TEST EQUIPMENT

Want to Sell

Simpson 379 battery tester or swap Simpson mdl 377 DC meter for above. J Roper, Imperial Snd Std, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

Eico 277 audio generator, gd cond, \$50. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

Tek 529 waveform monitors (9), clean, well maintained cond, \$200 ea. J Perez, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

TEST EQUIPMENT

We Buy and Sell

All types of late model Test Equipment
Hewlett-Packard, Tektronix, Wavetek,
Fluke R.F. & Microwave a Specialty

G.V. BELL & ASSOCIATES

San Mateo, California
1-800-366-5240
(Inside 408/415 area)
415-366-5240
FAX 415-369-9698

Altronix 5715 15 kW FM water cooled dummy load w/spare resistor, \$400. JA Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

HP 330B dist analyzer, tube type, gd cond, \$50. T Weeden, WMTV, 6802 Putnam, Madison WI 53711. 608-274-1515.

Techn-Physic Laboratorium ME 102B wow & flutter meter, made in Germany, serviced by Gotham Audio of NY, BO. C Kimbrough, WRXO, POB 1176, Roxboro NC 27573. 919-599-0266 aft 6PM.

Simpson 458 oscilloscope w/manual, old but works & looks like new, \$200/BO. R Fess, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Air cooled dummy load, 10 kW, like new, \$1200; 15 kW heat exch type water cooled load, excel cond, self contained, \$1500. J Mitchell, WJKL-TV, 315-673-9049.

Delta TCA-5-EX RF ammeter, excel cond, AM Delta base current meter w/toroidal current transformer, calibrated in Delta Lab on 6/16/87, includes all documentation & calibration data in original box, \$400. P Stage, WKVI, POB 10, Knox IN 46534. 219-772-6241.

B&K, Tektronix, Nicolet FFT, level recorder, beat freq oscillators, spectrum analyzers, sound level meters, plus more, call for complete list. G Guarino Sorcerer Snd, 19 Mercer, Nyny 10013. 212-226-0480.

Tek 526 vectorscope, needs HV transformer, gd CRT, complete, very clean, \$250. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

ADC patch panels w/jacks (2), ID panel in a rack mount case. Ed, 808-847-4300.

Potomac Instruments FIM-41 field intensity meter, less than 1 yr old, mint cond, \$1950; PI AT-51 audio test set, gen & analyzer w/TC-51 case, never used, \$2950. T Eifert, POB 1576, Eugene OR 97440. 503-345-5193.

Philips PM3055 oscilloscope, 60 MHz, dual time base w/probes & manual, never used, \$800; Riser Bond 2901B time domain reflectometer w/soft case & manual, never used, \$500. T Eifert, POB 1576, Eugene OR 97440. 503-345-5193.

Fluke DMM 8050A, excel cond, \$325. J Claybrook, WMJJ, 530 Beacon Pkwy, Birmingham AL 35209. 205-943-9600.

Want to Buy

Potomac Instr. FIM-71 FM-VHF-TV fld strth mtr. P Douglas, KWGN, 6160 S Wabash Way, Englewood CO 80111. 303-740-2222.

Distortion analyzer in gd workable cond, late tube-type unit preferred. F Kavenik, WNVN, POB 187, Vernon Hills IL 60061. 312-680-5066.

General Radio 684-A modulated osc maint/operation manual or photo copy. B Caithamer, WMBI, 820 N LaSalle, Chicago IL 60610. 312-329-4304.

TRANSMITTERS

Want to Sell

EMCEE HTU-100 UHF-TV LPTV/translator 100 W w/exciter/upconverter, many extras, clean, vgc. Sue Jenkins, WKOG, 1100 W 42nd St, Indianapolis IN 46208. 317-283-5800.

McMartin B-910 15W FM solid state exciter, tuned & tested to your freq by orig. designer. Ster. avail. Goodrich Enterprises, 11435 Manderson St, Omaha NE 68164. 402-493-1886
RCA BTA 50F 50 kW AM, fully operational, in storage for immed removal. Complete w/all tubes, schematics, floor plans plus many extras. \$18,000 plus shpg; RCA BTA 5F 5 kW AM, excel cond, w/all floor layouts, manuals, tubes, \$10,000 plus shpg; RCA mod transformer for BTA 5F xmt, new in original crate, \$600 plus shpg. G Heidenfeldt, 2880 W Lake, Wilson NY 14172. 716-751-6187.



High performance at affordable prices.

- New front panel programmable composite STL's.
- New directly programmable FM composite receivers
- New options for synchronous boosters and translators
- New FM power levels: 2, 10, 20, 30, 80, 100, 200, 250, 500, 800, 1000, 1500, 1800, 2000, 3000, 3500, and 15000 W

Bext, Inc.
739 Fifth Avenue.
San Diego, CA 92101
619-239-8462
Telex 229882 Fax 619-239-8474

Harris/Gates FM-10H3 10 kW w/TE-3 exciter w/composite STL interface, 20 yrs old, well maintained, in service as aux xmt. A Chambers, WAWZ, Box 14, Zarephath NJ 08890. 201-469-0991.

FM TRANSMITTERS

3.5 KW 1978 McMartin
1.0 KW 1971 CCA
20 KW RCA BTF-20E
10 KW CCA 10000D
Optimod 8000 & 8100
FM Exciters
STL- Marti & Moseley
PMA Marketing
414-482-2638

PCB 1000/S power reduction unit, set to 350 W input, 63.7 W output, tuned to 1150 kHz, complete w/coaxial switch. J Sidote, WELC, POB 949, Welch WV 24801. 304-436-2131.

Harris TE-1 FM exciter tuned to 97.5 kHz equipped w/Orban baseband interface card, \$800. M Hurst, WICO, POB 909, Salisbury MD 21801. 301-742-2312.

RCA BTA 1MX, \$3500; Moseley stereo generator, \$500 & McMartin B-910 exciter, \$850. C King, KIXZ, 1703-B Avondale, Amarillo TX 79106. 806-335-1954.

Harris FM5H 5 kW FM tuned to 89.5 MHz, 9 yrs old w/spares & documentation, excel cond, \$14,000. G Gilbreath, 702-454-2085.

AM xmt, 25 kW, 1 yr old. M Pulley, KYOO, 304 E Jackson, Bolivar MO 65613. 417-326-5257.

Continental Electronics 315R-1 5000 W AM w/solid state exciter, \$32,000. D Jack, Tamarack Comm, 5410 SW Macadam Ste 240, Portland OR 97201. 503-221-5166.

FM ANTENNAS	
1 BAY	\$1,000
2 BAY	2,000
3 BAY	2,900
4 BAY	3,800

MORE BAYS AVAILABLE
All warranted, tuned and tested
ARMSTRONG TRANSMITTER
Syracuse, NY (315) 488-1269
Open 7 Days FAX (315) 488-1365

Collins 21-E 5 kW AM's (4), Gates BC-5E (3), RCA BTA-5T (1) Choice \$8700. 1 kW AM's, Gates BC-1G (2), Gates BC-1F (3), Gates BC-1J (2), Collins 20V3 (2), McMartin BA-1K (2), \$2000-\$5500. Jerry Kautz, Armstrong Transmitter, 315-488-1269.

Continental 814-R1 2.5 kW FM w/exciter, ERI 3 bay antenna & 250' 1-5/8" coax at 93.5 MHz, antenna & coax on tower, like new w/extra tubes, make offer. W McCan, KBHT, 101 S 4th, 3rd Fl, Crockett TX 75835. 409-544-9694.

Ron Radio Comm Inc.

P.O. Box 201
Brightwaters, NY 11718

Energy Onix FM Transmitters 100w to 60KW

- Proven Grounded Grid
- Solid State IPA
- Solid State Cont. System
- The only 7.5KW FM TX on the Market
- Single optional to 12KW
- Leasing thru DACOM Financial Services

800-666-3525

Wilkinson 2500 E. E Kazmark, KAZZ, POB 1369, Deer Park WA 99006. 509-276-8817.

RCA TTU-30C 30 kW UHF, complete & on the air, chnl 45, can be retuned to ch 30-51, \$70,000. J Mitchell, WJKL-TV, 315-673-9049.

ITS 1615 & HMD12 H&V antenna, BO. W Ellis, KOZK, MPO Box 21, Splfld MO 65801. 417-865-2100.

Harris FM 3.5 kW, excel cond, includes exciter, Optimod 8100A & ERI single bay 96.7 antenna, will deliver & install if necessary. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

Gates BC-5B (2) 5 kW AM, excel cond, one tuned to 1590 kHz the other to 580 kHz, plenty of spares, BO. D Barton, KMTI, POB K, Montit UT 64842. 801-835-7301.

Harris FM 2.5 kW w/Versa Count exciter, top cond, \$16,500. G McCoy, KZEN, 1606-1/2 16th St, Central City NE 68826. 308-946-3816.

Harris TE-3 FM 10 W exciter, w/Orban baseband card, tuned to 104.1, \$1400/BO; Collins A825W 10 W, tube type exciter, needs minor work, tuned to 99.5, \$650; Harris MX-15 exciter tuned to 106.1, recently aligned & calibrated by Harris, \$4500/BO. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

Sintronics S1-F 1.5-2.0 kW FM xmt, (2) exciters plus spare parts, new IPA & new rebuilt final, 6 mos old, single phase 220 V, now on-air, you pick up, w/manuals. \$14,500/BO. F Morton, KEYB, POB 1077, Altus OK 73522. 405-482-1555.

Gates M-6095 FM exciter, 10 W, gd cond, w/manual & 94.1, \$350/neg. S Neumann, WRPS, POB 5343, Rocky Point NY 11778. 516-744-3704.

Gates/Harris FM-1G needs minor repair, w/all tubes & manual, tuned to 93.5, \$4500/BO. A Wilkerson, WLIL, POB 340, Lenoir City TN 37771. 615-986-7561.

Gates 1 kW w/RCA BTE 15A exciter w/stereo gen & SCA gen, gd cond, BO. D Agnew, 5601 So 27th, Lincoln NE 68512. 402-421-2223.

Acrodyne T210M/V LPTV xmt, 10 W low band VHF, low hrs, avail immed; Scala Yagi-5 element ant, \$5000. S Olson, WSSM, 1 Odana Ct, Madison WI 53719. 608-276-9454.

Harris 3.5 kW, 3 yrs old, excel cond w/Harris exciter & Orban 8100A Optimod, must sell for upgrade, on 96.7, also includes ERI single bay antenna, BO. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

FOR SALE

Collins 816-R 25kW FM \$33,000
30,000 hours w/exciter
Collins 831G 20kW FM \$27,000
All tuned and tested on frequency

ARMSTRONG TRANSMITTER
Syracuse, NY (315) 488-1269
Open 7 Days FAX (315) 488-1365

Want to Buy

FM xmt, 5 kW, any age or cond, RCA TTU-2 Series A, C, E or D & TTU-44 exciter, working, any cond or for parts. J Kautz, WJKL, 3342 Perry Rd, Camicus NY 13215. 315-673-9049.

FM 2.5 to 5 kW for class A FM in Washington state, less than 15 yrs old & in gd cond. R Larson, 509-453-6296.

AM 1 kW in gd to excel cond at inexpensive price. K Hill, WHCB, POB 2061, Bristol TN 37621. 615-878-6279.

Heathkit HA-10 or KL-1 Warrior or Chipewa and/or power supply for restoration or salvage. NE Stephany, WACK, POB 1420, Newark NY 14513. 315-331-7100.

Any FM xmt needed for high school, willing to pay reasonable price or gladly accept donation. J Mangold, KTBD, 100 Champions, El Paso TX 79912. 915-594-9441.

Any 3.5-5 kW FM or amp, exciter op. can rep. or retune. J Stromquist, WNCB, 2816 Hasberg St, Duluth MN 55811. 218-722-3017.

FM xmt, 30 kW, 6.7 C Froke, POB 811, Deer Lodge MT 59722. 406-846-1221.

Harris/BE/Continental preferred, for non-commercial Christian FM, 25 kW, must be reliable & in gd cond; also seeking high power handling antenna & coax for 100 kW operation at 91.5 MHz. E Welch, WKCL, POB 809, Ladson SC 29456. 803-553-5420.

Low band 2-6 VHF TV xmt, 100 W to 11 kW; RCA TTU-1B or TTU-2A UHF TV xmtrs for parts. J Powley, 1536 Logan, Altoona PA 16602. 814-944-8571.

AM major manufacturers late 2.5 or 5kW, with step down; also a 3.5-5kW and a 500 to 1000 W. L Maierhofer, WTGC, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Collins 20 kW xmt & 550' guyed tower in gd cond. D Radke, KWWK, 1220 4th Ave SW, Rochester MN 55902. 507-288-1971.

FM xmt, 2-4 kW, will pick up at your site; also a 10 kW FM xmt for EDFM. D Van Zandt, WJLU, 2596 S.R. 44, New Smyrna FL 32069.

FM xmt 4-5 kW. J Stromquist, WNCB, 2816 Hagberg, Duluth MN 55811.

TV xmt for 432.25 MHz ATV operation, any cond. G Kirby, WMRV, 13613 US 36, Marysville OH 43040. 614-261-8871.

Looking for 10-25 kW xmt for 93.3 MHz, ERI antenna & feedline. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

RCA BTA-250 manual/schematics needed, will pay copying costs. P Deets, WFHR, Box 8022, WI Rapids WI 54495. 715-424-1300.

TUBES

Want to Sell

Tubes including 4CX250B, 4CX250R, 6146B, 3CX1500A7, 4CX3000A & more. We carry large inventory of all major brands such as EIMAC, Amperex, RCA, etc. Call Stew at 1-800-842-1489.

Misc small tubes, all new, BO. J Sidote, WELC, POB 949, Welch WV 24801. 304-436-2131.

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

FM BROADCASTERS!!

We can meet all your FM transmitter needs!!

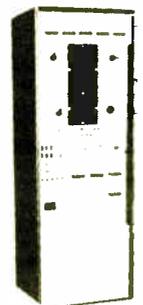
SOLID STATE - LOW POWER

Amplifiers and transmitters are available at the popular levels of 30W, 100W, 300W, 500W, and 1KW. All units are solid state, broadband, and designed for both local and remote operation.



ONE AND TWO TUBE HIGH POWER

Medium transmitters with broadband solid state drivers and one zero bias grounded grid triode in their PA are available at 1.5KW, 3.5KW, 5.5KW, 7.5KW, and 12KW. Higher power transmitter utilizing two grounded grid triodes (one as a driver) are available at standard outputs of 15KW, 22KW, 25KW, 30KW, 40KW, and 50KW.



Energy-Onix

752 Warren Street Hudson, New York 12534
(518) 828-1690 FAX (518) 828-8476

A Wise Enterprise

TRANSCOM CORP.

Fine Used AM & FM Transmitters and Also New Equipment
For the best deals on Celwave products, Andrew cable, Shively & Comark antennas.

- 1980 CCA 28,500 FM
- 1980 Harris FM 20 K
- 1976 RCA BTF 20E1
- 1976 Harris MW5A
- 1980 Harris MW50A
- 1976 CCA AM 50,000D, 50 kW AM
- 1985 CSI T-3-F

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

TUBES . . . WTS

Eimac 4CX3000A brand new, \$1200. K Carver, Project Light/Snd, 1418 Amber, Killen TX 76543. 817-699-1530.

EIMAC 8169/4CX3000A, \$75; EIMAC 8170/4CX5000A, \$975, both new. A Emerald, KGA, 8956 Swallow, Fountain Valley CA 92708. 714-962-5940.

Want to Buy

RCA 6181, used as final in RCA TTU-1B UHF TV xmtr. J Powley, 1536 Logan, Altoona PA 16602. 814-944-8571.

VA651A rebuildable or working cond for use in RCA TTU-2 xmtr. J Kautz, WJKL, 3342 Perry Rd, Camicucc NY 13215. 315-673-9049.

We buy electron tubes.
Contact us if you any for sale.
PATH
507 Superior Ave.
Newport Beach CA 92663
714-722-6733

RCA BTA 250-M tubes, cheap. P Deets, WFHR, Box 8022, WI Rapids WI 54495. 715-424-1300.

TUBE REBUILDING
FREELAND PRODUCTS
Since 1940
SAVE ABOUT 50%
—We buy dud tubes—
800-624-7626
504-893-1243
FAX 504-892-7323

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

TURNTABLES

Want to Sell

Stanton 210 phono preamp, \$100; Micro-Trak 2604 (2), \$75 ea. G Gilbreath, 702-454-2085.

Technics SP-10 12", 3345 remote start, working cond, BO pls shpg. R Norman, RNP, 11 Glenwood, Toms River NJ 08753. 201-349-8569.



ARMSTRONG TRANSMITTER

TUNED, TESTED, WARRANTED

We are the leading remanufacturer of radio transmitters with customers worldwide.

Our transmitters are:
* Remanufactured to factory specs.
* Tuned to your frequency
* Guaranteed for 30 days
* 48 hours burn-in prior to shipping
See before you buy, visit our showroom

Why settle for less than Armstrong?



ARMSTRONG TRANSMITTER
Syracuse, NY (315) 488-1269
Open 7 days FAX (315) 488-1365

Russco Studio Pro B (3), gd cond w/none arms, \$100 ea. M Black, WEOS, Hobart WS College, Geneva NY 14456. 315-789-8970.

QRK turntables (2), \$50 ea/BO. B Burnham, WHBT, 1293 Floyd, Jackson MI 49203. 517-782-1510.

Presto 6M (2) disc cutting lathes w/several lead screws in console, \$1300/both. E O'Brien, Imperial Snd St, RR 31 Box 405, Terre Haute IN 47803. 812-877-2663.

Astatic X26 crystal recording head, w/instructions, new in box, \$50/BO. J Workman, Maritz, 600 W Lafayette, Detroit MI 48226. 313-963-1200.

McMartin/QRK three speed work horse w/none arm cartridge & stylus, excel cond, \$150/BO. T Randall, KJJQ, Box 790, Brookings SD 57006. 605-692-9102.

Sony CDP5 5 trsy CD player w/auto stop, perfect cond, \$300. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

QRK 12-C 3 speed w/arms & Gates preamps (2), \$35 ea. M Ashley, SwingStreet Studios, 620 Bercut, Sacramento CA 95814. 916-446-3088.

Technics SL1301 w/arm & Audiotechnica cartridge, excel cond, but dust cover has some minor scratches, \$160/BO G Pernad, 1510-6 Peachtree, Cocoa FL 32902.

Neumann AM 32 B disc mastering lathe, variable pitch & depth, complete system in gd working cond w/lathe, stereo SX 68 Neumann head, stereo elect, VG 66 solid state, microscope, etc, \$8500/all. R York, Jewel Records, 1594 Kinney, Cincinnati, OH 45231. 513-522-9336.

Technics SP10-MKII, new, never installed, \$800/BO. R Bruce, UAR Stds, 8535 Fairhaven, San Antonio TX 78229. 512-690-8888.

Shure M-64 stereo TT/UTIC preamp, \$40. M Kuehl, 1418 N Stevens, Rhinelander WI 54501. 715-369-4007.

QRK Ultimate II stereo-phon preamp & power supply, gd cond, \$100/BO. M Patton, WXOK, 6619 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

Denon DCD 810 CD players, used 1 month (2), \$240. JA Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

Russco Studio B in gd cond, \$80; QRK SF4H13A w/nonearm, gd cond, \$125. J McMahon, WAMD, POB 970, Aberdeen MD 21001. 301-272-4400.

Gates M-6442 stereo TT preamps (2), excel cond, BO; Gates Level Devil M-5546A, works, BO. R Fess, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Technics SP-15 (2) complete w/preamps, excel cond, \$1000. D Agnew, 5601 So 27th, Lincoln NE 68512. 402-421-2223.

Technics SL-1200 MKII (2) in new cond w/Stanton 600A carts, also (2) in vgc w/Stanton 661A carts w/manuals, \$325 ea. D Davis, KMBA, 1217 Valencia Dr NE, Albuquerque NM 87110. 505-255-2431.

Russco Studio Pro B (2), gd cond, BO. M Black, WEOS, Geneva NY 14456. 315-789-8970.

Want to Buy

Rek-O-Kut B-12-H shock mounts, idler wheel, parts; Rek-O-Kut Micro-poise tone arms & parts; QRK 12-C parts, espec idler wheel & shock mounts. M Kuehl, Passage Prod, 1418 N Stevens, Rhinelander WI 54501. 715-369-4007.

TV FILM EQUIP

Want to Sell

GE 240 telecine camera, Eastman mdl 2 pneumatic multiplexer, Spectrum dual drum slide projector, Eastman 285 16mm TV film projector, little use, \$3000/all. J Perez, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

RCA FP10 16mm film recorder/reproducer, \$500 or trade for 1/2" VCR. J Workman, Maritz, 600 W Lafayette, Detroit MI 48226. 313-963-1200.

Numerous pieces of equipment including Gates/Harris TE-201 color film camera, Quanta character gen, RTI film editor & film cleaner, projector, power supply, waveform monitor, videotape recorder & more, to much to list, call for more details and prices. J Fuehrer, NTV Network, POB 220, Kearney NE 68848. 308-743-2494.

PAL film chain equip: Hitachi FP-20S 3 tube Salicon camera w/zoom lens & schematics, EIKI 16mm telecine projector, excel cond, misc monitors, 3/4" & 1/2" PAL VCR's also avail. J Garvey, Video Yesteryear, Box C, Sandy Hook CT 06482. 203-744-2476.

B&H JAN 614 EVMS light weight pedestal mount, 16mm optical & magnetic sound telecine projector, complete w/manuals, excel cond, \$795. G Ormrod, GFO Prod, 432 E. X St, Tumwater WA 98501. 206-352-8028

Complete RCA color 16mm film & 35mm slide chain, (2) TP66 16mm film projectors w/optical & mag sound, TP7 35mm slide projector, TP55 multiplexer & TK27 color camera w/2 sets of extra tubes, \$3000. J Krepol, RNDL, 6147 Walker, Phila PA 19135. 215-624-1050.

Quantel DPE-5000SP single chnl digital video effects; Bosch Compositor I 2 chnl character gen system. P Douglas, KWGN, 6160 S Wabash Way, Englewood CO 80111. 303-740-2222.

3M 210 color bar & sync generator, make offer. R Rhodes, POB 1550 Radio City Station, Nyny 10101. 212-245-5045.

JVC RM 82U 3/4" video editor, (2) JVC 8200, gd cond, \$3500/BO; JVC 6650 3/4", gd cond, \$700/BO. M Gellos, Pensacola Christian College, 904-478-8480 X 5041.

CMX 340X system w/3600 upgrade, never installed; GVG 1600 switcher & Wheatstone 6 input, stereo audio mixer included., (5) I-square boxes, all parallel control for Ampex VPR-2 VTR's, serious inquiries only, \$35,000/BO. E Dalton, WETA, 3620 S 27th St, Arlington VA 22206. 703-998-2666.

Panasonic AG-2400 1/2" portable VCR w/plug in pwr supply, \$800; Panasonic AG-DA100 A/V distributor, less than 1 yr old, \$450; Showtime Showmaster special effects generator, \$275, sold separately or all for \$1475. A McPeck, POB 444, Rogersville TN 37857. 615-272-4827.

Sony VP-5000 3/4 players (8) w/jog & shuttle, \$400-\$800; Sony SEG 2000-A special effects gen 6 wipes genlock, \$2600; Sony DXC-M3 3 tube camera ENG Canon lens, \$2985; Sony 4800 3/4 field recorder w/Portabrace case, \$1875. T Zingale, TZ Comm, 213-477-5803.

Video Media Eagle I edit controller in new cond w/Convergence SW1-101 switcher interface, \$3500/BO; (6) 1/2" R-R video decks in mint cond, BO; Sony FCG-700 frame code gen-reader, new, \$2400/BO. R Lawrence, Moonshadow Video Prod, 4280 Reston Rd, Roseburg OR 97470. 503-679-8966.

Vidicraft Video Image Enhancer w/RCA inputs, still in box, \$200. B Feinberg, Totalltape Publishing, 800-874-7599 X337.

JVC BY-110 w/access, JVC KY-2700 14x1 zoom, (2) Sony RM-430 controllers, (3) JVC CR-4400 portable u-matic recorders w/access; JVC BR-6400 VHS recorder. T Quinn, 408-475-0423.

Bosch Compositor dual chnl character gen, (2) keyboards, graphics compose console, election return package display unit, gd working cond, \$6000; Quantel DPE 5000 Plus dual chnl digital effects system, (2) control panels, needs pwr supply, \$3500; RCA TK-76 3 tube color camera (2), one working one not, fair to gd cond, \$500/both. R Yerema, World Video Prod, 10625 Scripps Ranch, San Diego CA 92131. 619-695-1045.

Telechrome 3200 video dist amps, rack of eight, gd cond, BO. M Cramer, WGBA, 1391 N Road, Green Bay WI 54307. 414-494-2626.

Magnavox 1012L video motion detector, as is, working cond, \$75. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

Vital VI-500 color stab amp w/cable EQ, w/manual, \$100; Cohu 2614-400 video waveform multiplexers (2), \$50 ea; RCA MI-4069B1 RCP for RCA TR-50 VTR. B Humpherys, KUSU, Utah State Univ, Logan UT 84322. 801-750-3133.

Harris 6528 video receiver, 24 chnl, excel cond, \$300/firm. B Feinberg, Totalltape Publishing, 800-874-7599 X337.

Sony/Winsted RM440, (2) SLO 383 off line editing system, \$1500. R Greenwell, WDSE-TV, 1202 E Univ Circle, Duluth MN 55811. 215-724-5867.

Lenco PCE 466 RGB color encoder, \$1900; videotape 1", 30 min & 60 min, less than 10 passes, gd cond, \$15 & \$22.50. J Workman, Maritz Comm, 600 W Lafayette, Detroit MI 48226. 313-963-1200 X501.

Norelco PC-72 (3) color studio cameras w/(3) Peerless pedestals CCU's & cables, two in gd cond, one needs a tube, complete package, \$8500; Sony BH-500 1" portable VTR C format, gd cond, \$4500; NEC digital effects system includes squeeze zoom flip options, multi freeze etc, gd working cond, \$8500. R Yerema, World Video Prod, 10625 Scripps Ranch Blvd, San Diego CA 92131. 619-695-1045.

Mindset II character gen & animation system, 2 disk drives, graphics tablet, titler, lumina, PC paint, animator, Glyph software, \$2000; Chyron III character generator, BO; 8000 CBS Labs 2H enhancer, GVG 731 color video insert keyer, Conrac CLD 14 rack mount B&W monitors. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Vidifont MK14-A character gen w/disk drive, little use, \$4000; RCA TK-44 studio cameras, gd overall cond w/Angineaux 18x15 300m lenses (3), \$3000 ea; Central Dynamics VSP414 special effects production switcher, gd cond, \$4500. J Perrez, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

Quick-Set QHT-1 Hercules, tripod w/QHD-1 dolly, friction head, vgc, \$350; Panasonic NV-A950 editing controller, excel cond, \$100. R Sumner, CAVU Comm, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Video equipment rack. M Bejarano, Falcon Comm., 6923 Forbes, Seabrook MD 20706. 301-794-5754.

Cezar The Controller, brand new edit controllers w/some cables, BO; Cezar EA-3X, new edit controllers w/some cables, BO. B Hoag, 2814 Hearshide Ct, Marietta GA 30067. 404-973-8918.

Conrac 9", 14" B&W monitor, half & full rack monitors, several available, BO. R Rickly, WJ-AB, 8443 Day Dr, Parma OH 44129. 216-845-6043.

Hotronic AD51-TFS frame sync/TBC, \$4000; Thomson-CSF 7011 chroma insert keyer, \$1250. H.M. Dyer Electronics, 2982 Wixom Rd, Milford MI 48042. 313-685-2560.

CBS Labs 8400 RGB, composite video enhancer, inter problem w/manual, \$100. J Cochran, Gateway Video, 225 Ross, Pittsburgh PA 15219. 412-471-3333.

Videotek VM 8PRW 8" color mon RGB switching, \$675; Tektronix 528-A waveform mon, \$1099; Videotek RS-10A 10 input video/audio switcher, \$675; URIE graphic EQ, \$275. T Zingale, TZ Comm, 213-477-5803.

BTX 4500 time code sync, make offer. R Rhodes, POB 1550 Radio City Station, Nyny 10101. 212-245-5045.

Canon UA Series assorted male, female, cable & panel mic connectors; Trompeter LPL-75 video patch plugs, 1" pin spacing (24), \$3 ea. B Humpherys, KUSU, Utah State Univ, Logan UT 84322. 801-750-3133.

Sony PVM-5300 (3) 5" color monitors in 19" rack mount, needs new CRTs, units new but dropped, call for info, \$175. P Russell, Bowdoin College, Silis Halls, Brunswick ME 04011. 207-725-3066.

Bogen 132 head 116, heavy duty tripod w/dolly, \$150; Quick Set camera pedestal head mdl 4-52304-9, pedestal model 4-74500-6, \$75. R Nimtz, Rm 9, CCE, Notre Dame IN 46556. 219-239-5465.

Sony PSA 101 manual. F Haynes, 1718 N 79 Terr, Kansas City KS 66112. 816-654-2407.

Sony 5850/5800/RM-440 wanted in gd cond. Have assorted equip to trade, or cash; also want video sync gen preferably wrack. R Lawrence, Moonshadow Video Prod, 4280 Reston Rd, Roseburg OR 97470. 503-679-8966.

Sony NV9500, NV9200, NV950 3/4" edit system, gd cond, \$2000 set; (2) Panasonic NV9500, NV9200 3/4" VTRs, heads OK, need tune up, BO. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Sony VO-6800 portable 3/4" U-matic VTR, AC-PS, 8-NP1's w/charger, kangaroo case/strap incl., \$2950.

Sony AG-6810S VHS HiFi & normal audio professional duplicator w/Dolby, 50 hrs on machine, like new, \$500. P Russell, Bowdoin College, Silis Halls, Brunswick ME 04011.

Panasonic NV9500, NV9200, NV950 3/4" edit system, gd cond, \$2000 set; (2) Panasonic NV9500, NV9200 3/4" VTRs, heads OK, need tune up, BO. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Sony VO-6800 portable 3/4" U-matic VTR, AC-PS, 8-NP1's w/charger, kangaroo case/strap incl., \$2950.

Panasonic NV-9400 port. U-matic, w/portabrace, charger, (2) bal. manuals, \$1500; Aquastar 3C vid. projector scans to 42 kHz hor, image size 4" to 20" wide w/Anvil case, manuals, \$800; JVC CP-5000 U-matic copyer only, \$125. R Nimtz, Rm 9, CCE, Notre Dame IN 46556. 219-239-5465.

Panasonic NV-9200 3/4", NV-9100 (2), 3/4" National NV-9200 PAL (2), 1/2" Panasonic AG-6200's, NV-8200's VHS Nordmende PAL VHS (4), National NV-8600 (2) PAL VHS, Sony PAL Beta (2), all units need work, call for details. J Garvey, Video Yesteryear, Box C, Sandy Hook CT 06482. 203-744-2476.

Sony BetaCam BVV 1A, rebuilt by Sony w/Portabrace custom case & component cable adaptor, & jam sync option & Dolby, also a Bogen tripod w/fluid head, like new. MRG Prod Assoc, 516-489-1071.

Panasonic NV-8030 time lapse logging VCR, w/tapes (2), BO; Panasonic NV-9100A U-matic 3/4" machine, gd cond, BO. R Rickly, WUAB, 8443 Day Dr, Parma OH 44129. 216-845-6043

Sharp VC-579E world wide video VHS VCR, compatible w/5 systems PAL, NTSC 3.58, Megecam, Secam, NTSC 4.43, like new 4 head HQ w/remote & US standard video connectors & adapters, vari-voltage & Hz, \$225. B Arnold, 700 Productions, 105 Dorado Court So, Middle Island NY 11953. 516-924-9020 aft 7PM.

Worldwide Digital Conversion
ALL FORMATS
BROADCAST QUALITY
Pal Multi-dupe/Hi-Band/1"

TK VIDEO 12300 Coppola Drive
Potomac, MD 20854 301-762-2786

WORLDWIDE DIGITAL CONVERSION
ALL FORMATS
BROADCAST QUALITY
Pal Multi-dupe/Hi-Band/1"
TK VIDEO 12300 Coppola Drive
Potomac, MD 20854 301-762-2786

VIDEO TAPE RECORDERS

Want to Buy
Panasonic AG-6810S VHS HiFi & normal audio professional duplicator w/Dolby, 50 hrs on machine, like new, \$500. P Russell, Bowdoin College, Silis Halls, Brunswick ME 04011.

Panasonic NV9500, NV9200, NV950 3/4" edit system, gd cond, \$2000 set; (2) Panasonic NV9500, NV9200 3/4" VTRs, heads OK, need tune up, BO. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Sony VO-6800 portable 3/4" U-matic VTR, AC-PS, 8-NP1's w/charger, kangaroo case/strap incl., \$2950.

Sony AG-6810S VHS HiFi & normal audio professional duplicator w/Dolby, 50 hrs on machine, like new, \$500. P Russell, Bowdoin College, Silis Halls, Brunswick ME 04011.

Panasonic NV9500, NV9200, NV950 3/4" edit system, gd cond, \$2000 set; (2) Panasonic NV9500, NV9200 3/4" VTRs, heads OK, need tune up, BO. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Sony VO-6800 portable 3/4" U-matic VTR, AC-PS, 8-NP1's w/charger, kangaroo case/strap incl., \$2950.

ACTION-GRAM

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: _____

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.

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 F. Recording studio
A. Commercial AM station G. TV station/teleprod facility
B. Commercial FM station H. Consultant/find engineer
C. Educational FM station I. Mfg, distributor or dealer
E. Network/group owner J. Other _____

II. Job Function

A. Ownership D. Programming/production
B. General management E. News operations
C. Engineering F. Other _____

WTS: WTB: Category: _____

Make: _____ Model #: _____

Brief Description: _____

Price: _____

Broadcast Equipment Exchange
PO Box 1214
Falls Church VA 22041

MARKETPLACE

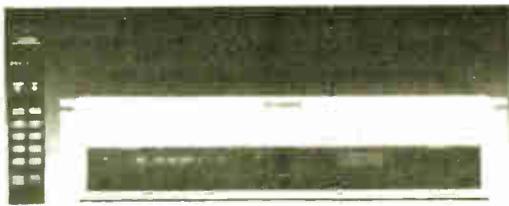
Send us your new product info. Be sure to include a black and white photo. Send all submissions to Radio World Marketplace, P.O. Box 1214, Falls Church, VA 22041



Near field monitor

The NFM-8 (DMT) by Tannoy is a primary mixing reference speaker of compact size which incorporates a new 8-inch dual concentric driver in a ported, mediate enclosure.

For information, contact **Bill Calma at Tannoy**: 519-745-1158, or circle **Reader Service 81**.

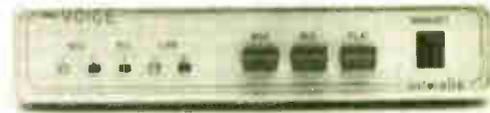


FM monitor tuner

Studer Revox's new A764 professional FM monitor tuner comes equipped with 60 station memories; balanced (XLR) and unbalanced outputs; tuning in 10 or 50 kHz steps and two switch selectable electrically isolated antenna inputs.

Parameters available on five relay contacts are: detection of the RDS and ARI radio signals, monitoring of the deviation and signal strength and a modulation detector.

For information, contact **Charles Conte at Studer**: 615-254-5651, or circle **Reader Service 88**.



Digital telephone response

Interalia's new "Voice" is a solid state, digital announcer which can link two messages together to sound like one.

This makes it possible to change part of the message—such as a "weather" or "concert line"—while leaving the commercial message intact.

With direct interfacing to the telephone line, there is no need for adaptors. Solid state design means no tapes to change.

For information, contact your regional **Allied representative at: 1-800-622-0022**, or circle **Reader Service 94**.

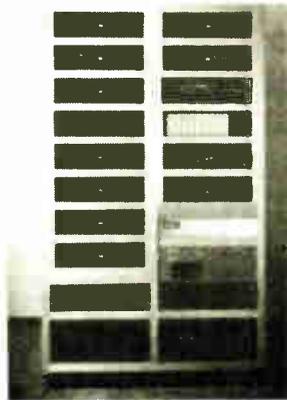
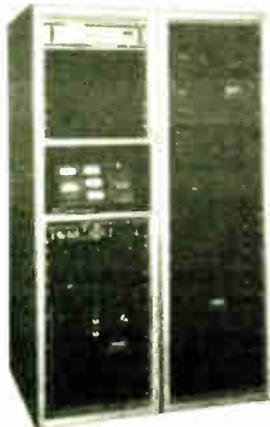
FMQ transmitter

QEI's new FMQ 20/30 kW transmitter, the latest addition to its "New Reliables" series, can be field-upgraded from 20 to 30 kW with the addition of a third IPA module.

The tube final amplifier uses QEI's grounded grid triode design.

The FMQ 20/30 is available with an optional ARC 27 microprocessor-based automatic remote control system including remote diagnostics.

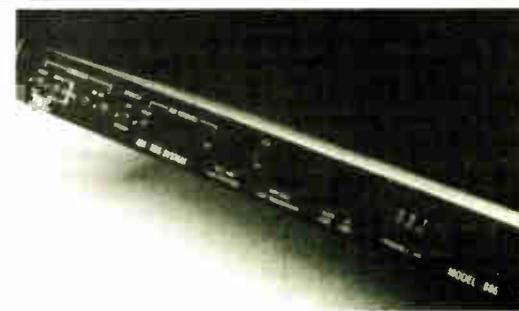
For information, contact **William J. Hoelzel at QEI**: 1-800-334-9154, or circle **Reader Service 92**.



Digital live assist

Schafer Digital's new digital audio programming sequencer, the DAPS™ 800, incorporates a number of Sony Beta VCRs onto which music and commercials are recorded using digital processors.

For information, contact **Jim Hansen at Schafer Digital**: 713-784-9400, or circle **Reader Service 87**.



EBS system

TFT has introduced a new series of EBS systems.

The Models 886 (AM) and 887 (FM) both have two LED displays. One display counts days since last transmission and the other, days since last reception of an attention test.

Two LED bar-graphs, one for audio and one for RF, indicate that the receivers are actually experiencing activity from the regional primary station.

For information, contact **Perry Kirk at TFT**: 408-727-7272, or circle **Reader Service 84**.

Subscription/Reader Service Form

Radio World

August 9, 1989 Issue Use until November 8, 1989

FREE Subscription/Renewal Form

I would like to receive or continue receiving **Radio World** FREE each month. YES NO

Signature _____ Date _____

Please print and include all information:

Name _____ Title _____

Company/Station _____

Address _____

City _____ State _____ ZIP _____

Business Telephone () _____

Please circle only one entry for each category:

I. Type of Firm

- | | |
|------------------------------|---------------------------------|
| D. Combination AM/FM station | F. Recording studio |
| A. Commercial AM station | G. TV station/teleprod facility |
| B. Commercial FM station | H. Consultant/ind engineer |
| C. Educational FM station | I. Mfg. distributor or dealer |
| E. Network/group owner | J. Other _____ |

II. Job Function

- | | |
|-----------------------|---------------------------|
| A. Ownership | D. Programming/production |
| B. General management | E. News operations |
| C. Engineering | F. Other (specify) _____ |

III. Purchasing Authority

- | | | |
|--------------|------------|------------|
| 1. Recommend | 2. Specify | 3. Approve |
|--------------|------------|------------|

Reader Service

Please first fill out contact information at left. Then check each advertisement for corresponding number and circle below. NOTE: Circle no more than 15 numbers, otherwise card will not be processed.

001	021	041	061	081
002	022	042	062	082
003	023	043	063	083
004	024	044	064	084
005	025	045	065	085
006	026	046	066	086
007	027	047	067	087
008	028	048	068	088
009	029	049	069	089
010	030	050	070	090
011	031	051	071	091
012	032	052	072	092
013	033	053	073	093
014	034	054	074	094
015	035	055	075	095
016	036	056	076	096
017	037	057	077	097
018	038	058	078	098
019	039	059	079	099
020	040	060	080	100

ADVERTISER INDEX

Page No.	Advertiser	Reader Service No.	Page No.	Advertiser	Reader Service No.
33	AKG Acoustics	64	11	Dolby Labs	43
8	Allied Broadcast Equipment	75	1	Fidelipac	82
9	Allied Broadcast Equipment	51	46	Full Compass Systems	30
24	Allied Broadcast Equipment	54	34	Hallikainen & Friends	65
31	Allied Broadcast Equipment	31	34	Hnat-Hindes	29
32	Allied Broadcast Equipment	69	7	Jampro	15
35	Allied Broadcast Equipment	42	26	LPB	74
38	Allied Broadcast Equipment	91	25	3M	50
44	Allied Broadcast Equipment	73	14	Motorola	85
28-29	Arrakis Systems	66	19	National Supervisory Network	36
7	ATI	25	26	Noble Broadcast	80
43	ATI	5	20	Northeast Broadcast Labs	13
45	ATI	86	43	Northeast Broadcast Labs	78
15	Audio Broadcast Group	34	23	Orban Associates	72
55	Audiopak	12	27	Pacific Recorders & Engineers	
39	Audionics	97	42	QEI	26
38	Belor Electronics	28	13	Radio Design Labs	46
3	Bradley Broadcast Sales	62	16	Radio Systems	49
3	Broadcast Electronics	47	17	Radio Systems	58
18	Broadcast Electronics	44	21	Radio Systems	6
13	BSW	21	41	Radio Systems	45
4	Burk Technology	63	22	RF Specialties	17
30	Cablewave	52	6	Studer Revox	24
22	CCA	48	36	Studer Revox	53
37	Comtech Systems	68	20	Tannoy	76
10	Cartona	10	21	Tascam	19
10	Current Technology	70	9	Tascam	67
24	Cutting Edge Technologies	27	35	Tascam	22
32	Cutting Edge Technologies	37	2	Wheatstone	4
45	Datoworld	32	56	Wheatstone	57
12	Delto Electronics	9			

Advertising Sales Representatives:

East & Midwest, Art Constantine: 800-336-3045 Fax: 703-998-2966
West Coast, Pat Macsata: 415-786-2198 Fax: 415-786-2754

WHAT MAKES AUDIOPAK

THE CART YOU CAN COUNT ON?



"DURABILITY. We've used AA-4s exclusively since 1978. I've tried other carts, but AA-4s are generally more stable. They hold their phase, and they can really take the abuse. We love 'em."

*Mike Sprysenski, C.E.
WOCL, Orlando FL*



"PERFORMANCE. We conducted rigorous evaluations of all the leading carts, both in our fully equipped testing facility and in several different cart machines. The results? We've standardized on AA-4s."

*Sonny Reschka, Dir. of Eng.
WNIC, Detroit, MI*



"SUPPORT. The AA-4 is a very good cart, period. And Audiopak stands behind their product better than any other company in the business. They really are a customer-oriented organization."

*Tom Cox, Technical Director
KKLQ, San Diego CA*



"STABILITY. The phase scope doesn't lie: We've found consistent phase stability with AA-4s. Their overall performance on commercial production, vinyl record and compact disc playback is outstanding."

*Chuck Waltman, Eng. Mgr.
KSAN, San Francisco, CA*



"CONSISTENCY. We've used about 7,000 AA-4s over the past five years, with very few problems. In fact, we just carted our entire easy-listening music library in stereo on AA-4s. They're tops in my book, and the only cart I use."

*Dwight Weller, Dir. of Eng.
WLIF, Baltimore MD*

Audiopak's advanced neutral-design casing and high performance lubricated tape give top stations the reliability and the unsurpassed quality they need. Shouldn't you have as much confidence in your carts as these radio pros do? You can: just call (800) 522-CART for the name of an Audiopak dealer near you.

**CART AFTER CART AFTER
CART...**



"RELIABILITY. I've tested just about every cart on the market, and for reliability, quality and ruggedness, the AA-4 is the best buy I have found. That's why we have been using them for the last four years."

*Jerry Bowers, C.E.
KSO/KGGO, Des Moines, IA*

audiopak®

P.O. Box 3100
Winchester, VA 22601

Tel: (800) 522-CART or (703) 667-8125 Fax: (703) 667-6379

Circle 12 On Reader Service Card

World Radio History

We Re-invented the Wheel AND IT'S SQUARE!

Naturally, with all of Wheatstone's experience at building and interfacing consoles, it was inevitable that we would take on the design and manufacture of suitable furniture for our audio installations. First we listened to engineers and their requests, then we went to work. The result is a significant improvement over previous designs.

Consider the advantages of double-sided equipment cabinets with fully interchangeable door panels, with each side able to accommodate 19 inches of rackmount equipment. Consider the convenience of hinged twin drop-down punchblock panels for easy installation and maintenance. Consider the advantage of hard chrome plated steel mounting rails that eliminate the stripping problems associated with lesser aluminum designs. Simply consider the strength we've achieved with full inch and a half thick side panels and hybrid inch and a half thick countertops.

We have re-invented cabinet technology. We've wedded the latest precision NC metal componentry to hybrid plywood/high density, high resin pressure-laminated substrates. Our construction and bonding techniques have been optimized to eliminate stress related laminate problems. We've handled wire management: there are generous pathways between each enclosure, as well as an integral channel punchblock housing under the console counter to keep everything neat, concealed and away from unauthorized hands. And, since cabinet faces can accept either equipment or door panels, systems can easily be configured to fit virtually any room. Doors can even be placed on cabinets intended for future electronics installation.

This cabinetry is very clever, unbelievably strong, and (of course) square--*precisely*. It has that Wheatstone major market look. So contact Wheatstone for furniture, consoles, or prewires.



 Wheatstone Corporation

6720 V.I.P. Parkway, Syracuse, NY 13211

Circle 57 On Reader Service Card

Tel 315-455-7740/FAX 315-454-8104

World Radio History