Radio World®

Vol 14, No 11 | Radio's Best Read Newspaper | June 13, 1990

Two File For Digital Radio

by Alan Carter and Benn Kobb

Washington DC Two separate proposals for direct broadcast satellite radio—each taking a different approach—that would launch US radio into a new digital era were announced 18 May and filed within days of each other at the FCC.

Satellite CD Radio of Washington, DC, filed a petition 18 May to establish a new, digital, "CD-quality" radio service between 1460-1530 MHz, now used for flight test operations. The service would be provided by satellite, with terrestrial repeaters and in part by a new terrestrial radio service, whose licensees would be current AM and FM broadcasters.

"Gateway" ground station

The second proposal is from Radio Satellite Corp. (RSC) of Pasadena, CA, that was to be filed 22 May for a "gateway" ground station for satellite access to provide audio and ancillary data services.

Both systems offer an alternative to the digital audio broadcasting (DAB) Eureka system developed by the European Broadcasting Union.

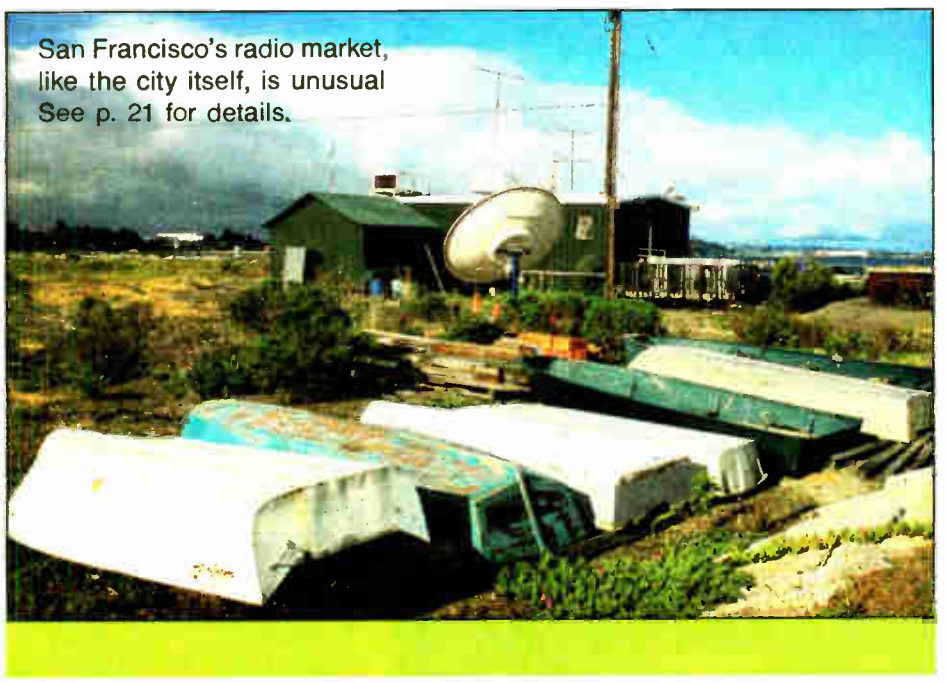
Unlike Satellite CD Radio, RSC does not propose to launch a dedicated satellite or obtain spectrum allocation.

RSC would lease capacity on a satellite to be launched in 1993 by the American Mobile Satellite Corp. (AMSC) of Washington, DC. This satellite will be devoted primarily to two-way voice and data communication with air, sea and land vehicles.

Designed to operate in the already-allocated 1.6 GHz "L-band," the AMSC "bird" will be one of the most powerful communication spacecraft put into orbit. The spacecraft's high power 1 MW (60 dBW) would enable small, inexpensive antennas and receivers to be used on the ground.

RSC also would not be CD quality initially, according to company organizer Gary Noreen, but could be added later

(continued on page 7)



San Francisco's radio market, like the city itself, is unusual
See p. 21 for details.

NRSC Test Proposed

by John Gatski

Denver CO Efforts of the National Radio Systems Committee (NRSC) FM Composite Spectrum Studies Working Group to develop a test plan for determining whether processing degrades FM receiver performance have drawn critical response from some members.

All particular disagreements with the initial test proposal were tabled at a May meeting in Denver and will be addressed at the group's next meeting, tentatively scheduled for late June in San Francisco, according to NAB Staff Engineer and NRSC coordinator Stan Salek.

The test procedure, submitted by Bob Orban of Orban Associates, is being proposed to assess the effect of "aggressive" processing on receiver signals. It entails determining the "undesired-to-desired RF protection ratios," according to the test outline.

The test would involve subjecting a modulated carrier with an interfering adjacent channel carrier and determining the RF levels of the undesired and desired carriers.

Based on Orban's proposal, the test would require at least three receivers of various bandwidth limits (mean, wide and narrow); three methods to measure the peak deviation of the carrier and two loudness meters to gauge perceived interference level.

The test also would require a source for the interfering signal, that would approximate "real world" modulation, according to the proposal.

Prior to the May meeting, Bill Loveless, engineering VP for Bonneville International, wrote a letter outlining his concerns about the test, that was read at

(continued on page 3)

Engineers Meet To Fight Digital Threat

by Alan Carter and Judith Gross

Washington DC Several leading radio engineering executives have met in an *ad hoc* group to address the "competitive threat" of digital audio broadcasting (DAB) to terrestrial FM.

"Our once premiere service, created to bring the audience quality entertainment, is now a fourth or fifth class citizen," Acting Chairman Paul Donahue, Gannett Radio engineering VP, said. "We'd better figure out what we're doing. We are going to address the competitive threat that digital audio resources pose to FM."

Donahue maintained that FM as it is broadcast today cannot provide the quality that listeners are growing to expect with compact discs and even cassettes. He also blamed receiver manufacturers.

"When receiver manufacturers take the steps they are currently taking to reduce multipath—which is FM's worst problem—they degrade the FM service," Donahue said. "So we face not only competition from other sources, but an

(continued on page 10)

Groups Still Oppose FM DA Use

Antennas Are "Technically Unsound" And Inadequate, According to Filings

by Charles Taylor

Washington DC Five broadcasting organizations have voiced continuing opposition to changes instituted by the FCC in 1988 that allow short-spaced FM stations to use directional antennas.

The groups—the Association of Broadcast Engineering Standards (ABES); engineering consultants du Treil, Lundin and Rackley; Greater Media Inc.; Mullaney Engineering; and the NAB—filed with the Commission in mid-May, charging that FM directional antennas are "technically unsound" and do an inadequate job of preventing interference among closely spaced FMs.

The document repeats a stand taken by the groups in an April 1989 petition for reconsideration. They noted in the May filing that the Commission has yet to act on their request.

Technically unsatisfactory

"We are very concerned that (without) Commission review of this consensus document (rules) would result that are still technically unsatisfactory or unnecessarily burdensome," they wrote.

"Because the FM industry and the Commission would need to live with these rules for many years, and because under existing rules, there is posed so great a risk to FM service areas and to FM reception by the public, it is very important to attempt resolution."

. . . the groups urged the Commission to readopt distance separation standards. . .

Specifically, in its 1988 ruling, the Commission allowed FM allocation applicants to request a transmitter site that would be minimally short-spaced to the facilities of co- and adjacent-channel FMs.

As a result, licensees can employ reduction in power, terrain features, directional antennas, or some combination, to protect existing stations from the short-spaced transmitter sites.

Suspend protection rules

In respective April 1989 filings, each of the groups urged the Commission to readopt distance separation standards for allocation and assignment of FM stations; reinstate case-by-case consideration of special waivers for distance separation requirements; suspend contour protection rules adopted in late 1988; and revise FM antenna installation, filing and maintenance requirements.

In the recent filing, they also requested the FCC to stop accepting construction permit applications as of 1 June and to grant applicants before the deadline a conditional approval, pending outcome of a review of FM directional antenna rules.

INDEX

FCC, FAA Work to Find Solutions by Lex Felker 24

Digital Interfacing for Control by Ed Montgomery 26

Effects Boxes Add Spice to Spots by Bruce Bartlett 27

Convening Radio's Roundtable by Dee McVicker 28

West Coast Pioneers And a Radio Veteran by George Riggins 33

Unmodulated Measurements by Harold Hallikainen 34

Spring Cleaning at the Station by Barry Mishkind 36

How to Stop Singing Circuits by John Shepler 37

Facing Facts About Contracting by Tim McCartney 39

An AES/EBU Interface Resource by Mel Lambert 40

Occupied Bandwidth: Early Data by Eric Small 45

NRSC Receiver Test Talk Tabled

(continued from page 1)
the meeting.

Loveless stated in the letter that the test may be beyond the scope of the NRSC and the results could be interpreted in a way that may result in more stations crowding the FM band.

"I am concerned that NRSC is proposing to use incorrect and unconventional techniques to measure FM receiver protection ratios. NRSC must provide a proven correct and clear documented track back to CCIR standards, methods and data," Loveless stated in his letter.

Basis for more stations?

Loveless and Eric Small, a group member and Modulation Sciences' VP of enigneering, said they believe that protection ratios, based on receiver measurements, could provide numbers which could support adding more stations, possibly causing more interference.

A lot of questions need to be addressed before a test proposal can be finalized, such as whether processing is a denigrating factor or if interference is caused by the station allocation scheme under FCC Docket 80-90, they said.

"We're not sure if there is even a problem," Small said.

Even if the Orban test proposal purpose is adequately addressed, critics are convinced the protection ratios will not produce valid findings.

Protection ratios are the function of the receiver and provide more of a "broad brush" approach to trying to answer the processing question, which could do more harm than good, test opponents argue.

A better way to approach whether processing affects receiver performance would be to measure occupied bandwidth, Loveless said.

Small agreed. "Occupied bandwidth is a nice deterministic measurement and we know what the occupied bandwidth is under the allocation scheme. So why don't we just measure occupied bandwidth?" he asked.

Orban said the concern about the test results being used as ammunition for opening up space for more FM stations is unwarranted.

"I don't see how anyone is going to go to the Commission and try to get more stations with this," Orban said. "The point of this is doing research." Orban concurred with his critics about the uncertainty of whether processing causes interference, but said that is why the test research is being done in the first place.

Car receiver manufacturers consider the issue important enough to perhaps narrow the IF bandwidth in receivers because of broadcaster modulation practices, Orban maintained.

As for protection ratios vs. occupied bandwidth, Orban said his proposal makes more sense.

"I think they are the only realistic measurements because they are the only ones that realistically relate to perceived first adjacent channel interference," Orban said.

Although not mentioned in the test outline, Orban pointed out that occupied bandwidth measurements also will be done during the test and the results will be compared.

Differs from CCIR

Even if the protection ratios can be used as the evaluating criteria, Orban's test procedures are substantially different from protection ratio testing recommended by CCIR, the world broadcast standards-making body, according to Loveless and Small.

Among the differences is Orban's proposed use of a stereo interfering signal rather than a mono signal, which the CCIR recommends.

Another area that differs from the CCIR recommendation is Orban's suggested use of a CBS Loudness Meter rather than a psophometer loudness meter for measuring perceptual loudness.

Orban said the CBS Loudness Meter uses a more sophisticated algorithm for approximating perceptual loudness, but Small disagreed.

Small noted that a psophometer is the CCIR-recommended loudness meter and the CBS meter is based on a design that was never put into production.

Because of concern raised at the composite work group meeting, suggestions were made to use both loudness meters, according to Salek.

But the differing results from using two meters could open the results to different interpretations, Small said.

Orban said his proposal is not that different from CCIR protection ratios measurement procedures other than using a stereophonic modulating signal for the interference and the choice of loudness meters.

The use of stereo signal approximates real world modulation and would reflect more accurately broadcast conditions in the US, Orban explained.

And, he added, the CBS Loudness Meter is adequate for the test.

Go ahead anyway

Despite criticism that the test is beyond the scope of the composite working group, Small believes there is a danger it might be approved anyway because of the NAB's commitment to get results from the group.

"There is a tendency for these type of groups to be self-perpetuating," he said.

In defense of the project, Salek said the Orban plan is only a "framework" test proposal and can be modified prior to any approval action.

Salek also said the processing test results could be forwarded to CCIR for consideration when the standards-making body periodically updates its standards and recommendations.

Procedurally, Salek said the NRSC has not yet worked out whether the test proposal needs a unanimous vote by members for approval.

Giving Chicken Little Her Due

by Judith Gross

Falls Church VA It never occurred to me until recently, but suppose **Chicken Little** had a point?

Not so much that the sky really **is falling**, but that there is **something** out there getting closer, gathering momentum that if stations don't pay attention to pretty soon promises to change the playing field—and the rules of the

game—when **nobody's looking**.

You don't have to be a **genius** to see what happened to **AM**. That's not to say that there aren't still plenty of good, thriving AM stations out there **serving their listeners** and raking in the ad revenues.

But the technology changed and tastes changed. **Stereo** and **high fidelity** raised listeners expectations. A lot of AMs didn't see the **handwriting on the wall**. Now AM listening is down to 23% and the FCC is writing (yeah, they're still working on it, the **longest homework assignment** in the history of the industry!) a new set of rules to help AM stations cope.

And what about **FM**? Can stations afford to sit back and rest on the knowledge that the band offers stereo and higher fidelity than AM, especially when **CD players** are everywhere, **DAT** is gonna get here sooner or later and now (drum roll please) the digital **satellite systems** have taken the first step.

Two, count 'em, two filings at the FCC have proposed satellite audio services. **Canada** is going to test out a digital system this summer. And in **Europe** they're spending millions.

It's no wonder some top **engineering execs** recently got together to start the ball rolling to meet the challenges of a digital world. They're waiting to see now if they'll get **NAB support**. Maybe they need it, and maybe there **needs** to be a committee like this one way or the other.

Will **special interest groups** and silent agendas try to get their digs in? You bet. Will the **political forces** try to dominate the discussions? Absolutely. But is the **threat** from a digital future going to disappear? **No way**. So let's get real.

As for **AM**, maybe stations on the oldest radio band are starting to feel a little **left out**. Can they get on the digital bandwagon? Well, it's doubtful that **technically** an AM station could realistically benefit from all that's being tossed about these days.

But how about when it comes time to make those **allocations** of the new digital stations? AM could certainly be **given a preference** then. So stations should be guarding their interests closely here, too. In the rush to offer immediate band-aids for **AM** today, stations shouldn't compromise their **options on the future.**

I think we could quiet Chicken Little down a bit if we started to face all this now, instead of waiting for disaster to **sneak up** on on us. The future is here.

☆☆☆

Meanwhile, as the **NRSC deadline** (June 30) fast approaches, I hope all you AMs have your processing in place. It'll be a lot easier to prove you comply that way, when the **FCC** comes calling.

Out in LA **Sandra Woodruff** and her **Chapter 47 SBE** buddies wanted to let me know awhile back about their **subcommittee** on NRSC. The group is encouraging all AMs to meet the deadline by going NRSC, hoping to **educate consumers** about improved fidelity and get them to buy the new **IQ NRSC radios** and help other groups do the same.

The group is also doing a study to see **which stations** have implemented NRSC (both processing and transmission), what stations might be doing other than the 75 μsec preemphasis and which are **stereo**.

Then they're going to compare their info with ADI stats to see **how many listeners** benefit. Pretty nifty. **Sandra**, by the way, is chairing the NRSC committee for the chapter. I'll check back with her and tell you more when I hear it.

I just got to ask it, because nobody else really has, but why, of all places, **Pittsburgh**?

The Pittsburgh Shuffle: Why are these people smiling?

I mean, OK. they got a couple of rivers and a baseball team, and industry and all. But why would the **FCC** choose Pittsburgh as the place where everybody's **got to file** their feeable applications?

They say it's **cheaper**, but since a lot of attorneys doing such filings are based in DC, I wonder. They even sent this picture of communications attorney **Frederick Polner** of the Pittsburgh firm of Rothman Gordon handing the **first FCC** filing to **Wanda Wynn** of the Mellon Bank.

Polner started his career with the FCC, he said. "It's nice to see the FCC recognize that the practice of communications law can thrive outside the Washington DC beltway." Gee, I can't wait until they move the filings to Sheboygan.

☆☆☆

The **LA radio** scene, by the way, seems to have quieted down a bit, with none of the **"Big Dogs"** (KKBT and Pirate KQLZ) getting the ratings they had hoped for, heavy processing or no.

Don't know if the **listeners** are trying to tell them anything, but I was a bit curious about a picture of a Pirate billboard sent to me awhile back. It showed a **cartoon pig** in place of the well-known **Scott Shannon** mug.

What is it with **pigs**? We heard about the Power Pig in Tampa, and now this. Are pigs supposed to be **hip** these days? Am I missing something hot here? Pirate says they are the "Party Pigs." OK. That's one party I think **I'll skip**.

Heard a juicy tidbit? Spill your guts to **Earwaves** *by faxing JG at 703-998-2966, writing to PO Box 1214, Falls Church VA 22041, or calling 703-998-7600. Who knows, you could win a coveted* **RW** *mug.*

Better Tests Needed

by David Maxson

Cambridge MA Regarding the 25 April articles on FM station modulation measurements, I'd like to comment on how inaccurate these measurements really are. As Chief Engineer of WCRB and principal of Broadcast Signal Lab, I've had ample opportunity to measure FM deviation in both laboratory and field conditions.

It is easy from the circuit design point of view to look at FM as simply sweeping a frequency up and down with an audio source. When it comes to measurement though, you can't very well measure the instantaneous frequency of the carrier every cycle. Even Hewlett Packard's new "modulation domain" analyzer cannot handle the complexities of 75 kHz deviated FM broadcast signals with the precision we would want.

So instead, we measure using methods that compare a calibration from a standard to the signal under test. Each time we "transfer" a calibration to another instrument we add error and uncertainty. Let's look at the process the FCC uses to measure a frequency modulated station:

First, establish a 75 kHz deviated reference with a signal generator and a spectrum analyzer. Using a Bessel null, you can generate a very precisely modulated signal. In the example given, a 31,187.62 Hz signal frequency modulates a carrier being observed on a spectrum analyzer.

The modulation is adjusted until the appropriate dip occurs on the analyzer. This is the only truly rigorous part of the entire measurement process. You are actually looking at the test signal while it is still RF and establishing a dip based on a purely mathematical relationship.

GUEST EDITORIAL

If the modulating signal is off by 1 Hz, the resulting error is only 0.0032% from 100% modulation. That's only the calibrating signal's accuracy.

Now disconnect the spectrum analyzer and connect a "high quality receiver" such as the mil. spec. rigs in the FCC vans. The RF connection is a short jumper between a reliable source and load.

Take the "flat" composite output and put it into a storage oscilloscope. The top of the trace represents the voltage produced by the receiver when subjected to an RF source deviated exactly 75 kHz by a single modulating tone.

Finally, disconnect the laboratory source and connect a roof antenna (or transmission line tap at the transmitter) to the receiver. Make sure there are no standing waves, or multipath of any significance.

We performed an on-air Bessell null once with a spectrum analyzer on the transmission line tap and another at a good receiving location miles away. The null did not occur at the same time on each analyzer! The difference between the two was nearly 2% modulation.

We tried to be sure the cables, sources, loads and levels were all appropriate for the measurements. Although we did not determine the cause of the discrepancy, this illustrates that there is uncertainty introduced when trying to observe a signal outside of laboratory conditions.

Let's assume that the RF signal into the test rig is untainted and goes through a precision demodulator in the receiver. How flat is it? How about plus or minus a tenth of a dB 10 Hz to 100 kHz? That translates to ±1.16% modulation, or a worst-case error of 2.32% modulation from the top to the bottom of the response curve. (In addition to measuring the flatness of these receivers, has anyone ever tested them for overshoot under broadcast modulation conditions?)

Now observe this composite signal on a storage oscilloscope. If you are reading off the screen you probably have the voltage corresponding to the 75 kHz

(continued on page 16)

Radio World
Vol 14, No 11 June 13, 1990

Editor, Judith Gross
Associate Editor, Alex Zavistovich
News Editor, Alan Carter
Reporters, Charles Taylor, John Gatski
Benn Kobb, Frank Beacham/L.A.
Editorial Assistant, Marissa Friedman
Technical Advisor, Tom McGinley

Production Director, Kim Lowe
Ginger Bamford, Lisa Roach, Bill Spencer
Ad Production Coordinator, Jeanne Pearson

Publisher, Stevan B. Dana
Associate Publishers, Arthur Constantine
Carmel King

Ad Coordination Manager, Simone Leeser
Circulation Manager, Tiana Hickman
Accounts Receivable, Valerie Mason

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

Radio World (ISSN: 0274-8541) is published semimanthly (except February, which has 3 issues) by Industrial Marketing Advisary Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phane: 703-998-7600, Fax: 703-998-2966. Secand-class postage rates is paid at Falls Church VA 22041 and additianal mailing affices. POSTMASTER: Send 3579 farms and address changes ta Radia Warld, P.O. Bax 1214, Falls Church VA 22041.

Free subscriptians are available upan request ta prafessianal braadcasting and audiavisual equipment users. Far address changes, send current and new address ta RW a manth in advance at the abave address. Unsalicited manuscripts are welcamed far review; send ta the attentian af the apprapriate editar.

Next Issue
Radio World
June 27, 1990

Erratum

NAB Science and Technology Senior VP Michael Rau was inaccurately quoted in the 9 May issue in an article on WAEB multipath testing when commenting on the role of the National Radio Systems Committee (NRSC) in standards setting.

His correct statement is, "The NRSC is a standards committee, it is not a research committee."

Radio World regrets the error.

A Good First Step

The beginnings of an *ad hoc* group by FM engineers concerned about increasing competition from digital audio is a good first step in planning for the future.

While many questions need to be addressed and the agenda may change before any definite directions emerge, the FM industry is at least recognizing the need to address changes in technology before those changes harm the service the way a failure to keep AM competitive has hurt that band.

Stations today face not only competition from digital entertainment such as CDs but are at the mercy of receiver manufacturers who narrow the IF bandwidth to address interference issues in an increasingly crowded spectrum.

Meanwhile Europe is well on its way to implementing digital transmission while Canada is poised to being testing a system this summer.

And with two recent filings at the FCC by companies interested in providing direct satellite audio service in this country, the threat is more immediate than many engineers and managers would like to think.

Whether the informal committee becomes a sanctioned industry group or merely continues to meet according to mutual interests it's important that a forum to air a wide diversity of views be maintained.

These views need to include all facets of the industry, political, economic as well as technical, and consider AM as well as FM interests.

And by subjecting these discussions to industry scrutiny, the threat of special interests or manipulation of private agendas can be minimized.

The twin goals of educating the industry and exploring new technologies—especially terrestrial digital methods—are ones which can help generate support and allow the industry to speak with a single voice.

And an early start to such discussions now insures that when action is necessary, it can be taken in a timely manner. —**RW**

READERS FORUM

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

The truth about WNEW

Dear **RW**:

While packing for Easter vacation, I took along the just-arrived **Radio World** for 11 April—wouldn't miss it.

However, I noticed an error that is often repeated. This time it showed up in George Riggins' *Old Timer* column, and was about New York's WNEW.

He has the generally-accepted story of Ed Wynn's involvement as the source of the "EW" in the call sign (some people claim just one letter). But in Nightingale Gordon's history of the station, *WNEW—Where The Melody Lingers On,* he gives quite another version:

"Ed Wynn's initials are often said to be the source of WNEW's call letters. But retired engineer John Zarpaylic offers this first-hand account: One Sunday morning I had to drive Mr. Blow (an ad exec) and Richard O'Dea (owner of station WODA) to the new location in Carlstadt where they were building the transmitter. And the discussion was, what are we going to call this? Milton Blow said, 'We haven't had a station built in this area since 1928. I think the best call letters we could have are WNEW, which says new. New in the metropolitan area. The newest thing in radio.'"

Now, as I write this, it is much later, because I have just read almost the entire book again. For perhaps the second dozenth time. I'm the manager of a radio station here, but WNEW is The Station for me.

Tom Carten, Manager
WRKC-FM
Wilkes-Barre, PA

Interference or fatigue?

Dear **RW**,

After reading the *Delco Balks at NRSC "IQ" Certified Radio* article in the 9 May, 1990 **RW**, I am reminded again that the sad state of affairs many AM broadcasters find themselves in is due almost entirely to receiver manufacturers attempting to "protect" their consumers (our listeners) from interference.

I'm sure Delco, Motorola, Denon, et al must have extensive market research data that indicates consumers don't want interference. However, after having initiated and studied numerous passive listener research projects in several markets, I have never seen one listener complain of "interference" (or "static" or "noise" or "other voices" or whatever).

On the other hand, many studies show that lack of fidelity and dynamic range causes "listener fatique." This shows up on the most important piece of research broadcasters deal with—the ratings—as shorter "time spent listening."

I would be interested in what forms and amounts of research the receiver manufacturers have conducted to determine that their consumers want to be protected from interference.

I am currently working for a chain that has a Class A FM station. Talk about co- and adjacent channel interference! Even so, I am certain that we would never accept a trade-off of fidelity for greater interference-free range.

Pete Owen, OM
WKEU
Griffin, GA

BROADCAST EQUIPMENT

ITC Builds It

Allied Sells It

The next cart machine you buy may just be the last cart machine you'll ever buy.

The ITC Series 1 will be pulling tape for you until the miracle we all expect takes place.

WINNER AND STILL CHAMPION

So before you mortgage your program director or settle for something of less value than ITC, check out the new Series 1 today.

You won't need an excuse to buy one. Features and price prove its value and its worth.

Introducing the Series 1. The first new machine of the new decade. It's lean, mean & strictly business.

The new Series 1 is designed with all the features you need at a realistic price. Pound the buttons. Flip the switches, jam a cart in and yank it out a few hundred thousand times. The new Series 1 has been built to take anything you can dish out, 24 hours a day, 365 days a year.

ITC sells more cart machines than anyone else. Allied sells more ITC than anyone else.

Call us. Let's make it a Win, Win, Win situation.

HARRIS ALLIED
BROADCAST EQUIPMENT

800-622-0022

"Literature Only" Circle 11

"Call me, I'm interested" Circle 102

Proposals Detail Digital Services

(continued from page 1)
on additional AMSC satellites. RSC would broadcast 10 digital audio channels throughout the US using 1 MHz of spectrum.

100 new channels

Under Satellite CD Radio's proposal, nearly every broadcast licensee will be able to operate in a local, 34-channel capacity. At the same time, the company maintained, a new, 66-channel CD-quality satellite radio service will be made possible as well, resulting in the provision of 100 new broadcast channels.

Satellite CD President Peter Dolan explained that the company would contract with stations interested in purchasing transponder space. Satellite Radio CD would connect stations' program studios to an uplink center proposed for Montrose, CO, via "some high quality" transmission line that would "most likely" be fiber optic, he said. The filings referred to ISDN/optic fiber.

Dolan also said, as noted in an abstract of the company's petition for rulemaking and application provided by Dolan, that consumer automobile and home receivers are being developed by Stanford Telecom of Santa Clara, CA, that would receive over-the-air AM and FM, and the new CD radio. (The filing at the FCC had not been processed for public viewing at press time.)

Satellite CD Radio said the project would cost $330 million.

Satellite CD Radio is 50% owned by Marcor, a DC communications consulting business owned by Martin A. Rothblatt who has stock in Geostar Corp., a licensee in the Radiodetermination Satellite Service.

The other 50% of Satellite CD Radio is owned by New Era Corp., a Maryland corporation in technology development that is 100% held by Jean-Jacques Portrel, a French citizen.

Two-satellite system

According to the technical filings, Satellite CD Radio would consist of two operational satellites, a multiplicity of terrestrial repeaters primarily serving permanent urban areas, and an earth station that provides feeder links to the satellites and performs tracking, telemetry and control of the spacecraft.

The two satellites of 6000 W are expected to be built by Ford, General Electric and Hughes. They would be launched by such companies as General Dynamics, Martin Marietta or McDonnell Douglass, Satellite CD Radio noted in a prepared statement.

Satellite CD Radio proposed that the system use Dolby AC-2 compression encoding for both satellite and terrestrial. The encoding system compresses 720 kB/s of CD quality stereo audio into 128 kB/s, according to the filing.

In the petition for rulemaking, Satellite CD Radio described itself as a system operator/licensee that would "merely act to provide an antenna farm in the sky for use by broadcasters." It would sell channels to third parties and exercise no control over content.

But the filing stated that Satellite CD Radio would decide which program providers should be given access to its channels.

In a move to expedite the proceeding through the FCC, Satellite CD Radio suggested the matter be resolved by February 1991 so the proposed spectrum usage could be adopted by the 1992 WARC.

Optimistic for FCC

"We're quite hopeful that we will receive a favorable FCC ruling on this," Dolan said. "We will be providing the first CD quality radio broadcasting service. It is within the FCC mandate to promote an advanced type of broadcasting service. We are certainly within that mandate."

"We're quite hopeful that we will receive a favorable FCC ruling on this. We will be providing the first CD quality radio broadcasting service."

Radio Satellite Corp. proposes to resell the satellite capacity to broadcast, paging and mobile communications companies. The broadcast services could be advertising or subscription supported and the ancillary services would be provided to resellers. The digital architecture of the system permits encryption.

RSC plans to license ASIC (application-specific integrated circuit) technology to manufacturers of satellite mobile radios. These special "Radio Satellite Microchips" will contain most of the baseband processing needed to receive the satellite.

"We're taking advantage of dramatic increases in chip capability to consolidate most of the processing required by these sophisticated radios into a single, mass-produced low-cost chip," Noreen said.

He said he expects the satellite radios to cost about $100 more than conventional AM/FM radios. Development of the Radio Satellite Microchip would cost $3-5 million.

In addition to audio programming, the radios will be capable of navigation and alphanumeric message service. Two-way communication will be available via an optional transmitter. The company plans for these radios to be available through retail electronic outlets by the Christmas 1993 sales season.

Localism or diversity?

At the NAB, Science and Technology Senior VP Michael Rau suggested the filings were an "attempt to show a need" for DBS radio.

"Historically, a radio satellite service is contrary to locally based, free, advertiser-supported broadcasting," Rau said.

The NAB Board of Directors is expected to issue a policy statement on digital audio broadcasting (DAB) after its 19-22 June meeting in Washington, Rau said. He declined to elaborate on that stand.

Noreen, in what he called NAB's opposition to satellite broadcasting, said, "The kind of programming we're looking for is a diverse set of formats, suited to the traveling public as well as listeners in rural areas. Talk programming is preferred, but we will provide music programming too," he said.

While on the staff of NASA's Jet Propulsion Laboratory, Noreen designed communication systems for interplanetary space missions.

In 1983 Noreen organized Transit Communications Inc. (TCI). This firm was one of the original 12 competing US mobile satellite license applicants, which the FCC directed to join together in a consortium.

TCI is one of eight stockholders of that consortium, which became AMSC. Other AMSC stockholders include LIN Broadcasting, Hughes Communications, McCaw Communication Companies, MTel, and Millicom Inc.

For more information from Satellite CD Radio, call 202-408-0080; contact Radio Satellite Corp. at 818-564-9333.

FCC Seeks To Prevent Abuses

by Alan Carter

Washington DC Taking its cue from broadcasters, the FCC has dropped a proposed lottery for new radio and TV allocations and started proceedings to further revise the comparative hearing process.

The rulings

In dropping the lottery proceeding under docket MM 89-15, the FCC noted that it was concerned that any potential gains in efficiency by a lottery would be outweighed by the "possible reduction in quality of broadcasting licensees and service to the public."

Commissioners also adopted several proposals designed to deter abuse of process.

It will now be illegal to receive or make payments in excess of expenses in exchange for withdrawing or refraining from filing a threatened petition to deny.

The FCC further said it will review on a case-by-case basis all citizens' agreements reached in consideration for withdrawing petitions to deny or threats to file petitions to ensure that they reflect public interest.

The Commission said the public interest is served by its decisions to limit settlements to competing applications . . .

The Commission also proposed reinstituting limits on the amount of payments that would be permitted to settle comparative new hearings. These proposals are intended to expedite the initiation of new service, as well as to reduce the potential for abuse of the application process.

The FCC took the action 10 May on a unanimous vote at a regular monthly meeting.

No lottery support

Across the board, commenters opposed the lottery system. Those against the action included the NAB, the Federal Communications Bar Association, the Black Media Coalition and the Community Broadcasters Association, a trade group representing low power television that has a lottery.

Opposition generally focused on a lack of true broadcast interest and localism in a lottery process.

Among the proceedings the FCC opened in revising comparative renewal is a proposal to shorten the hearing process and the time for related appeals.

In other action, the Commission also expanded the scope of an applicants' criminal record it will consider in granting a license. Now, all felony convictions, not just misconduct directly related to any relationship with the FCC, and misdemeanors, will play a role.

In a final action, the FCC rejected an appeal by a group on previous comparative reform under docket MM 81-742.

The Commission said the public interest is served by its decisions to limit settlements to competing applications; eliminate the Cameron doctrine that permitted competing applicants to use the transmitter site of the incumbent, and cease the enforcement of programming commitments made in citizens' agreements between renewal applicants and citizens' groups.

Austerity For NAB

by Charles Taylor

Washington DC The NAB Executive Committee's decision to hold the association's 1990-1991 budget steady at $15.7 million will have little effect on current Science & Technology work but will delay plans for some new projects.

NAB officials, who met 8 May, attributed the no-growth budget to a general downturn in the nation's economy, according to an NAB spokesperson.

For Science & Technology, the new budget means less participation in the International Radio Consultative Committee (CCIR) and eliminates proposed testing of Improved Definition Television, said Senior VP Michael Rau.

Other departmental effects include a decrease in the travel budget. "We won't have as much flexibility to travel to state associations and SBE (Society of Broadcast Engineers) as guest speakers," Rau said.

While the cuts will prevent Science & Technology from moving ahead with some projects, Rau said the department is accustomed to working within its means.

"NAB is a non-profit association and cannot spend more than we take in, so whatever the income levels are is what our income is held to," he said. "We would like to develop revenue sources in order to increase industry services, so that we can keep dues as low as possible to our membership."

In other business, NAB staff presented reports on radio issues including AM improvements, FM translators, allocation policies, AM directional antennas and digital audio broadcasting (DAB). The NAB Board is expected to release its position on DAB in a policy statement to come out of a full board meeting scheduled the third week of June.

THE ONLY BLUE

THAT'S TRUE.

When broadcasters worldwide need performance they can depend on, they reach for one cart. The original blue one—The genuine Audiopak broadcast cartridge. They know every batch of "workhorse" A-2s, "stereo" AA-3s or "digital-ready" AA-4s will deliver true quality + superior performance, cart after cart after cart.

Making carts you can count on. That's what has made us #1 in the US and around the world. And we intend to keep right on doing precisely that. To make it easy for you to recognize *genuine* Audiopak carts, we're introducing a new Quality Assurance seal and molding our name into the top cover. Of course, the real proof of our commitment to quality is the consistent performance and long-term durability we build into every Audiopak cart. So if reliability and unsurpassed audio performance are important to you, insist on the one cart that's true blue for more stations than any other—Audiopak.

audiopak®

P.O. Box 3100 • Winchester, VA 22601
Tel: (800) 522-CART or (703) 667-8125
Fax: (703) 667-6379

Circle 152 On Reader Service Card

FCC Plans Ahead for WARC '92

by Alan Carter

Washington DC The FCC is well underway in planning for the US position at the ITU 1992 World Administrative Radio Conference (WARC), which Chairman Al Sikes has said will set the stage for telecommunications in the 21st Century.

In addition to a notice of inquiry, the FCC 92-WARC Advisory Committee recently organized informal working groups through which the committee will prepare recommendations for the Commission.

"This is the broadest based WARC since 1979," said FCC International Communications Director Walda Roseman. "There is a broad range of interest."

HFB, UHF and SHF

The preliminary agenda includes the high frequency band, the UHF band and the super high frequency (SHF) band, which is 10 GHz and above for space services including direct broadcast satellite, she explained.

The agenda will be finalized when the ITU administrative counsel meets 11-22 June in Geneva. "This is a critical bench mark for WARC," Roseman said.

Sikes has called the upcoming world conference that will be held in Spain the "21st Century WARC," Roseman said. US planning for the session will set the framework for the US and others in telecommunications for the 21st Century, according to Sikes, she noted.

Broadcast participation is sought through the working groups of the advisory committee, which is co-chaired by Commissioner Sherrie Marshall and Frank Urbany of Bell South.

Those committees and chairpersons are: IWG1, high frequency from 3-30 MHz, Bob Raish of Fletcher, Heald and Hildreth; IWG2, UHF from .5-3 gHz, Ben Fisher of Fisher, Wayland Cooper and Leader; IWG3, SHF from 11-35 gHz, Donald Jansky of Jansky Barmat Telecommunications; IWG4, technical committee considering frequency sharing, Burt Halprin of Verner, Liipfert, Bernhard, McPherson and Hand, and IWG5, procedures, Leslie Taylor of Leslie Taylor Associates.

Report schedule

The first interim report from the advisory committee to the FCC is due 30 June, with a follow-up on 31 January 1991 and the final report due 30 April 1991. The next advisory committee meeting is 27 June.

Roseman said the FCC is moving on a second front with a notice of inquiry.

Among those who commented, the NAB cautioned federal regulators against crowding the marketplace with new communications services, arguing that they threaten to interfere with or displace local radio and television signals already in use today.

The NAB questioned whether the US broadcast spectrum could support the additional allocation of spectrum space. These new offerings could include mobile services and a proposed satellite broadcasting service in the 500-3000 MHz range, as well as high definition television broadcasting by satellite.

Sikes has called the upcoming world conference that will be held in Spain the "21st Century WARC," Roseman said.

At a third level, Roseman said the FCC is participating in the Interagency Radio Advisory Committee (IRAC) that monitors government frequency. The FCC and Commerce Department are coordinating efforts on these issues.

For information from the FCC on WARC preparations, contact the International Communications Office at 202-632-0935 or the Office of Engineering and Technology at 202-632-7060.

Varian Repositions

by Alan Carter

Palo Alto CA Continental Electronics and TVT Limited are on the sales block along with several non-broadcast divisions, parent company Varian Associates announced in mid-May.

The sales are part of a companywide "repositioning" to focus on the component aspects of its operations rather than systems, according to Varian.

Varian also announced it will eliminate approximately 600 corporate jobs, 20% of its work force, in addition to those with the divisions for sale. Varian employment will drop from approximately 12,000 to less than 10,000.

Varian has been in negotiations for "a couple of months" with buyers for Continental and TVT, a spokeswoman confirmed. She said she could not identify the interested companies.

While Varian's announcement did not indicate what it would do with Continental and TVT if they were not sold by the designated 29 September deadline, the spokeswoman said such a situation developing is not expected. "I don't think anyone has really considered that because it is such a highly unlikely happening," she said.

Continental and TVT are operating "business as usual," the spokeswoman said. Varian classified the two companies as "discontinued operations" in a written statement, but she clarified the expression as common accounting terminology.

Continental Domestic Sales Director Walt Rice also said Continental has not closed its doors as some would suggest. "We are conducting business as usual. We are booking orders daily."

Varian Chairman and Chief Executive J. Tracy O'Rourke said the divestiture will allow Varian to take a one-time, pretax charge of $74 million against third quarter results and report a loss for the period ending 29 June.

The operations to be sold represent annual sales of about $200 million and employ about 1600.

Varian said it will retain "core businesses" that are electron devices, analytical instruments, semiconductor process equipment, and medical therapy equipment.

For information from Continental, contact Walt Rice at 214-381-7161.

Digital Group Meets

(continued from page 1)

FM service which is degraded in a way we have no control over."

Engineers who have met include CBS Radio Technical Operations Director Tony Masiello; Susquehanna Senior VP Charlie Morgan; ABC Radio Satellite Systems Director Robert Donnelly; communications attorney Robert Mazer of Nixon Hargrave, Devans & Doyle; EZ Communications DE Bud Aiello; Infinity's WJFK CE Dan Ryson; and National Public Radio Engineering and Operations Director Don Lockett and Senior Engineer Mike Starling.

Donahue said that the group has the support of the FM industry's major players and is concerning itself only with FM issues.

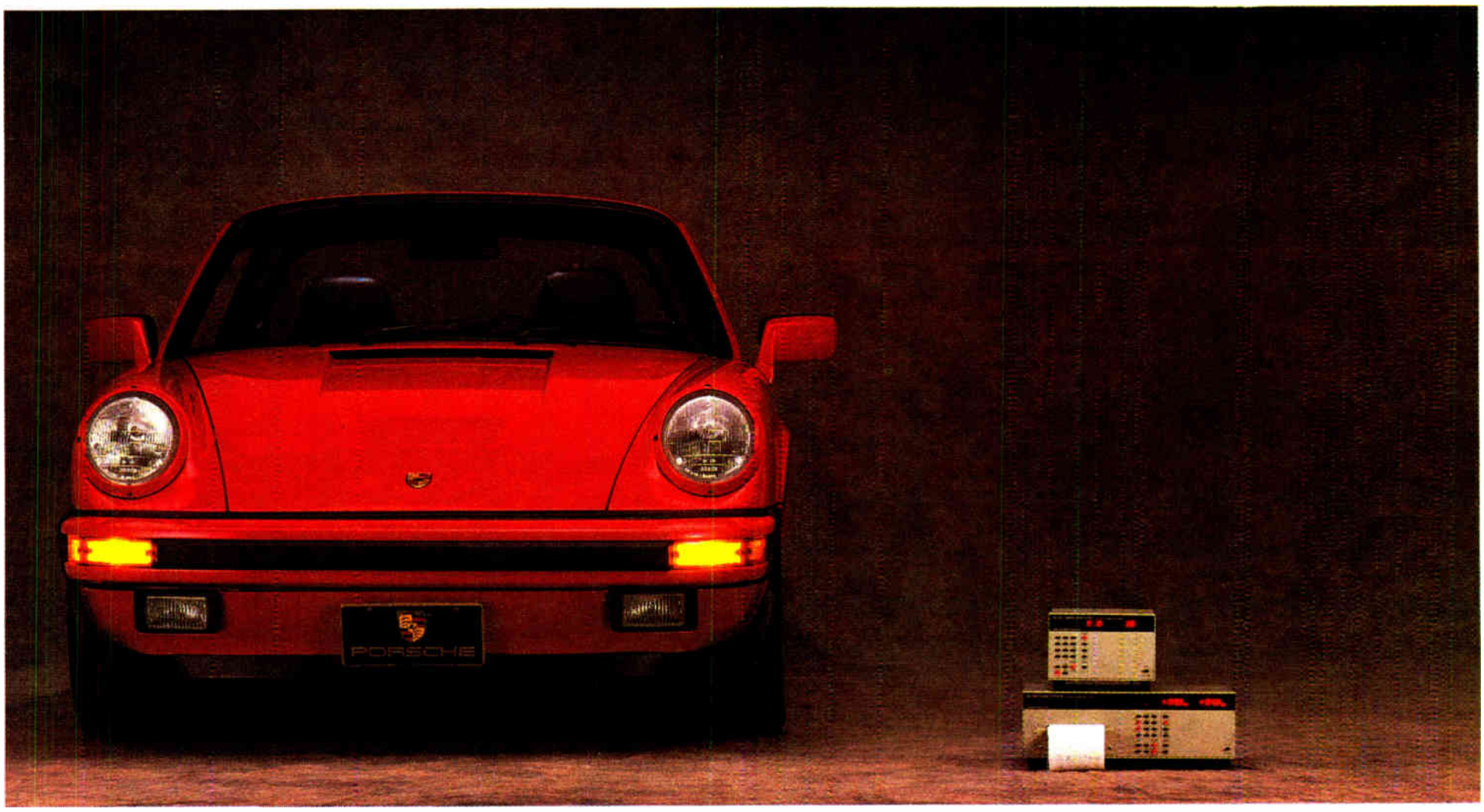
The group held two meetings in May after being informally organized at NAB '90.

Donahue said the group has asked the NAB through Science and Technology Senior VP Michael Rau for its position on digital broadcasting and the group's efforts. A response is expected after the NAB Board meeting to be held in June.

"We invited the NAB to participate because we want to speak with one voice and not waste our efforts. We've given the NAB an opportunity to state its position. Before we move much further we need NAB's position."

Donahue said the committee hopes to stress the need for FM stations to become more informed in an increasingly competitive environment.

"If the public is saying with their buying dollars that they want higher quality and we're not delivering the quality they want, then we are violating a public trust."



Fast.

Very Fast.

On your left, the Porsche 911 Targa Carrera, one of the fastest production cars in the world. It goes from 0-60 in just 6.1 seconds. *Fast.*

On your right, the revolutionary Schmid SIAT, the world's fastest, most precise audio network testing system. It features technology so advanced, you can check 10 critical parameters of your audio broadcasts, including noise, harmonic distortion, frequency/phase response, channel transposition and more, all at the push of a button.

Even more impressive, you can test *any* transmission network, from the simplest to the most complex, all from a single location. All in an amazing 5 seconds flat. *Very fast!*

No more time-consuming manual tests. No more annoying tone tests. No more service interruptions. Instead, faultless audio transmissions that will leave your viewers and listeners coming back for more.

Save time. Save money. All while revving up your audio performance. For more information and a *free* copy of our SIAT video presentation, call toll-free 1-800-955-9570 or mail the coupon today.

RW

☐ **Yes!** Please send me the SIAT video at no cost or obligation.

☐ Please call with additional information.

Name_____

Title_____

Company_____

City/State/Zip_____

Country_____

Phone_____ Fax_____

Mail to: Schmid Telecommunication, 15 West 26 Street, 12th fl., New York, NY 10010

U.S. Sales Office: Holzberg Inc. ☐ P.O. Box 323 ☐ Sea Bright, NJ 07760
Tel: 201-530-8555 Fax: 201-842-7552
Canadian Sales Office: M.S.C. Electronics Ltd. ☐ 147 West Beaver Creek Road
Richmond Hill, Ontario ☐ L4B 1C6 Canada ☐ Tel: 416-731-9500 Fax: 416-731-5195
Headquarters: Schmid Telecommunication ☐ Rieterstrasse 6 CH-8002 Zurich
Switzerland ☐ Tel: 011 41 1 206-1111 Fax: 011 41 1 201-2372

Schmid Telecommunication

TAKING IT TO THE STREETS

Programming Crossroads- Radio programming is now at a crossroads with stations using sound alike formats to attract target demographics. How your station gets its next advertising dollar may depend on how you handle remote broadcasts. Remotes will give you an edge on the competition, involve your listeners and give you station recognition.

The Premium Vehicle- You need a premium vehicle to broadcast the cleanest sound. Your next remote doesn't have to be an audio compromise. Deliver studio quality sound with the **new Moseley Remote Programming Link 4000.**

Quiet Ride- The **RPL 4010 Transmitter** delivers up to 20 watts in a package that's lightweight, portable and field programmable.

You can drive to your remote with confidence that the **RPL 4020 Receiver** will operate in high RF environments virtually immune from adjacent channel interference.

Cruise Controls- You and your air talent will enjoy the easy set-up of the RPL 4000 featuring a built-in 3-channel audio mixer for mic and line inputs, 2:1 internal noise reduction, two frequency operation, wide/narrow bandwidth and extensive metering and diagnostics. The RPL 4000 is also fully compatible with existing RPUs.

Service and Support- As with all Moseley products, the RPL 4000 carries a 2 year warranty and 24 hour technical support.

The RPL 4000 puts you in the driver's seat. So what are you waiting for. Get your economical **Moseley RPL 4000** and take it to the street!

Destined to be a classic, the RPL 4000 is available NOW from your favorite Moseley dealer!

Moseley

The Trusted Name in Communications

Moseley Associates Incorporated
111 Castilian Drive
Santa Barbara, CA USA
93117-3093
a GRC Int'l Company
Phone 805 968 9621
Telex 658448
FAX: 805 685 9638

Circle 13 On Reader Service Card

VOA Phase 2 Done

by Charles Taylor

Washington DC The Voice of America (VOA) has completed the second phase of its long-awaited 19 broadcast studio renovation project, bringing to completion a contract more than 15 months overdue.

Phase 2 included the complete modernization of 10 broadcast studios, including custom-designed multi-bus stereo mixing consoles, bus mix-minus systems, open reel analog tape recorders, cart decks and a state-of-the-art IFB/monitoring system.

Gary Marco, president of the National Federation of Federal Employees Local 1418, VOA's technical union, confirmed that the project's contractor had completed work on the studios.

"We've got our guys in there now with the goal of making them ready for production and studio work," Marco said.

Completion of the 10 studios wraps up a $6.63 million contract that has been plagued by delays and unforseen troubles since it was signed three years ago. The project's first phase of nine broadcast studios was completed last spring, nearly a year behind schedule.

Problems encountered in the first phase ranged from the discovery of wires that were leaking hazardous PCBs to the removal of asbestos. Equipment delays also kept Phase 1 from timely completion.

Xu Kai-lan (left) and Michael Yan tape a Voice of America program for VOA's China branch.

Studios in Phase 2 are scheduled to begin operation by the end of May, according to VOA.

Rinaldo Lauds FCC

John Gatski

Washington DC One of radio's key congressional allies has praised recent FCC attempts to help the ailing AM band with a proposed rulemaking that would open up the expanded band and mandate AM stereo.

Rep. Matthew Rinaldo (R-NJ) of the House Telecommunications and Finance Subcommittee told **Radio World** that the FCC's action is a reflection of FCC Chairman Al Sikes' commitment to AM.

"I'm pleased that Al Sikes has made the viability of AM radio a top priority," Rinaldo said.

Rinaldo, the ranking Republican on the House Telecommunications and Finance Subcommittee, has been trying to bring about AM improvements through the legislative process.

Last year, he introduced the Radio Quality Improvements bill (HR-2714). The legislation would mandate the FCC to seek technical relief for the crowded, interference-ridden AM band.

The bill also would require receiver manufacturers to add AM stereo to FM-stereo equipped receivers, limit FM translators and move stations to the expanded band (1605 kHz to 1705 kHz) while allowing them to continue broadcasting on their existing frequency for five years.

The FCC's recent proposed rulemaking also addresses several of these concerns. They include moving interfering AMs to the expanded band, offering incentives for or possibly requiring stations to broadcast in AM stereo without designating a standard, abolishing AM simulcast on FM and changing protection ratios.

With the introduction of the AM bill last year, it became obvious that concern about the AM band extended into Congress, according to Rinaldo.

But he said, it does not matter who initiates a plan along as action is taken to help AM.

"My chief concern is that local AM service is improved and interference is reduced," Rinaldo said.

Although the bill and the FCC action addresses similar AM issues, Rinaldo said they take different approaches in some areas.

"Wherever they (FFC) fall short, we are going to put it in our bill," Rinaldo said.

In its final form, HR-2714 should be a "consensus" bill that will be supported by Congress, broadcasters and the FCC, he added.

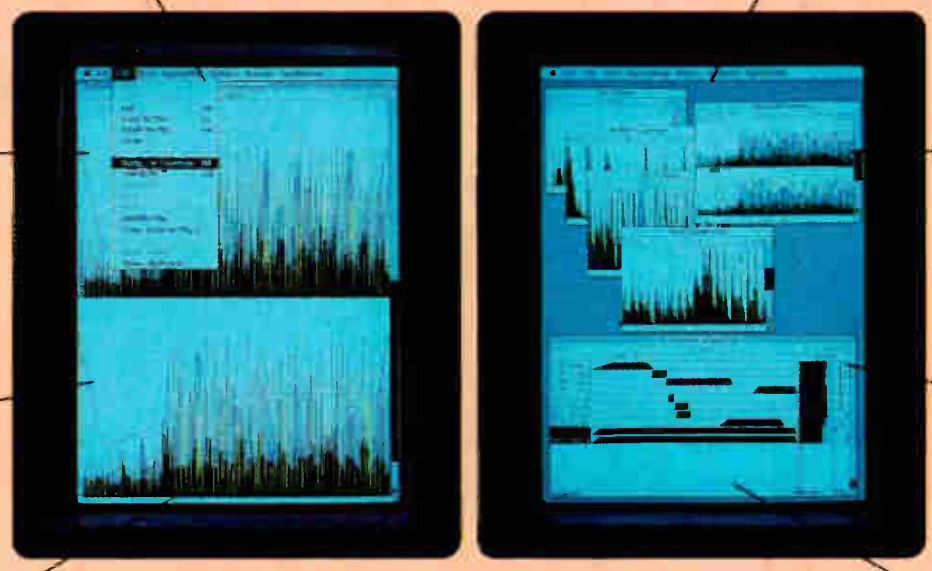
Also, the AM technical bill is likely to contain an amendment to codify the FCC's April 1990 regulations that changes the comparative renewal process to prevent third party payoffs, according to Rinaldo.

RADIO PRODUCTION 1990.

Total creative control, starting at less than $6,500.*

Interface easily to analog and to all major digital formats.

Fast learning curve to high creative output. Difficult editing tasks made quick and easy.



"Duck" a background track beneath a voice-over. Fade-out/fade-in, with complete accuracy.

Time expansion and compression—<u>without</u> pitch change

Storage capacity from 10 minutes to 6 hours of <u>stereo</u> digital audio.

Superlative audio quality. Multiple mixes and multiple generations—<u>without</u> degradation.

Easily expandable and upgradable—now and in the future.

STUDER DYAXIS. DIGITAL AUDIO HARD DISK FOR RADIO. YOUR LOW COST WAY TO BEAT UP ON THE COMPETITION.

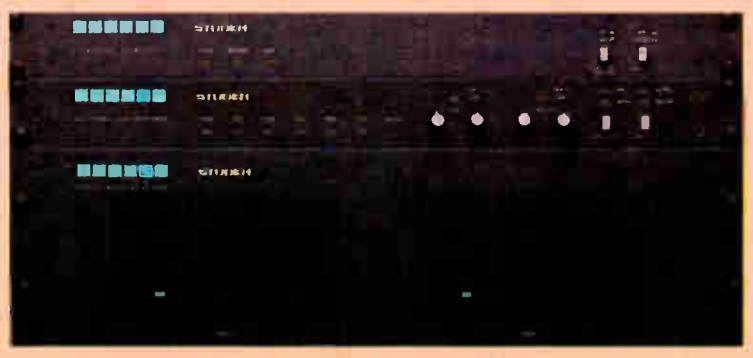
Ratings wars—the push to get advertisers—the crunch on operating costs...You always need to move faster and be better than the competition.

The station offering quick turn-around and the ability to produce more complex, sophisticated and creative spots, jingles, promos and programs is likely to be the winner. With Dyaxis, you can *be* that winner. Your advertisers love you. Your listeners love you. And your competition hates you.

The Studer Dyaxis is the most powerful and cost effective hard disk digital recording/editing system available, starting under $6,500*—*proof* that digital audio for radio doesn't have to be expensive.

No ad can tell you all that Dyaxis will mean to production at your station. So call us at **800-366-4900** for our 12-page Dyaxis color brochure and read about your exciting future in digital audio editing with Dyaxis.

Now, *see* what you *hear*. On Dyaxis. From Studer, a name you can trust.



*Price not including Apple Macintosh computer.

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 Canada Ltd., Toronto (416) 423-2831

NOW AVAILABLE
MacMix™ version 2.3
and
Excellerator/DSP Card

Circle 57 On Reader Service Card

Audio Cards for IBM

by Frank Beacham

Albuquerque NM The IBM personal computer sitting on your desk now has the capability to become the centerpiece for an automated digital radio station, according to an announcement here by Ariel Corp. of Highland Park, NJ.

Two new circuit cards were shown at the International Conference for Acoustics, Speech and Signal Processing (ICASSP) that turn IBM-compatible desk top computers into complete audio post production workstations and digital routing devices for DAT audio recorders, CD players and storage disks.

The PC-56D card, priced at $895, allows any PC to perform functions such as digital audio recording, filtering, compression/decompression, multiplexing, mixing, transferring sounds to disk and recreating original or modified sounds, speech or data.

The DAT-56 card, priced at $1995, interfaces a PC to DAT decks, CD players and other professional audio equipment using the AES/EBU digital interface standard.

Hard disk recording

The card includes a SCSI interface that permits the recording of digital sound to standard hard disk drives and comes with DSPnet, intelligent networking software that allows the connection of multiple cards circumventing the need to use the host PC bus.

DAT-56 can also interconnect to digital audio products that transmit by both electrical and fiber optic mediums.

"With properly configured software, PC-based systems can use the new cards to create anything from a small post production studio to a full blown digital radio station with the IBM PC as central audio mixing console and automated controller," said Tony Agnello, president of Ariel Corp.

"DSPnet allows you to synchronize across multiple two-channel DAT-56 boards so you can create a multi-channel recording/editing system. All of your mixing is done digitally with 24 bits of precision," Agnello said.

Up to seven 600 megabyte hard SCSI hard disk drives may be used for audio storage, allowing a system to hold about seven hours of audio programming on random access disks.

Motorola processor

Both circuit cards utilize the Motorola 56001 digital signal processor, which creates the ability for PCs to transmit, store, manipulate and recreate compact disc quality sound.

Both boards connect to Ariel's recently introduced digital microphone, which captures stereo analog signals and then digitally encodes them for the PC to analyze, modify or store on computer disk.

"With our digital microphone and DSP boards, PCs become multimedia systems, digital recording studios, speech recognition development systems, scientific and data acquisition instruments," Agnello said.

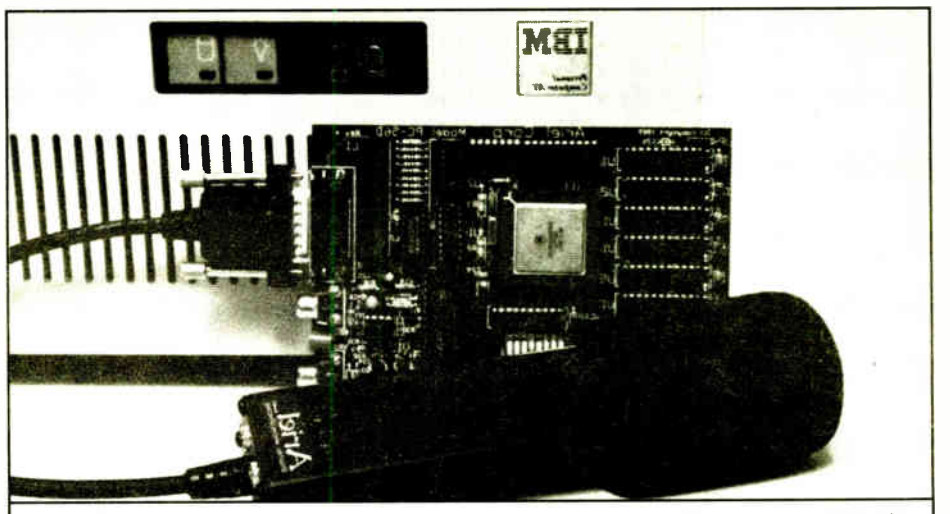
"Our aim is to provide a hardware bridge; upgrading the installed base of conventional PCs to a new performance level which contains features and abilities found only on the most expensive, most innovative computer platforms."

Ariel, Agnello said, also offers equipment developers complete software development tools such as assemblers, debuggers and example programs.

He emphasized Ariel is not developing end user software for the new DSP cards, but is aiding companies who do so.

Agnello, one of the inventors of the Eventide Harmonizer and other digital processing products, said both of the new circuit cards were to be available for delivery 1 May.

For information contact Les Listwa at Ariel Corp., 201-249-2900.



Ariel's PC-56D and digital mic can now bring speech and stereo audio features to IBM PCs.

VOA Hits Environmental Snag

by Charles Taylor

Negev Desert ISRAEL Construction of a radio transmitting station here that the Voice of America (VOA) intends to use for the broadcast of programming in at least 20 languages has been stalled by environmentalists who claim the project would create more trouble than it is worth.

The $270 million station, a joint project with the US Board for International Broadcasting (BIB), has been in the planning for more than five years.

The agency would use the transmitting station to deliver programming to Soviet Central Asia, East Africa and South Asia, according to VOA spokesman Michael Schoenfeld. VOA would employ six of 16 transmitters and 22 of the 37 antennas at the station. Peak height of the antennas is 558'.

"This station really is a vital part of our worldwide modernization programs," Schoenfeld said.

Birds and plants affected

Opposition was raised in late February when the Society for the Protection of Nature in Israel said at a Congressional hearing that the project is in the pathway of the major bird flyway connecting Europe and Asia with Africa and also threatens thousands of desert plants, according to published reports.

The organization also claimed that the project would emit RF waves that might interfere with the guidance systems of planes flying from a nearby Israeli air force training base.

"I would like to see you stand up and scrap this undertaking that will disturb the environment and the quality of life," said Yoav Sagi, chairman of the society.

Most claims refuted

Pat Sowick, a spokesperson with the BIB, said that most of the environmental claims brought up by the group are refuted in a $2 million environmental impact study conducted in the early stages of the project's planning.

(continued on page 18)

Accuracy in Measurement

(continued from page 5)

deviated test signal about 3/4 of the way up the screen, representing about 1 kHz deviation per tenth of a division. How thick is the trace? 500 Hz to 1 kHz thick? The equivalent of 1% modulation?

How flat is the scope's response? How flat is the display? What about parallax error between the time you set the reference to a line on the screen and the time you sit down to "observe" the overmodulating station?

You can bypass the errors related to display and observation by using a digital oscilloscope. Have the scope calculate the difference between the reference and some maximum value you have chosen on the screen. With, say, a thousand vertical points of resolution, you have the equivalent of about one tenth of a percent modulation per step. (Plus or minus at least one step, of course. This is digital.)

What point do you pick to measure? Pick the apparent top of the accumulated traces (on a storage scope) or something which looks like a typical maximum level (on a digital scope). On most well-engineered stations this will be at a pretty clear level on the screen, with occasional higher excursions. But is that value the level of the peaks of frequent recurrence or the cutoff level of nearly all the peaks regardless of duration and frequency of occurrence?

There is nothing on the screen to characterize the duration of those peaks for you. You use your eye to perform a statistical analysis. With a little practice, you can judge it pretty well, but it's not empirical!

What this discussion points to is the fact that there is room for error and uncertainty when trying to measure an FM broadcast station's modulation.

The FCC's method of measurement is not as precise or accurate as it might seem. At the very least, if the FCC is going to use this method of enforcement it should do the following:

1. Properly identify the uncertainties in its measurements and include them in their reporting (e.g., 103%, ±5%).
2. Announce one acceptable, rigorous, repeatable method for all to use to measure modulation. Define what a peak is in the context of that measurement method.
3. Establish an official range which is enforcement-neutral to allow room for the combined errors of the broadcaster and the FCC (say, through one dB over your applicable modulation limit). Balance this with a penalty for any modulation which the FCC measures even one percentage point above the neutral range. Then, any station which tries to take advantage of the enforcement-neutral range does so at its own peril.

Better yet, since the purpose of enforcing modulation standards is to prevent harmful interference, let's switch to using occupied bandwidth as the primary enforcement tool.

■ ■ ■

David Maxson can be reached at Broadcast Signal Lab at 617-864-4298.

RADIOMIXER®
For everyone who thought a PR&E console was out of reach.

You've tried, but your console budget just can't accommodate a Pacific Recorders BMX—not this time. So you're probably thinking about settling for a copy, even though it won't have the standard-setting features, performance and long-term reliability that have made our BMX consoles so successful.

Fortunately, you don't have to settle. Radiomixer is genuine PR&E. All the way from its high quality components to its efficient BMX-style layout, comprehensive telephone mix system and unique Off Line Mix Matrix. Yet its manufacturer-direct price is no higher than the "clones."

How did the PR&E engineering team build a less expensive console without lowering our standards? Let's start with what we <u>didn't</u> do:

We didn't compromise on quality. Radiomixer uses the highest caliber components throughout, including our standard professional-spec meters, faders, and switches. Plus the best-sounding VCA technology in the industry. To keep Radiomixer's cost down, we've limited the number of different module types and mainframe sizes, and simplified the construction of the card frame, mainframe and modules.

The final result? In less than a year, Radiomixer has quietly become one of our most popular consoles. In fact, it's now one of the best-selling boards in broadcasting. Our color brochure will tell you more of the reasons why, and help you configure a Radiomixer for your particular application. To get your copy, call PR&E direct at 619-438-3911.

PACIFIC RECORDERS & ENGINEERING CORPORATION
2070 Las Palmas Drive ▪ Carlsbad, CA 92009 ▪ Tel 619-438-3911 ▪ Fax 619-438-9277

Circle 110 On Reader Service Card

SF Radio Trailblazer Reminisces

At only 40, Bonnie Simmons already can be called a pioneer in San Francisco radio. She was at the vanguard of the progressive FM sound that was uniquely San Francisco radio, as program director and DJ at KSAN-FM from 1969 to 1978.

Recently a compilation of KSAN programming with legendary disc jockey Tom Donahue was released on compact disc. Simmons, who later worked at other Bay area stations, has left broadcasting.

Today, she plays records without a playlist at Slim's, Boz Scaggs's San Francisco nightclub. **Radio World** *Los Angeles correspondent Frank Beacham recently talked with her there.*

RW: *What was so special about KSAN and San Francisco radio during the late '60s and '70s?*

Simmons: There was an alternative lifestyle at the time that you could program to because you were part of it and understood it. When I was on the air at KSAN, I knew exactly who I was talking to.

Hardly any of us had any radio experience, with the exception of (Tom) Donahue who hired all of us. We came into it through a love of music and a love of radio that was never schooled.

We broke a lot of the rules that a lot of people seem to think are important and I think that was part of our charm. We had no sense that we were making history. We were just a bunch of hippies having the best time of our lives and somebody was paying us.

RW: *I've been told that radio programmers from all over the country used to come to San Francisco, check into a hotel room and record KSAN and other stations with new formats in the market.*

Simmons: They did, but what they never understood is there was no format. (Laughter). It was a radio station with 35,000 record albums. They were within 30 feet of you while you were on the air and nobody ever knew what they were going to play from one record to the next.

We played rock'n'roll, gospel, R&B . . . we played blues country.

RW: *When did radio begin to change in San Francisco?*

Simmons: In the late 1970s. Part of it is that radio is real estate rather than anything that has any heart to it any longer. Stations are so expensive that the people who can afford to buy them are not going to take a chance for the love of radio.

Radio today does not allow the passion of the people on the air to come through. You are so restricted in everything you do. For the most part, every record is picked for you. Every liner card is written for you. Every nuance is planned.

KSAN wasn't just a music station. It had an extraordinary public affairs department. It had an award-winning news department. The jocks were all people who were out on the street. They went to shows. They knew what was going on in town. These are not commodities that are easy to come by.

RW: *How do you feel about today's stations in the San Francisco market?*

Simmons: I talk to a lot of listeners. People climb up the ladder here at Slim's and talk to me about radio. I've never had anybody climb up the ladder and say, "Ain't radio great?"

Everybody complains about it. I believe, especially in the Bay area, there is a huge disenfranchised radio listening audience that no longer listens. KFOG and KRQR supply them nothing. They don't play new records. That infuriates me.

With the exception of KMEL, which is an urban station—they do a mindblowingly good job. That is a great urban station. Then, you can listen to Live 105 and hear the modern European stuff.

(continued on page 21)

VOA Plans Are Stalled

(continued from page 16)

"It's complex and there's certainly disagreement about it, but while there's a lot of emotional testimony that came from people from Israel and the United States, they still have yet to produce evidence of any real danger," Sowick said. "There are shortwave transmitter facilities all over the world, and there really has not been any link with any ill effects on plants or animals as a result.

"My interpretation is that perhaps they're giving it the last hurrah here to defeat it. It appears imminent at this point," she added.

The issue of interference with the Israeli air force training base is not covered in the study, according to Sowick, because it was not raised until after completion of the report.

To date, the plot of land for the transmitting station has been partially cleared, however, a final contract for construction is pending resolution of the conflicts with the Israeli National Board for Planning and Building.

Language services restored

Meanwhile, on another front, VOA got good news from its parent agency, the United States Information Agency (USIA), when Director Bruce Gelb told VOA officials 2 March that funding has been restored to continue its language services division.

The 2 March announcement came two weeks before the division, which provides worldwide programming in numerous languages, was slated to shut down because of federal budget cuts.

The division is budgeted at $3 million a year.

For information, contact VOA public affairs at 202-485-7050.

"Features and specs sold us on Auditronics 200 consoles."

Robert Lankton, Chief Engineer
WDUV/WBRD in Bradenton, Florida

"Their performance and reliability keep us sold."

"We wanted a console flexible enough to use in master control, production and news. We shopped for features and specs, but we also looked for ease-of-use and reliability. We got just what we wanted in our four Auditronics 200s."

Features

"I insisted on outboard power supplies and no monitor amps in the console for noise reasons. I was impressed with Auditronics' VCA technology, which at the time was not available elsewhere. We wanted the self-contained clock and timer. We needed the switching logic to interface between the A and B inputs, (a neat concept most other consoles don't offer). And we needed a lot of extra line inputs to support our satellite feeds. We needed a first-rate telephone interface. Auditronics beat its competitor hands-down on this. And, of course, modular design was a must for serviceability. We got it all in the Auditronics 200."

Specifications

"We go for the widest dynamic range we can get because much of our programming originates on CD. So the 200's 3dB better S/N is really important. Everything on the Auditronics 200 tests out better than the specs they publish, and you can't ask for more than that."

Ease of Operation

"I found the 200 logically laid out and very easy to train our people to use. The jocks like them and can easily understand them, which is very important to management."

Reliability

"We're just ecstatic about the Auditronics consoles. They've run 24-hours, 7-days since turn-on without a failure. What's more, they've held their specs, which I check every month to audiophile standards."

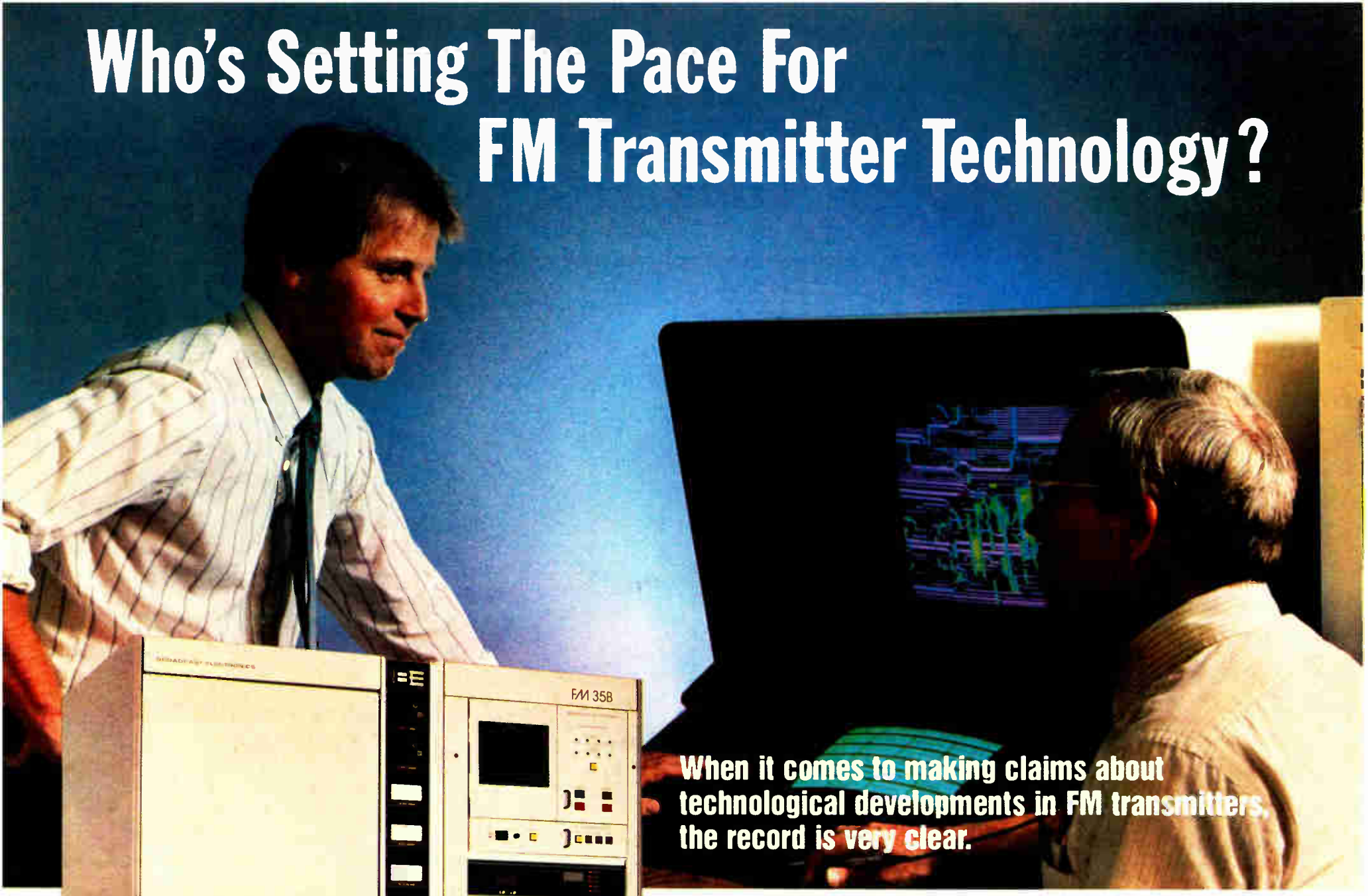
"Would I buy Auditronics again?"

"At WDUV/WBRD everybody is happy with both the Auditronics consoles and the support we've received from the company. We look forward to doing business with them again." If you'd like to know more about why Rob Lankton swears by Auditronics consoles, call 1-800-638-0977 or contact

auditronics, inc.
3750 Old Getwell Road, Memphis, TN 38118
901-362-1350

Circle 39 On Reader Service Card

Who's Setting The Pace For FM Transmitter Technology?



When it comes to making claims about technological developments in FM transmitters, the record is very clear.

Broadcast Electronics:

First to introduce a Proportional VSWR Foldback System.

First to introduce "PWM Automatic Power Control" with "Soft Start".

First to offer a built-in synchronous AM test port.

First to design a single tube high power 30kW FM Transmitter.

First to introduce a single tube 10kW FM Transmitter with a 4CX7500A tube.

First to introduce a single tube 3.5kW FM Transmitter with a 4CX3500A tube.

First to introduce a Microprocessor Video Diagnostic System.

First to offer built-in, PC based, transmitter remote control.

First to offer a standard synchronous FM booster option.

And, Broadcast Electronics again sets the world standard for FM Exciters with the new FX 50 which stands alone in audio performance with 93 dB S/N and .003% THD and IMD.

Patented Innovations

Broadcast Electronics has the largest and most skilled engineering staff dedicated to the radio broadcast equipment industry. Significant FM transmitter design patents awarded to B.E.:

- Folded Half-wave Output Cavity, patented 1982.
- Internal Second Harmonic Suppressor, patented 1982.
- Broadband Input Impedance Matching Circuit, patented 1985.

State of the Art Leadership

Stereo technology, only B.E. designs it all - AM, FM and TV stereo generators.

Broadcast Electronics is the only major FM transmitter manufacturer who designs and manufactures its own solid state intermediate power amplifier (IPA).

All products are backed by B.E.'s 24 hour parts and service and a strict quality assurance program.

The result of this commitment to state-of-the-art innovation is a complete line of RF products, designed to provide you with years of reliable service. Certainly it's clear who **is** setting the standards for FM transmitter technology!

Put our engineering expertise to work for you. Call (217) 224-9600 for the Broadcast Electronics Representative in your area.

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 146 On Reader Service Card

Analyzing the Frisco Market

MARKET UPDATE

by Frank Beacham

San Francisco CA San Francisco has long been one of America's strongest AM markets because of its mountainous terrain.

"There are some hills here close to 2000 feet tall," said Kevin Mostyn, engineer for KYA-FM and KSFO-AM. "Any FM signal that gets to the other side of the hills is usually weak and noisy."

Partially for this reason AM news/talk stations have long dominated the ratings in the nine-county market surrounding the San Francisco Bay. KGO-AM slipped nearly a point in the winter Arbitron ratings but still held onto the number one position in the market.

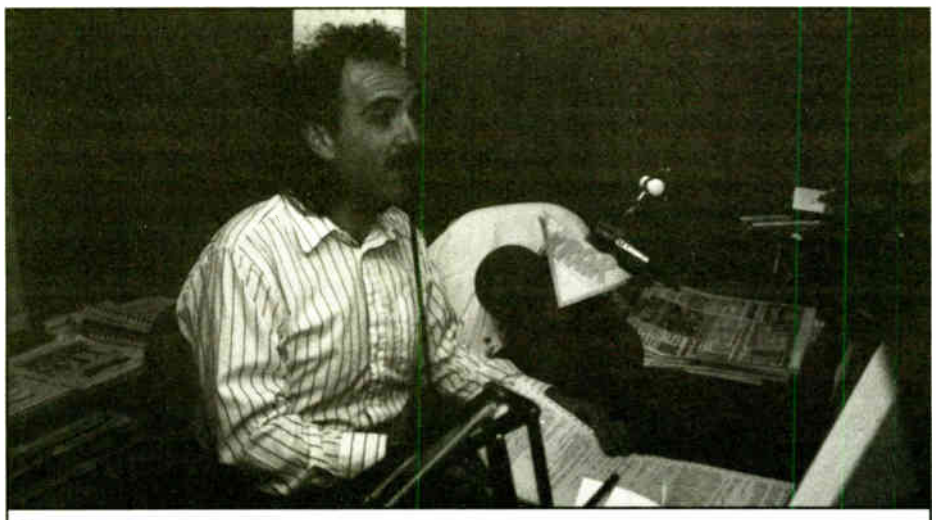
People needed radio

"Both the news and talk stations (KGO-AM and KCBS-AM) had a terrific fall book and I think we could attribute a little of that to the 17 October earthquake and to the newsworthy events in Eastern Europe," said Sue Ream, radio specialist at Lewis, Browand & Associates, a San Francisco advertising agency.

Currently the fourth largest radio market in the US, San Francisco is among the most competitive. The market has 61 radio stations, more per listener than Los Angeles or New York.

But the 1980s sales boom of radio stations now appears to be over. "A number of station sales have fallen through in recent months," Ream said. "I think everybody has pretty much paid the premium price here and are now trying to hang on.

"These debts to service have really gotten out of hand. We've topped out everywhere. And, of course, the junk bond market has failed and there isn't going to be that junk bond money to help pay the bills."



"The Lobster" brings in the morning prime time audience for CBS-owned top rock station KRQR. He's been on Bay area stations since 1971.

Due to improved consumer receivers, cable television systems which carry radio broadcasts and a recent FCC ruling allowing increased power for on-channel boosters, FM has finally emerged as a major force in the market.

"This is a hotbed for on-channel FM boosters," said engineer Dennis Gooch at KABL-AM/FM. "About a year ago we put the biggest booster on in the country. It's 10,000 W and it added a million people to our FM audience."

In July 1987, the FCC allowed broadcasters to increase booster power to 20% of their maximum permissible effective radiated power (ERP).

The old rule limited stations to a 10 W maximum power limit. Gooch said about 15 San Francisco stations have boosters operational or planned. He said they help fill in the gaps where FM signals are lost due to rugged terrain.

"FM is now doing pretty well here," Mostyn said. "But you can't deny that it's often hard to get an FM station. If we are able to fill in the gaps with boosters it will improve the situation considerably. Right now the problem is getting a usable signal to areas behind these mountains."

Loudness not a problem

No serious modulation war exists in the Bay area airwaves, several engineers agreed.

"There is always a modulation battle with the youth-oriented formats,"

(continued on page 23)

The Glory Days of FM

(continued from page 18)

But there isn't a radio station here that plays anything interesting as far as mainstream rock'n'roll new records. And when they do play a new record, they are so insecure about it they have to herald it by announcing it as: "KFOG New Music!"

RW: *If you were to program a station today, would you do it again like KSAN?*

Simmons: I am not positive that were I given the opportunity to actually do a radio station that I would not have some restrictions. Because I would. Without any restriction, if you come in there and you are having a bad day . . . you don't have anything to save you.

You also have a tendency to get quite self-indulgent. One of KSAN's main problems in the late 70s when things started to sort of go awry, was that we all had become kind of bored with what was going on musically in the mid-'70s and we all latched onto New Wave.

We became so enthralled with what was going on as far as new music that we over-played it. It was overkill on everything. We moved away from our basis that we had for years.

You have to have some control but I think that the format should be something that helps the disc jockeys shine rather than turn them into automatons.

Bay Broadcasters Under Fire

MARKET UPDATE

by Frank Beacham

San Francisco CA Bay area broadcasters have come under fire from the FCC, a Congressional delegation and the deaf community for their handling of emergency broadcast information during the 17 October earthquake.

A major snafu involving the Emergency Broadcast System (EBS) and the failure of Bay area television stations to use visual displays for hearing-impaired viewers has prompted anger and consternation from the broadcasters who say they are taking an unfair rap.

However, when the dust settles, California is expected to have the nation's first new digital enhanced EBS system that will help resolve many of the problems. And the FCC is preparing a public notice advising TV broadcasters of their responsibilities during emergencies, **Radio World** has learned.

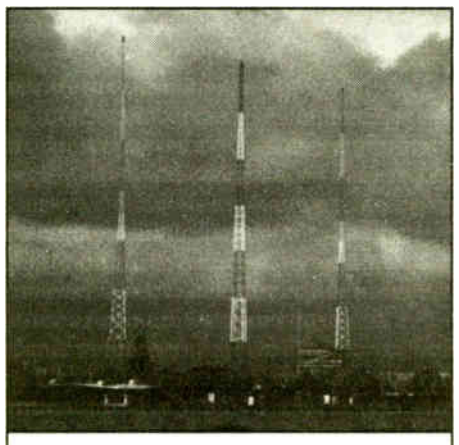
KNBR Radio, common program control station #1 has the responsibility of activating the EBS system in San Francisco.

But the stations failed to follow procedures and activated the system without legitimate cause in the aftermath of the earthquake, said Jim Gabbert, State EBS Coordinator, president of the California Broadcasters Association and owner of KOFY-TV here.

"What happened was KNBR (station CE) went running off and activated the system because a fireman called him," said Gabbert. "A fireman from a fire station called KNBR. The message was: 'Off duty firemen report to work.'"

Gabbert said under the Bay area emergency plan filed with the FCC the Alameda County Office of Emergency Services (OES) is the clearing house that has authority to call for activation of the EBS system. In this case, he said, no legitimate OES order was given to activate the EBS system.

"The engineer did not follow the plan which was supposed to come out of the Alameda County OES and he went like a chicken with his head cut off and there was no message," Gabbert said. KNBR Engineering Manager Bill Ruck refused to give his side of the story to **Radio World.**



KDIA's triple AM antenna towers overlook the Oakland Bay Bridge and the bay. The top of the tower on the left is bent due to earthquake damage.

Ruck said, "I will not talk with anybody who has talked with Jim Gabbert is full of misinformation, lies and innuendo." Though the EBS system was never officially activated after the earthquake, Gabbert said it would not have worked even if it had been.

Gabbert called the EBS system a relic from World War II days. He said the current system is full of holes ranging from the technical reliability of the control stations in a disaster to disc jockeys not hearing the audible messages over EBS receivers when alone on a station air shift.

As a result of the earthquake, Gabbert and the California Broadcasters Association have proposed an all-digital enhanced EBS system to alert California radio and television stations via a state-owned emergency microwave network.

The system would allow emergency authorities to trigger receivers in all stations simultaneously and send emergency data via hard copy to printers at radio stations and by printer and visual crawl to television stations.

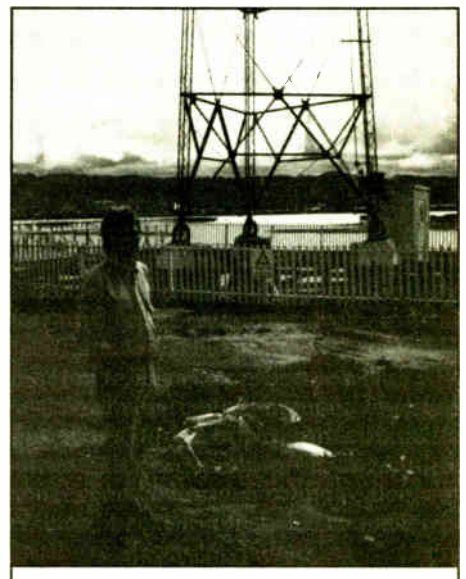
The new digital system would use California's existing emergency microwave network and the initial phase would cost about $100,000 to cover the San Francisco, Los Angeles and San Diego markets.

Each station would have to spend about $500 to purchase a receiver and printer to acquire the data. The new system would not replace existing EBS receivers, which would function as usual.

In a related matter, FCC Chairman Alfred Sikes, responding to the California Congressional delegation, has accused Bay area TV broadcasters of failing to follow FCC rules because of their failure to use visual presentations to convey emergency information after the earthquake.

Stemming from a complaint by the California Association of the Deaf to Bay area Congressman Pete Stark, the delegation petitioned Sikes to take action to insure that information be provided the hearing-impaired in future emergencies.

Sikes responded that he was "distressed to learn that some (CA) television stations did not comply with the Commission's rules." Sikes said he had directed Commission staff to promptly issue a public notice reminding all US television stations of requirement.



KABL engineer Dennis Gooch at the base of the AM tower on the San Francisco Bay.

The response from California broadcasters was outrage. "This is politically motivated. The FCC chairman made a political decision because he got a letter from members of Congress," said Vic Biondi, executive director of the California Broadcasters Association, who maintained that the EBS rules are not clear.

But Bill Hassinger, Asst. Chief of the Mass Media Bureau of the FCC, said the San Francisco stations clearly violated the rule. "The stations must tell the deaf what is going on during an emergency," Hassinger said.

Golden Gate Radio

(continued from poge 21)

Mostyn said, "but it's not nearly as severe as LA or New York. There are some people on the air with what some would called pretty trashed audio."

Gooch laughed at the question of a modulation war. "It's not as gruesome as other places. Some stations do screw around with it but it makes them sound horrible and they lose confidence and go back to the old ways. I don't hear a lot of super-processing here."

On the AM side, it's estimated that more than two-thirds of AM stations now comply with the NRSC standards and five stations broadcast in AM stereo (four Motorola, one Kahn).

Engineer Paul Pravettoni at the board on KRQR's morning show with "The Lobster."

So who are the current winners in the Bay area market? Arbitron shows KMEL-FM at No. 2 with a strong youth-oriented urban format; KOIT-FM at No. 3 with soft contemporary; KCBS-AM at No. 4 with news/talk and KFRC-AM at No. 5 with big band music.

Also showing strong ratings were KABL (AM/FM simulcast) with soft contemporary and KRQR-FM with classic rock. The city also strongly supports two classical stations and KSAN, now with a country format.

Difference of opinion

Even if business is good for San Francisco stations, not all agree that Bay area listeners are as well served as in the past.

Bonnie Simmons, former program director and disc jockey at the freewheeling progressive KSAN-FM from 1969 to 1978 and a protege of legendary Bay area disc jockey Tom Donahue, feels the narrowly targeted, research-driven formats of today have left a large disenfranchised radio audience in San Francisco. (See separate story.)

Dawn Tognoli, executive director of the Northern California Broadcasters Association, disagrees with the notion that Bay areas stations have lost their pioneering heritage.

"There's still experimentation in this market," Tognoli said. "Personally I don't think music is as innovative right now as it was but we always hit little flat spots. Today's formats are very well defined and that's why they work so well."

FCC, FAA Work to Find Solutions

by Lex Felker

Washington DC As many broadcasters have already found out through personal experience, it can be an extremely difficult and time-consuming matter to get a no-hazard determination out of the FAA these days.

The bulk of the difficulties is related to the aviation agency's desire to prevent electromagnetic interference (EMI) to aeronautical communications and navigation services.

FM applicants are most affected by the FAA's EMI scrutiny because of the adjacency of the FM broadcast band to the 108-136 MHz aeronautical allocation, but no radio service is immune. Even applicants for UHF TV and amateur radio stations have experienced difficulty in obtaining FAA clearance.

This month, we'll take a look at where things stand, what changes can be expected and what applicants can do to improve their chances of receiving FAA clearance.

Background

Although the problems have become apparent only recently, the FAA has actually been examining EMI effects of proposed broadcast facilities for several years. Initially, the process employed so-called "Venn diagrams"—charts indicating protection zones and station signal contours. Possible interference areas were indicated by overlaps between signal and protection regions.

FAA and FCC staff disagreed as to the validity of the assumptions used in developing these diagrams, but relatively few construction permits were denied solely because of FAA EMI concerns.

Frequently, the FCC would condition a CP grant upon no actual interference to aviation communication and navigation services.

A couple of years ago, the FAA began to use a computer model, developed under contract by Ohio University, to analyze the EMI potential of proposed radio facilities. Although the source code for the model was not immediately available, it became apparent that the model had some flaws in it, and scores of FM applications were bounced by the FAA.

The problem became so serious during my tenure as Mass Media Bureau Chief that my staff drafted a Notice of Proposed Rule Making to propose new aeronautical EMI standards to replace those employed in the FAA computer model.

The draft Notice was never sent to the Commission for consideration, however. Instead, at the suggestion of the Chairman, coordination between senior FAA and FCC staff members was begun.

Things are looking up

The interagency coordination was just beginning when Dennis Patrick and other senior FCC (and FAA) officials left their government posts. Under Chairman Al Sikes, the coordination effort has been stepped up, however.

Senior officials from both agencies have met several times to present their respective concerns, and neither side is completely faultless. The FCC is concerned both with the lack of openness with which the FAA is developing its EMI standards and procedures and with many of the assumptions and algorithms employed in the FAA's computer model.

The FCC is concerned with the lack of openness with which the FAA is developing its EMI standards and procedures . . .

The FAA, on the other hand, would seem to have a legitimate gripe that the Commission has neither consulted with it on numerous rule changes that introduce potential EMI concerns nor provided the data needed to more accurately predict the presence of interference.

In addition to these higher level meetings, mid-level staff members from both agencies are convening monthly in an effort to reach agreement on specific CP applications.

FELKER'S FORUM

The typical case considered in these meetings involves the use of inaccurate data by the FAA or a misunderstanding of the circumstances which may result from grant of a particular application. The latter case can arise in upgrade situations where changes for several different facilities are contingent upon one another.

Where are things headed?

One thing seems clear: Because of the potential for EMI, the FAA is going to continue to involve itself in the authorization of broadcast facilities (and those of other radio services).

As helpful as the monthly problem-solving meetings between FAA and FCC staff may be, this *ad hoc* procedure is no substitute for the establishment of a systematic method of accurately accounting for interference.

The FAA has apparently indicated a willingness to make reasonable modifications to its computer model—including, significantly, a more accurate propagation algorithm.

Hopefully, the FCC will take the initiative to supply the FAA with reliable facility data and other relevant information in a form that the FAA can use to quickly and accurately reach air hazard determinations.

For the FCC, however, the development of this information could be resource-intensive. Unfortunately, considering the austere budget climate, the number of other attractive projects competing for scarce resources and the priority Commission management has placed (correctly, in my view) on processing applications quickly, the Commission may not be able to provide this information anytime soon.

Hence, it looks like the FAA problem is going to be with us for some time to come. In the meantime, there are some steps applicants that have been bounced by the FAA—and their consulting engineers— can take that may ameliorate their situation.

What applicants can do

Importantly, the computer model employed by the FAA is being made available to the engineering community through the AFCCE (Association of Federal Communications Consulting Engineers). Therefore, applicants who have been rejected by the FAA can use this software to "check" the FAA's work.

The first step is to get a copy of the "analysis" performed by the FAA. This document will list all of the stations used in predicting the EMI effects and it should be examined to ensure that all of the stations the FAA factored into the EMI analysis are actually on the air.

The analysis can also be refined to account for actual conditions (e.g., antenna patterns) which might make the difference in the air hazard determination. Engineering consultants should also be able to show rejected applicants a variety of other ways of refining the analysis to avoid an EMI problem.

Applicants who choose to object to the FAA's initial determination based on their own analysis must do so quickly, however. The FAA only keeps its files open for 30 days and any appeal or objection should be filed within this 30 day period.

All in all, the prospects seem good for the FAA and the FCC to eventually develop a procedure for analyzing the EMI potential of broadcast facilities that meets the aviation community's safety concerns and treats broadcasters fairly.

In the meantime, there are procedures broadcasters can use which, while time-consuming, can frequently result in FAA approval of a new or modified facility.

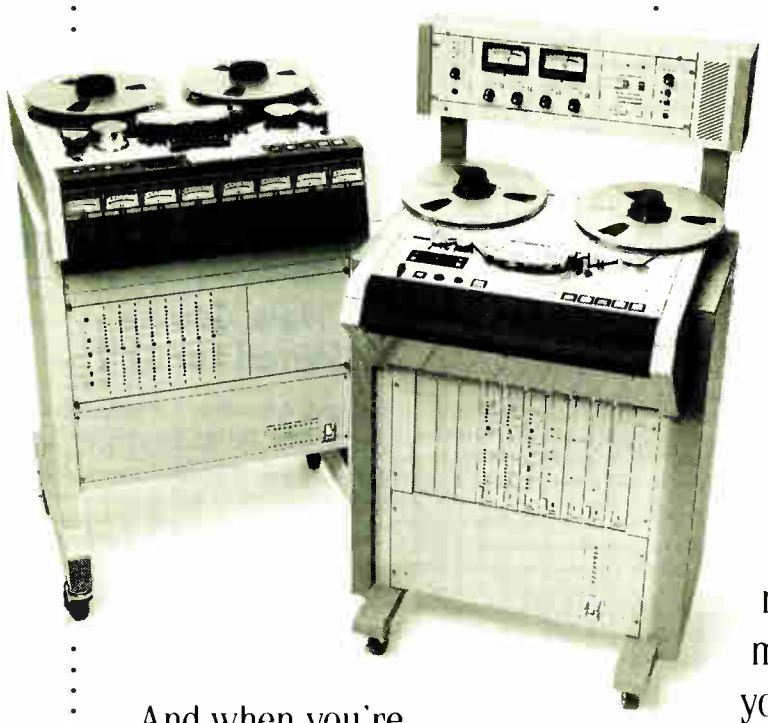
■ ■ ■

Lex Felker is a technical/engineering consultant with the law firm of Wiley, Rein & Fielding, Washington DC, and former FCC Mass Media Bureau Chief. He can be reached at 202-429-7000.

Radio's Top Ten!

Many of our customers understand that this is more than a hollow boast. They know that when a manufacturer offers them a broad choice of products, it means money in their pockets.

How? Simple. You can select *exactly* the right equipment for your specific application.



And when you're not forced to make compromises in features or performance, your station not only sounds better to your listeners, it is also much more efficient in its day-to-day operation.

Otari has machines for news editing, on-air, and production with features to fit any application or budget.

* HX-Pro is a trademark of Dolby Laboratories Licensing Corporation

To make a point, let's say you are in the market for a multitrack.

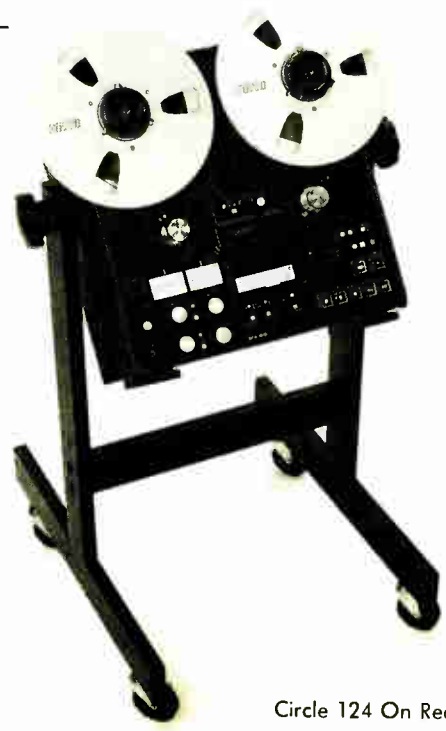
You can choose from our top of the line MTR-10 that gives you all the features you'll ever need, or our BQII, MKIII/4, MKIII/8, or the MX-70 with 8 or 16 tracks.

Need a 2-track?

How about our famous "workhorse" MX5050 BII, or the MKIII/2, or the MX-55NM with gapless, seamless, punch-in, punch-out and HX-Pro*.

And don't forget the MX-50, perhaps the most affordable professional 2-track on the market.

We also offer three models of our CTM-10 cart machine. And if yours is an automated radio station,



our ARS-1000 reproducer is the most popular machine in the world.

You could say we have a *broad cast* for *broadcast*. But as we've pointed out, it can mean a lot more to you than just a phrase.

Call your nearest Otari dealer today, or call Otari at (415) 341-5900 for more information.

OTARI®

Circle 124 On Reader Service Card

Digital Interfacing for Control

This is the eleventh in a 12-part series called An Introduction to Digital Electronics. *Northern Virginia Community College will offer 1.3 CEUs (continuing education units) to registered students who successfully complete the course and an examination mailed at its conclusion.*

Successful completion of the course and the final exam will also earn 1.3 professional credits toward recertification under the maintenance of certification provisions of the SBE Certification Program. 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 XI of XII

Annandale VA Most digital devices do not carry enough power to control or operate electrical or mechanical equipment. Digital circuitry must be interfaced in a manner that will permit the devices to control much larger currents and voltages.

The purpose of interfacing is to control a very large amount of power with a very small amount. This can be done electrically, mechanically using hydraulics or with a combination of electric and mechanical systems.

Some examples of interfacing equipment would be traffic signal timing devices controlling miles of streets, electromechanical systems controlling the movement of light rail cars or aircraft controls. Transmitter remote controls also employ these systems.

In order to view these systems from an introductory level, consider the control of a motor or a switch using a digital microprocessor. The microprocessor could be sensing minute changes in light or temperature and, at a certain level, turn on a relay.

The small changes in current produced in the microprocessor would not be enough to energize a relay, however. Some basic transistor theory must be employed to make this system practical.

Transistorized solution

The microprocessor may not be able to energize a relay, but it can produce enough current to forward-bias a transistor. The transistor has the ability to conduct the current to activate the relay. Figure 1 is an illustration of what this circuit might look like.

The sensing voltage is generated in the microprocessor and established across R_1. This will produce the current necessary to bias Q_1, causing it to conduct. A high amount of current will then flow through the relay coil causing the contacts to close. The relay contacts can handle an even higher amount of current and voltage.

The purpose of D_1 is to protect Q_1. When the sensor in the microprocessor sends Q_1 into cut-off, the magnetic field around the relay coil collapses. A "back-emf" or self-induced reverse voltage is created that could send a pulse of current through Q_1, destroying its junction.

D_1 is placed in such a manner that it will become forward-biased with the pulse of reverse energy only shunting it within the relay protecting the transistor.

Numerous circuits are available. One place to start looking at interfacing is Radio Shack, which has published a family of handbooks describing how to design your own projects.

On the road and in the air

Today's automobile uses a microprocessor to monitor numerous constantly changing functions. The automobile microprocessor contains a ROM or Read Only Memory. The ROM is programmed with data gathered by the manufacturer describing how the engine and related electrical system is to operate.

In the future these ROMs may be replaced with EEROMs (Electronically Erasable Read Only Memories). This will allow the microprocessor to be updated rather than replaced when the manufacturer wishes to change an operating parameter.

The ROM is interfaced with several sensors throughout the car that measure fuel mixture timing, temperature, etc. The microprocessor senses this data several times a second, compares it with the data stored in the ROM and makes appropriate changes to improve combustion, timing, cruise control or warn you of doors not closed or seat belts not connected. They can also be used to prevent brakes from locking in emergency applications.

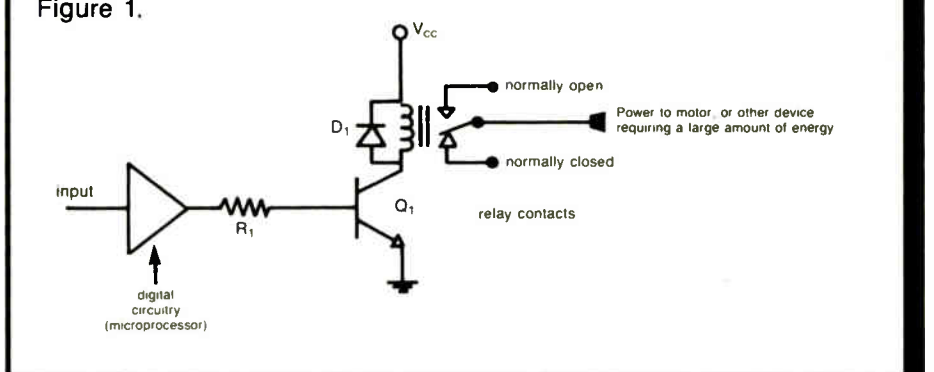
Microprocessors are used in flight management in today's aircraft. A microprocessor controls several subsystems that actually fly the plane.

On planes outfitted in such a way, a passenger would be unable to detect whether a pilot or the computer was flying the aircraft. An airplane with a flight management computer allows the pilot to act in the capacity of a flight manager overseeing the data the computer is displaying. The system is presently in service on Boeing 757s and 767s.

■ ■ ■

Ed Montgomery currently is an electronics teacher at Thomas A. Edison High School in Fairfax County. He has taught broadcast engineering at Northern Virginia Community College and worked as broadcast engineer for several radio stations.

Figure 1.



New Course Slated for Fall

Starting with the 12 September issue of **RW** Ed Montgomery will begin a new 12-part course on Amplifiers.

The course will cover various classes of amplifiers, designs and related terminology and will cover RF and audio.

As with past courses, students may register for credit at North Virginia Community College or for SBE accreditation. Watch future issues of **RW** for details.

Effects Boxes Add Spice to Spots

by Bruce Bartlett

Elkhart IN Want more pizzazz in your station's IDs and spots? Try the new special effects boxes, such as the Eventide Harmonizer® , Marshall Electronic Time Modulator, or Quantec Realtime Signal Processor. You won't believe what these devices can do to the human voice.

Chances are you've already heard one of these on the radio: The announcer sounds like Darth Vader.

Basically, these devices sample a sound—record it digitally—into memory chips. Once recorded, this digital data can be manipulated to provide a wide variety of sonic effects.

Pitch change and time compression

A recorded voice can be played back at a different pitch without changing its duration. You can lower the announcer's voice to sound like a monster, giving your station an image of power. Raise the pitch, and you've got a Martian.

LINE OUT

How does this effect work? In the Marshall Electronic Time Modulator, the incoming signal is recorded into memory and read back out after a short delay. If this delay is varied, the pitch shifts at the instant the delay changes, then returns to normal.

The Time Modulator creates a constant pitch change by varying the delay in repetitive sweeps every 20 milliseconds. This results in a Doppler shift that varies the pitch.

Some devices generate three different pitches simultaneously. These can be layered or mixed together, so that you hear three pitches at once. Turn your announcer into a three-voiced mutant.

Or, you can change the duration without changing the pitch—a function called "time compression." If you need a 30 second spot, but your production times out at 32 seconds, simply enter those two times into the device. You'll hear the same spot fit into a 30 second slot (without any pitch change). A 57 second PSA can be stretched to 60 seconds, and so on.

Pre-recorded and other effects

Some devices, such as the Eventide H3000B Ultra-Harmonizer for broadcast post production, have pre-recorded sound effects available at the touch of a button. Need a helicopter for a traffic report? Or a siren or doorbell? They're in there, plus many others.

Most units have echo and reverberation. Echo is a discrete repetition of a sound (hello . . . hello . . . hello), while reverberation is a continuous decay of sound (HELLOO-Oo-o . . .).

Reverberation is the sound you hear just after you clap your hands in an empty gym or cathedral. Physically, reverberation is a series of diminishing echoes, too closely spaced in time to be resolved by the ear, randomly timed.

By using the various reverb programs in the effects device, you can put an announcer in any sort of space: a bathroom, concert hall or canyon.

Some stations put reverb on the DJ all the time. The extended decay time that results increases the average modulation level. Of course, whether or not you use this effect is an artistic decision; your listeners may tire of it.

Some devices generate three different pitches simultaneously . . . Turn your announcer into a three-voiced mutant.

Gated reverb is reverberation that cuts off suddenly after a short time. You hear it on many Top 40 records on the snare drum (that "Phil Collins" drum sound is a good example).

Another effect is stereo panning. Sound images swim around, left to right and back again. The phased, spacious sounds produced by variable interchannel delays and phase shifts are impossible to describe.

Flanging, vibrato, stutter

Flanging or combing is unusual, too. A signal is combined with its delayed repetition, with the delay varied or swept between 0 and 20 milliseconds. This causes a series of phase cancellations—notches in the frequency spectrum—that shift up and down in fre-

(continued on page 29)

Convening Radio's Roundtable

by Dee McVicker

Washington DC Call it Watergate all over again, but recently UPI Radio Network has been tapping into the backroom conversations of three political heavyweights. And it's not parlor room chit-chat either. We're talking laundered money, congressional scandals and even White House jibes.

The backroom banter of heavyweight political journalists Jack Anderson, Helen Thomas and Pye Chamberlayne would leave even Watergate's "Deep Throat" speechless. But, thanks to the devices of broadcasting, it is just the kind of insightful conversation that makes UPI Radio Network's new show what it is—straight from the wire.

The new show, called *UPI Roundtable*, is perhaps the strongest editorial to come across the wires of UPI. The setting, however, is hardly a ponderous round oak table where three legendary journalists sit elbow-to-elbow to exchange their views on the week's hot political issues.

Instead, they table their viewpoints on a 5 kHz broadcast loop that runs from a UPI studio to three remote locations—including the White House.

Helen Thomas, as long-time UPI White House bureau chief correspondent, presides over an elaborate studio situated in the First Family's residence. From this full-function studio, with all the broadcast trimmings necessary to keep pace with political news, Thomas joins her counterparts in a half hour of enlightening conversation.

Syndicated columnist Jack Anderson has a studio in his office.

Meanwhile, across town, syndicated newspaper columnist Jack Anderson joins the conversation from his office studio and, across the Potomac, UPI's senior political correspondent Pye Chamberlayne gets his political digs in from his home in Alexandria, VA.

Chamberlayne set up shop in his home after a broken leg made it all but impossible for him to report to UPI every day. The phone company personnel, commented UPI Radio Network's Chief Engineer Sam Brown, were more than a little stymied with Chamberlayne's home studio setup. "(They) found it awfully amusing to be installing a broadcast loop in the basement (of a home)," remarked Brown.

OFFBEAT RADIO

Of the hundred or so communication lines coming and going through UPI Radio Network, the most noted is the talkback loop that joins the three in their half-hour show.

The Wash Talkback line, as Brown refers to it, makes the circuit from the White House to the US House and Senate and is directly tied to both Thomas' White House studio and Anderson's office studio.

Normally, Chamberlayne feeds his correspondence to UPI through a talkback line appropriately referred to as the Pye Talkback line. But for *Roundtable*, Chamberlayne taps into the Wash Talkback line through a telephone coupler from his home studio.

Although the three cross wires every week in *UPI Roundtable*, rarely do they cross paths. The trio's most recent elbow-to-elbow discussion was over lunch when they discussed the details of launching the program, which began airing in September.

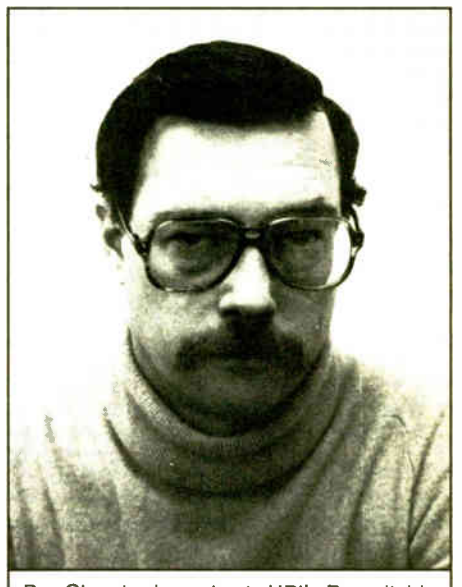
What followed were some of the most intriguing conversations to take place over the airwaves. Even renowned journalist Helen Thomas, who has spent more years reporting the news than commenting on it, has been known to speak freely of presidents and White House blunders. In fact, she often has reservations about the nation's policymakers and has no problem saying so.

That Thomas holds no great affinity for some of the officials she has covered as a reporter was news to Jack Anderson, who has known Thomas most of his career.

"She (Helen) has been brought up all her life—all her news career—not to inject herself into the story. Now she does it, and she does it almost as if you've shut the doors and nobody's listening," said Anderson.

On the other hand, Anderson, as an outspoken Pulitzer Prize winner with a lot on his mind, rarely has had to restrain himself from expression—political or otherwise. Known for his candor and wit, Anderson is self-described as "always popping off" with his opinions. This, he said, comes more naturally for him than his two counterparts.

Helen Thomas offers insights from a studio booth in the White House.



Pye Chamberlayne hosts UPI's Roundtable from his basement.

The master of ceremonies, as Anderson calls show host Pye Chamberlayne, adds another flavor to the broadcast. Chamberlayne, who has covered just about every political beat since the mid-'60s, has been revealing a talent recently for being a bit on the off-beat side.

"Pye has a habit of bringing up some absolutely off-the-wall, bizarre subject and asking Helen and Jack for their opinion," commented Producer Ken Robinson. These side-news vignettes usually trail a fervent discussion of one world news event or another, and they usually come off as tongue-in-cheek.

For instance, on the heels of an ardent

(continued on page 36)

Put Pizzazz in Your Spots With Special Effects Units

(continued from poge 27)

quency. The result is a swishing, filtered sound, like a jet plane passing overhead.

Vibrato is a wavering in pitch, or frequency modulation, of the input signal. Filtering is available in highpass, lowpass or bandpass—say, for a CB radio effect.

When a unit is programmed to act as a vocoder, it accepts signals from a musical instrument as well as a speaking voice. What comes out is a talking guitar, singing organ or whatever. That is, the speech modulates the tone produced by the musical instrument.

Another popular effect is stuttering, in which a sample p-p-p-p-plays repeatedly. (Sampling was discussed in detail in previous columns).

The enhancer effect "highpass-filters" the signal and adds even-order harmonic distortion. The distorted signal is mixed at a low level with the clean signal. This creates a brighter, more treble sound by the addition of harmonics.

Several of these effects can be combined. You might add panning to flanging and reverb. You can either call up and combine these effects yourself or use the preset combinations stored in the effects device.

Controlling the effects

Most units include an LCD window that displays information such as the program name and parameter presets. It also displays the specific function that a "soft key" will perform. A soft key is a button whose function depends on what part of the program you're in.

You can enter control data either by a continuous knob or with a data-entry keypad. For example, you might work on the parameters of a reverberation program. Change the reverb decay time, the delay before reverb starts, the wet/dry ratio, and so on. ("Wet" means the reverberated signal; "dry" means the original non-reverberated signal.)

Some units can be controlled by MIDI, which lets you remote-control the device or automate its operation with a sequencer computer program.

One device has been specially designed to work with a personal computer: the Quantec QRS/XL. This programmable digital signal processor comes with a wide range of top-quality effects, such as room simulation and digital filtering. It can operate as a standalone unit or can be controlled by your personal computer.

If you want to manipulate the XL parameters or design new effects programs, you'll need a PC running software such as Marshall Electronic's XLC Controller. You can define your own effects programs on your computer screen, then store them in RAM or on disk.

One program shipped with the XL-A library might be especially useful for broadcasters. Called "Air," it makes an audio program sound louder and punchier with no level increase on a VU meter.

Quantec has set up a network by which users can communicate via modem. They can access recent software and updates, get technical assistance or exchange programs.

As we've seen, there are loads of special effects available to intrigue your listeners. You can choose either the convenience and speed of factory presets or the flexibility of parameter control. Whatever your choice, special effects can help your station stand out sonically.

■ ■ ■

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

When a unit is programmed to act as a vocoder, it accepts signals from a musical instrument as well as a speaking voice.

NEW NEW NEW

NEW NEW

12,000 MODULAR

6 CHANNELS – $3,999/ 12 CHANNEL

2619 Midpoint Drive • Fort Collins, CO 80525 • (303)

NEW NEW NEW

NEW NEW NEW

SERIES CONSOLES

S – $6,499 /18 CHANNELS – $8,893

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 switchs
  - 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 switchs 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

NEW NEW NEW

Circle 21 On Reader Service Card

DIGITAL AUDIO HARD DISK RECORDING HAS BECOME...

CHILD'S PLAY.

Finally, a hard disk digital audio recorder that's simple, fast, and affordable. No computer monitor, keyboard or mouse, just an easy to use two-track digital recorder providing up to 60 minutes of CD quality stereo audio. The **DR-2™** automatically chases or generates SMPTE timecode depending on the application. Control the **DR-2** directly from your editor, or stand alone with the optional remote which features familiar tape recorder controls. Access sound instantly with the touch of a button. Non-destructive digital editing features allow you to throw away the razor blades and work faster with greater creativity. Install the **DR-2,** and make digital your domain, today.

AlphaAudio®
Automation Systems

HARRIS ALLIED
BROADCAST EQUIPMENT

800-622-0022

"Literature Only" Circle 29

"Call me, I'm interested" Circle 100

West Coast Pioneers And a Radio Veteran

by George Riggins

Long Beach CA Recent comments about early stations and on-air dates brought a response from WPAX of Thomasville, GA. Len Robinson, General Manager, called to pass along some rather interesting information about the early days of WPAX. The phone call was followed with copies of the original station license.

Old Timer

The license was dated 24 December, 1922 and was for a period of 3 months, to expire on 24 March, 1923. The provisions of the license stated: "Limited to Commercial, Class 'A,' broadcasting entertainment and like matter. One commercial second class operator or higher required. This station is licensed for the specific service shown, on the wave lengths indicated, no other service permitted.

"The hours of operation specified below may be changed or a division of time may be required, whenever in the opinion of the Secretary of Commerce, such action is necessary."

West Coast pioneers

Ed Janney (who retired from KOY, Phoenix, AZ shortly after Jack William went from being the station GM to being the governor of Arizona) sent three vintage magazines. Two are from the late fall of 1925 and the other one is the first issue of the RCA "Broadcast News."

On the west coast, one of the early entries to the radio broadcast industry was the McClatchy publishing empire. The McClatchy group of papers included the *Sacramento Bee*, the *Fresno Bee*, the *Bakersfield Bee* and a Reno newspaper.

The first notation of a station owned by the McClatchy interests was in 1926 when the company was listed as the owner of KMJ, Fresno. KMJ was put on the air by San Joaquin Valley Light and Power Co. in 1923 or earlier. With no listings in my library of the intervening years, an exact date of transfer of KMJ from the power company to McClatchy ownership cannot be stated.

By 1929, there were two stations listed as being associated with McClatchy owned newspapers: KMJ, Fresno and KFBK, Sacramento. KMJ's listed frequency was 1200 kc with 100 W; KFBK was listed at 1310 kc, also with 100 W.

By 1931 the group had increased to three stations with the addition of KOH, The Bee, Reno, NV. KOH had an assigned frequency of 1380 kc with power set at 500 watts. KMJ and KFBK were at the same frequency and power as listed for 1929.

Changes in frequency, power

Between 1931 and 1936, both frequency changes and power changes took place. KMJ moved from 1210 to 580 and increased power from 100 watts to 500 watts. KFBK went from 100 watts to 5000 watts and moved to 1490 kc. There were no changes at KOH, Reno.

Two stations were added between 1926 and 1937: KWG, Stockton, and KERO, Bakersfield. The Stockton station was one of the earliest pioneers of the area, having gone on the air 7 December, 1921 under the ownership of Portable Wireless Telephone Co., 823.8 kc, 50 watts.

The 1941 *Broadcasting Yearbook* credits the McClatchy interest with owning a total of five stations in California and Nevada. The CA stations were: KMJ, KWG, KERN and KFBK. The Nevada station was KOH, Reno. The major changes that took place between 1938 and 1941 were the changes in frequency dictated by the Havana Treaty.

KERN changed from 1380 to 1410, KFBK moved from 1490 to 1530 and KWG went from 1200 to 1230. Power at all of the stations remained the same until after WW II. The only change that took place between 1941 and 1946 was the upping of power at KWG to 500 watts.

More words from Smith

When we left off with Al Smith last month, he had made comments about getting hooked on radio after seeing his first receiver, an Atwater Kent with three knobs for tuning. He also described the power supply, a 6 V storage battery and the two B batteries for the plates.

OT: *Which stations could you hear in your part of Nebraska?*

Al: In those days there were many low powered broadcast stations with powers of 100 W or less. I remember hearing KDKA in Pittsburgh, PA; KFKX in Hasting, NE; WHG in Kansas City and WOAW in Omaha. These were higher powered stations. Also we heard WSB in Atlanta and a high powered station in Havana, Cuba. I lived near Fairbury, in south-central Nebraska.

OT: *When did you get into radio?*

Al: While in high school in Fairbury, NE I met a radio ham. I used to eat my lunch and visit with him at the ham station of an older brother. In 1930 I started an NRI (National Radio Institute) course while working in a drug store. I also started servicing radio sets—nearly all battery operated.

In 1933 I obtained my amateur conditional radio license with the call W9PEX; it later became W0PEX, my present call. I started studying in earnest to obtain a First Class Radiotelephone License, which I obtained in 1934. I thought that

(continued on page 35)

59 Years Ago

Studio Walled By Glass Wool

For the past four months workmen have been busy redesigning, reconstructing and redecorating the studios of KHJ, in the Don Lee Building, Los Angeles.

This work is now completed. The entire second floor, comprising 20,000 square feet, has been given over to the studios and executive offices of the station. Three separate sound-proof studios have been constructed, consisting of one large studio capable of accommodating a 200-piece symphony orchestra, and two smaller studios. Each of these rooms has been sound-proofed to an efficiency of better than ninety-five percent. Each has its own monitoring room and separate broadcasting equipment control units.

These three studios serve to materially increase the broadcasting flexibility of KHJ. It is now possible for the station to broadcast a program locally, release a program to the Don Lee Coast network and conduct a rehearsal simultaneously.

Because of the thick partitions, filled with glass wool, it is impossible for any sound to escape from any of the studios. The walls have all been acoustically treated.

Canada Court Rules On Air

Washington

The Supreme Court of Canada has held that control of radio broadcasting is a duty of the Dominion Government rather than of the individual provincial legislatures, according to advice received by the Department of Commerce from Acting Commercial Attache, Oliver B. North, at Ottawa.

The decision, which was rendered by a 3-to-2 vote of the court, is not final, since either side may appeal to the Privy Council.

The decision was rendered after lengthy hearings on the contending argument for privincial or Dominion control of radio broadcasting. The case started in connection with the refusal to grant a broadcasting license to a station which was to put on the air a program sponsored by the Quebec provincial government.

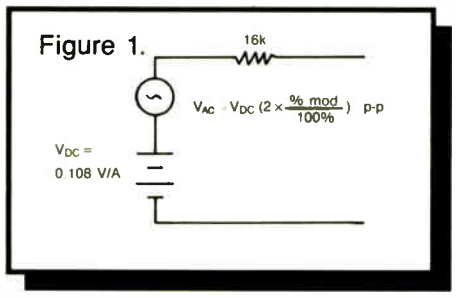
The court's decision is in line with the legal conception of broadcasting in the United States, i.e., interstate commerce. Comment was made on the closeness of the vote, paralleling the 3-to-2 vote in the recent decision by the Federal Radio Commission in the Clause 9 case.

Reprinted from ***Radio World*** *July 18, 1931. Editor's note: The* ***RW*** *of old, printed for a time in the 1920s and 1930s and today's* ***RW*** *are unrelated except in name.*

Unmodulated Measurements

by Harold Hallikainen

San Luis Obispo CA I recently received a call from a station that had just gone through an FCC inspection. The remote antenna ammeter had been calibrated so it read the unmodulated



antenna current when the station was modulated (which is its normal condition).

However, when the transmitter was not modulated, the remote antenna ammeter read high. The FCC check of remote ammeter calibration was done without modulation, causing the remote meter to be outside the 2% tolerance allowed by 73.57(d)(2).

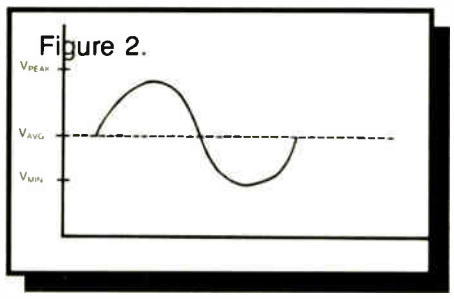
Rule 73.1820(a) requires that all parameters whose indications are affected by modulation must be read without modulation (for logging in the station log). The FCC inspector said that calibrating the remote ammeter "up" to compensate for the downward indication due to modulation was not acceptable.

If the meter is affected by modulation (although to what degree is not specified), the meter must be read without modulation. Trying to get a pause in modulation past the programming department can be difficult (many don't even want to run the legally required ID!).

So, the trick is to get an antenna (or common point) sample that is not affected by modulation.

Measuring antenna current

Until recently, the most common way of measuring antenna current was to use a thermocouple ammeter. In constructing a station ten or fifteen years ago, I found that the "brand new" thermocouple ammeters agreed at 60 Hz, but when



run at 1 MHz, they read substantially high, causing us to get an indicated transmitter efficiency of slightly over 100%.

As such, I don't trust thermocouple ammeters, which should indicate accurately over a wide frequency range.

Since thermocouple ammeters are based on the amount of heat generated by the current to be measured, it is a true measure of the "heating value" of the current or the RMS value.

INSIGHT ON RULES

If we 100% modulate a 1 kW transmitter with a sine wave, it'll (ideally) take 500 W of audio. We still have the 1 kW of DC (100% efficient RF amplifier here). So, we have 1500 W going in, and we indeed have 1500 W coming out.

Of that, 1 kW is in the carrier and 250 W in each sideband. An RMS ammeter (such as a thermocouple) will accurately indicate this 50% increase in power by reading about 23% higher than it does without modulation.

The RMS current (square root of the mean of the squares of the currents at all times) increases with modulation, but the average current (actually, the absolute value of the average, since the average of a symmetrical AC waveform is 0) remains the same.

If we look at how a plate modulated transmitter works (whether it is transformer coupled audio or PDM), we end up with an AC waveform (the audio) in series with a DC plate voltage. The DC component of the voltage applied to the final amplifier remains unchanged with modulation. As such, the DC component of a rectified antenna current should also be unaffected by modulation.

Carrier amplitude regulation

Ideally, the carrier amplitude (the RF signal less the sidebands) remains constant under modulation. Our total amplitude varies with modulation, but that is due to the sum of the carrier and the sidebands.

We can recover the carrier amplitude by rectifying the RF. We end up with a DC voltage representing the carrier amplitude and an AC voltage representing the modulation.

If we run this signal through a low pass filter, we can remove the AC component, leaving a DC voltage that is proportional to the carrier level, which is the same with or without modulation. Using such a "diode meter" should give us an indication of unmodulated antenna current even when modulation is present.

However, things are seldom ideal. Most transmitters have "carrier amplitude shift" (less than perfect carrier amplitude regulation). Standard plate modulated transmitters share the same high voltage power supply for the modulators (typically class B) and the RF amplifier.

As more audio is required, the load on the power supply is increased (as is typical of class B amplifiers), decreasing the power supply voltage and decreasing the carrier level.

Other factors can also contribute to carrier shift. As the final RF amplifier tubes age, the RF output amplitude may not be directly proportional to the applied voltage, causing a "soft clip" of the positive peak of the RF.

Lack of symmetry and broadbanding of the RF load on the transmitter may also contribute to carrier shift. Recent measurements (made at 1 AM this morning!) showed that with modulation, the indicated common point current (using a diode meter) decreased 3.3% and the plate voltage decreased 1.5%.

So, it appears that plate voltage regulation contributes to carrier shift, but is not the sole contributor. This 3.3% decrease in indicated common point current would require us to read common point current without modulation to comply with the remote ammeter accuracy requirements.

Section 73.40(a)(5) (deleted in 1986) required transmitters to have less than 5% carrier shift when modulated 100% with a 400 Hz tone. This allowed 5% shift would still require us to read antenna current without modulation, since it is more than the allowed 2%.

A commonly used RF ammeter is the Delta TCA (torroidal current ammeter) series. This diode ammeter is ideally unaffected by AC amplitude modulation. However, it does accurately reflect variations in carrier amplitude, causing it to be unstable in most stations.

From measurements, I determined the

(continued on next page)

Meter Measurement Minus Modulation

(continued from previous page)
Thevinin equivalent of the sample output of a Delta TCA2OEXR to be as shown in Figure 1. Into an open circuit, it will provide 0.108 volts DC for each ampere of RF current (V_{DC}). In addition, it provides an AC voltage that is proportional to the DC voltage and the amount of modulation. Finally, based on measurements with the output loaded, it appears to have a 16k source impedance.

Carrier shift compensation

A common approach to trying to get rid of the "meter bouncing" is to put a big capacitor across it. Unfortunately, this doesn't get rid of the bounce, it just slows it down. The "big capacitor" and the internal resistance of the TVA form a low pass filter (Fh=1/(2×pi×R×C)).

This removes the AC component of the TCA output, but the DC component still changes with modulation level, since the actual carrier amplitude is changing. What is needed is a way to boost the meter reading during modulation and drop it back down during lack of modulation.

Figure 2 shows the output voltage waveform of the TCA with modulation. If we run this through a low pass filter, we get V_{AVG} (the average DC voltage).

If, instead, we were to run this through a series diode followed by a shunt capacitor, the capacitor would charge to the peak voltage, which varies in the same direction as modulation.

Figure 3 shows a combination of a low pass filter and a peak detector. During periods of no modulation, no current flows through R_1, leaving R_2, D_1 and D_2 out of the circuit.

With modulation, if the wiper of R_2 is towards D_1, the output voltage will increase (the capacitor charge path has a lower resistance than the discharge path, tending to increase the capacitor voltage towards V_{PEAK}).

If the wiper of R_2 is towards D_2, the output voltage will decrease with modulation. The trick is to adjust R_2 towards D_1 such that the increase in output due to modulation just cancels the decrease in output due to carrier shift.

In my testing, I found (using a DVM) that the output of the TCA would drop from O.950 volts (no modulation) to a voltage varying between 0.936 and 0.942 with typical program modulation. This was about a 1.2% decrease in indication due to modulation.

With the circuit of Figure 3, I again measured the no modulation sample (0.950), allowing several minutes for it to stabilize. With modulation, I was able to get 0.844 to 0.998 volts, depending upon the adjustment of R_2. Then, with normal programming, R_2 was adjusted to yield the 0.950 volts that was present with no modulation.

Over a wide variety of programming (talk and music), the output varied about 0.1%. In my testing, I ended up with 8.1k to D_1 and 83.2k to D_2.

Final notes

Note that we're using germanium diodes for D1 and D2. I tried silicon, but the "knee" voltage drop was too much, making R_2 have a minimal effect.

Also note that these measurements were all made with the output "unloaded" (driving an 10 M input resistance DVM). As the load resistance is decreased, I'd expect the output voltage to drop and for R_2 to have less control.

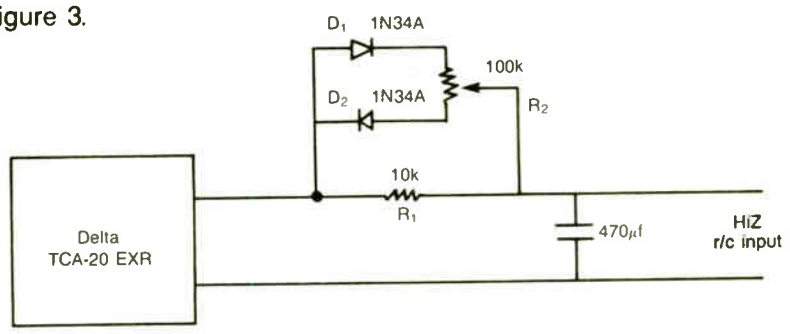
You may want to follow this circuit with an op-amp voltage follower if you're driving a low resistance remote control input (less than 1 M).

Thanks to the caller who inspired me to work on this. I've known about the AC component of the TCA output for years, and the carrier shift problems, but never followed up on it. I'll look forward to your comments.

■ ■ ■

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

Figure 3.



Radio's Early Days

(continued from page 33)
I was on top of the world and was going to go out and make big money as a radio operator.

OT: *How easy was it to get into radio at that time?*

Al: The Depression was on. I finally got work after sending out applications to about every radio station in the Midwest, saying I would fill in for vacations, illness, whenever they needed someone for a few days, a week, a month, whatever the case may have been.

After a year or so, I put on my application that I had experience on nearly every type of broadcast equipment.

OT: *Where was your first job?*

Al: One of my first jobs was at the Omaha Police Department. That didn't last long once some radio people found that I was not an Omaha citizen. I worked at Dodge City, KS, Kearney, NE and finally back to Omaha for KICK in Carter Lake for several months until they (KICK) were purchased by WOC in Davenport, so WOC could get the KICK frequency assignment.

OT: *Why did WOC want KICK?*

Al: WOC and KICK were operating on the same frequency with the same program—not a success due to the fact that they could not synchronize frequencies closely enough. I remember delivering the frequency monitor to Davenport for WOC. KICK was composite—homemade equipment, except for the frequency monitor. That is all WOC wanted.

I got $50 for delivering (the monitor). I had hoped to obtain a job at WOC. I did not get the job, but another operator from KICK did.

OT: *What did you do between broadcasting jobs?*

Al: During these times of temporary employment, I serviced radios back home. Some people would wait for me to return. They thought that if I could work at broadcast stations, I should be a good serviceman.

OT: *What kind of service did these early receiving sets require?*

Al: My main service work was converting battery radios to low drain tubes so that a large storage battery was no longer required, eliminating the problem of battery charging.

OT: *What type of programs were being broadcast?*

Al: This was the time of the big network shows which continued until the advent of network TV: Jack Benny, Amos and Andy, Fred Allen, George Burns & Gracie Allen. We had daytime soap operas such as *Oxydol's Own Ma Perkins.*

We will continue with Al Smith next issue, as well as highlighting another newspaper/radio station common ownership from the formative years.

■ ■ ■

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

Spring Cleaning at the Station

by Barry Mishkind

Tucson AZ Once again, it's time to take our annual look around the station to examine the condition of the plant. Yes, spring has sprung over most of the nation (what do you mean, there's still white stuff on the ground where you are?), and that's the traditional time to see how your facility has weathered the winter.

Of course, it's not just weather damage we are looking to find. Taking full advantage of the situation, many engineers decide to do a complete checkout, seeking things that need attention and devising new projects to improve operations.

You might even decide to call it your traditional spring cleaning project. This kind of project can take many forms, depending on how much time and/or assistance you may have.

Some use a checklist that the station engineering department prepares to do a complete and thorough inspection of every piece of equipment.

Another checklist might be of points of compliance with all FCC Rules. It might cover everything from EPMs to checking DJ permits.

At the same time, why not collect suggestions from the staff on what new items they would like installed or changed in equipment location. On the other hand, you may just want to walk around, electronically "kicking the tires," so to speak.

Start at the end

Perhaps the best place to start is at the transmitter site. When was the last time you opened up and cleaned out that old beauty standing out there by the tower?

If it was just a quick peek to change tubes during an emergency, you owe a mercy visit to clean out the dust, cobwebs and critters.

Of course, in your area, maybe rust is more a problem than dust. While you're in there, check the wiring in and out of the transmitter and rack for any signs of needed maintenance.

At any rate, grab the vacuum, the oil can and a rag. A little oil in the right places, a quick tune-up and a tightening here or there all make for a happy transmitter. And a happy transmitter stays on the air and makes you happy too!

Even if your transmitter readings are logged regularly, make a special effort to read *all* the meters of *both* transmitters as you tweak the tuning.

ECLECTIC ENGINEER

Don't forget a quick check to ensure the STL and TSL signal strengths have not deteriorated. That can save a lot of trouble later.

The building itself may be in need of attention. You might want to check the roof periodically, to ensure that wind, for example, has not shifted material, or caused cracks around the air vents from the transmitter.

(The last thing you'd want is to open the back of the transmitter and find that water and dust have been getting into it. Even worse is finding this out immediately after the transmitter has failed!)

The air conditioning system also deserves attention. Not just the filters, but the whole unit. Any good AC system keeps its cool even as temperatures climb.

This helps prevent transmitter failure and also extends the lives of those expensive tubes hiding behind the PA cavity door. Let's go out now, and get some fresh air.

Outside are those highly important piles of steel, without which you wouldn't have much coverage at all. So, it's important to regularly check the antenna and tower for weather damage.

Not only can the elements bend or twist antennas (especially STL and TSL antennas), the guy wires deserve attention too, perhaps even a tensioning.

Checking the tower

Look around and ask: What of rust or other deterioration of the guy anchors, tower base insulators, etc.? Are the ball gaps in good condition?

It's even a good idea to check for weepholes on the tower that may have become blocked and thus allow water to sit

(continued on page 40)

Roundtable Roundup

(continued from page 28)

discussion regarding Lithuania, Pye piped up with: "Helen, there seems to be a huge setback for the American Secretary of Agriculture this week: broccoli."

Chamberlayne, of course, was referring to the tonnage of broccoli sent to President Bush recently after he announced his disdain for the vegetable.

Most of the half-hour show, though, deals with breaking news stories and the stories behind those stories. Discussions are unscripted, free-wheeling and very impromptu.

"What happens," said Anderson, "is two minutes before we go on, Pye tells us what the subject matter should be." When the mics open, caution is thrown to the wind as the trio assert their opinions, sometimes from opposing sides of the fence.

Sounding off over the wire

With all three mics live, each routed to a different pot on UPI's studio console, these hotbed discussions can keep Robinson quite busy.

At the board, Robinson or a stand-in producer rides gain on all three and occasionally interrupts the feed for a public service announcement. Commented one stand-in, "Your hands are definitely busy while you're running the board for that show!"

Seldom are all three in agreement on any one subject. One hotbed subject, at least for Anderson and Thomas, is the Middle East. "Helen tends to be more pro-Arab than I think I am. I'm more pro-Israel than she is; (we've) had some clashes," said Anderson.

Occasionally, whoever is sounding off gets a heavy dose of cross-fire from the other two. Recalled Anderson of one incident that still has him hopping mad, "Pye actually sounded as if the crackdown (in China's Beijing) contributed to the stability and policy of George Bush!"

This also raised the ire of Thomas, who, according to Anderson, "really (put) him in his place that time, and I certainly joined in."

Since the show is taped, however, the final word always rests with the producer. Sometimes, said Robinson, he has to step in with a heavy hand—usually holding a tape splicer.

Marshalling the trio from an actual elbow-to-elbow roundtable, he maintained, would definitely be a challenge and another story entirely.

But then again, maybe bringing in three such diverse opinions on three distinct audio sends is one way to keep the peace for listeners.

■ ■ ■

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

How to Stop Singing Circuits

by John Shepler

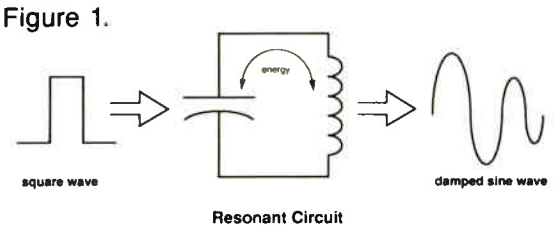
Rockford IL Ringing is a natural feature of musical instruments. It's the resonance that gives instruments their voice. It is also a byproduct of the inherent resonance of many electronic circuits.

What is ringing?

Ringing is the natural waveform of a sharply excited resonant circuit. Hit a bell with a hammer and it rings. Hit a tank circuit with an impulse and it rings, too. As far as nature is concerned, they are the same phenomenon.

Figure 1 shows what happens when a tuned circuit is hit by a sharp waveform.

Figure 1.



The energy is exchanged back and forth by the reactive elements, with a little being lost in circuit resistance on each cycle.

Eventually it is all gone. Hook a scope across the coil or capacitor, apply a pulse, and you see a dampened sine wave. This is exactly what you expect from big tank circuits, like those found in transmitters.

In fact, transmitters won't work without their resonant circuits. These tuned circuits are also essential in receivers, filters and music synthesizers.

Unfortunately, most other circuits exhibit this resonant behavior, whether you want them to or not. It's just a matter of how much and at what frequency.

In high performance audio circuits, especially those related to modulation, ringing is not that easy to control or dispense with.

Ringing and modulation

So what's all the excitement about ringing in audio circuits? If modulation was only measured with meters, nobody would care. However, modulation is measured with peak flashers and ringing causes peaks.

Look at Figure 2. The ideal signal is the square wave that goes into your audio board and comes out of the modulation monitor looking exactly the same.

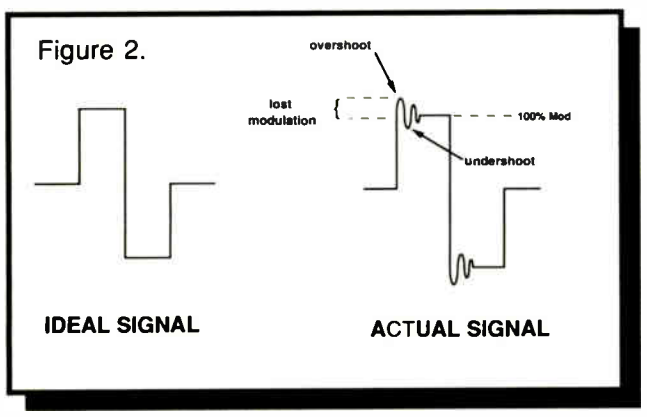
What really comes out of the monitor is the other waveform, the messy one. Something has been added to the top of the square wave.

If you look closely, it is that same dampened waveform that was shown in Figure 1. Somewhere along the line, a sharp audio waveform excited a resonant circuit and added ringing to the pure square wave.

The big concern is that the leading edge of the square wave has grown in amplitude. The ringing waveform is *added* to the top of the square. This is called overshoot.

If the gain of your modulator was adjusted so the top of the square was 100% modulation, you would now have more than 100%. The peak light would be blinking.

Figure 2.



Q-TIPS

To turn off the light you have to turn down the modulation so the top of the peak is back to 100%. The difference between the top of the square wave and the top of the ringing peak is lost modulation.

Actually, the ringing has other ugly effects, too. The overshoot is accompanied by an undershoot that takes away even more of your "brick wall" modulation.

Moreover, the change in the ideal waveform shape means new frequency components have been added to the signal. These new frequencies add distortion to the signal.

Where to find ringing circuits

Just about any circuit will ring under some adverse condition. Here are some culprits that have been found to cause ringing problems resulting in overmodulation:

Input transformers. Transformers are likely candidates because of their high inductance from many turns of small diameter wire.

Add some stray capacitance and you have a resonant circuit. Yes, audio input transformers can be built to minimize ringing effects. Are you sure the ones on your transmitter are that variety?

Even if most of your equipment has balanced solid state drivers, one transformer in the line is enough to ruin a beautiful waveform.

LC filters. The classic example is the 15 kHz low pass filters that were common in stereo generators a dozen years ago. These have been largely replaced by solid state components in new designs.

If you have an older stereo generator, suspect the low pass filters of lowering your modulation.

Long wires. A long audio line is like a reservoir. It stores energy in its distributed inductance and capacitance. Telephone lines are even worse, because the phone company adds loading coils to smooth out the response.

Waveforms don't come out the other end of long lines completely intact. That's why final limiting needs to be done at the transmitter.

STLs. OK, so no wire in your plant is over 10' and an STL relays the signal from studio to transmitter. Any filters or transformers on the input or output of the STL (transmitter or receiver) can still ring.

Electronic filters. Just because it's made of opamps doesn't mean it won't ring. There is a popular circuit called a gyrator that is used in equalizers. It has resistors, caps and opamps, but acts like a coil. Looks can be deceiving.

Unstable circuits. An amplifier on the ragged edge of stability can pop in and out of oscillation when struck by sharp waveforms.

Maybe you have a bad component or a marginal design. If it's in the exciter or transmitter you've got trouble.

Modulation components. They don't call those old AM behemoths "big iron" for nothing. The modulation transformers and chokes love to sing on their own.

Many processors now give you compensating circuits to tune out some of these effects. Otherwise, make sure your audio waveforms are filtered to reduce the sharp edges before they get to the transmitter.

To find ringers, inject a square wave at various points in your system and monitor with a scope. Make sure you are looking at those critical leading edges where the overshoot occurs.

You want your entire system to pass the high energy waveforms, but the most important areas to check are related to the transmitter site.

What to do about ringers

You may have to replace older equipment with newer designs. Perhaps a new final limiter is all you need to maintain a solid modulation level.

A composite clipper at the output of the stereo generator will chop off ringing from previous circuits. Despite their bad rep from abuse, a clipper may be all you need.

Newer modulation monitors—like the ModMinder from Modulation Sciences, which passes short duration transients— may allow you to raise modulation levels and ignore ringing circuits. It's worth a try.

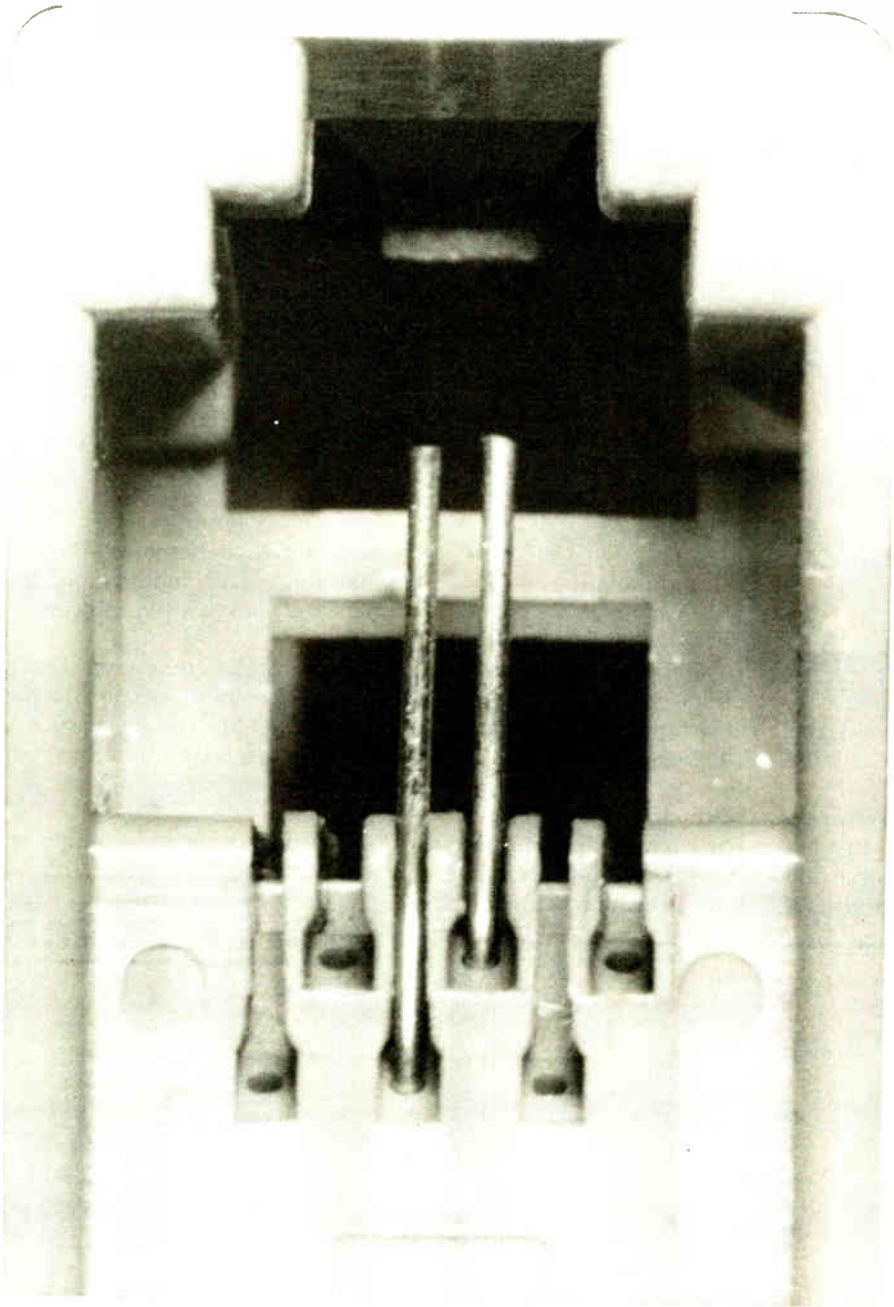
Don't forget that even good equipment can go bad and start ringing. A little probing with the scope could save thousands in new purchases. Happy hunting!

■ ■ ■

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

GET IT RIGHT

GET IT FROM ALLIED



Now the right phone system goes right where you need it.

No matter where you need access to your on-air phone system, Gentner's new Telemix 2000 delivers. Custom control panels to match most consoles and studio furniture are available at no extra cost. Now the phone fits any place you need it.

Telemix 2000's advanced design lets you do more with your phones, and do it all more easily. Hands-free, one-button operation lets talent record calls on-air or off-air, talk to callers on or off the air, conference calls together—all without taking off the headphones or leaving the mic.

With all this, the best thing about Telemix 2000 may be the way it sounds. Gentner's technology delivers the cleanest, clearest telephone sound ever.

If you broadcast talk shows, news, sports, remotes and call-ins, Harris Allied has the right phone system for you—Gentner's Telemix 2000. And to help you get the right Telemix 2000 for your station, we've put together an informative white paper, "Getting the most out of your phone system with today's technology." Call your Harris Allied representative today for your copy.

HARRIS ALLIED
BROADCAST EQUIPMENT

800-622-0022

CANADA 800-268-6817

STUDIO EQUIPMENT • HARRIS RF PRODUCTS • SATELLITE GEAR • TRADE-INS • TURNKEY SYSTEMS

"Literature Only" Circle 141

"Call me, I'm interested" Circle 10

Facing Facts About Contracting

by Tim McCartney

Bemidji MN As the industry shifts from full-time to contract engineering, I've begun to hear increasing reports of problems and concerns. After talking with engineers from several markets, I've noticed the emergence of a few common themes.

One such theme points to an uneven demand for radio engineers. Another pits contract engineers against their full-time, employed counterparts. The third and most volatile is about getting paid.

Uneven demand

The general demand for radio engineers is spotty. In some locations, a shrinking engineering job market contributes to excess supply of competent engineers. In others, positions are left unfilled for lack of the proper expertise sought at the wages offered. And, in still others, the status quo remains, but is threatened as engineers face retirement.

Many contract engineers face competition from employed engineers working on the side. Even though these full-timers typically feel overworked, they are nonetheless unlikely to decline outside offers. Thus, contract engineers often find themselves vying for leftovers.

In one major market, four or five contract engineers keep their prices down in order to remain competitive with each other and with moonlighting fulltime engineers. In one medium market, competition among 30 radio stations means that any money from the local booming economy fails to stop at engineering desks.

In that market, the three full-time radio engineers join TV engineers in absorbing some of the available contract work. The balance is largely handled by a busy contractor who bills about $30,000 per year.

But others run into problems when attempting radio contracting.

One full-time radio engineer, laid off following an ownership change, now works in TV engineering. He greatly enjoys regular hours and reduced on-call responsibilities.

In another case, in a small but growing market, three local contract engineers handle the business, but earn most of their incomes from other sources. Again, the full-time TV engineers obtain some of the available contract work.

Payment versus ethics

It's no secret that for several years now, managers of both radio and TV stations have been reducing engineering budgets in order to save money. In so doing, normally-followed ethical practices can sometimes be ignored.

Take, for example, the GM who requires his full-time engineer to bear the cost of driving to the transmitter sites, one of which is located 20 miles away. Conveniently ignored is the company mileage reimbursement policy, routinely granted to other staff members. The GM manipulates the otherwise content engineer by carefully sidetracking any discussion on the topic.

Or, consider the contract engineer who is not expected to charge for certain services. The GM believes that pay is restricted to hands-on repair of equipment and related studying of schematics, not for time spent discussing engineering plans with him.

By far, the most often heard complaint regards the difficulty of getting paid in due time—or at all. Thus, the matter of timely payment for services rendered is a major issue for the growing numbers of contractors.

Survival strategies

Engineers are coping with the changing environment in various ways. As mentioned, some contract engineers are leaving the field while others remain in anticipation of an improved future. Some believe that several years of neglect will soon produce a period of equipment backlash, in which demand for engineering services will rebound.

There appear to be few personal relations problems between contractors and moonlighting full-timers. In some cases, however, this competition has served to decrease the rates that contractors can charge customers.

Engineers generally reserve their outrage for problems connected with collecting money owed. This is one area in which each engineer has clear choices to make.

John Cummuta, in his 26 July, 1989 **RW** article "Collecting on Payment Owed," argues that "you definitely want the reputation of being hardnosed about getting your money." He suggests providing "perks" for early payment, such as discounts.

Another method exists for contractors who work regularly for fiscally-delinquent managers. Should needed equipment fail, the unpaid engineer has an ideal opportunity to collect past-due bills in full as well as to obtain advance payment before resuming maintenance. Certainly, there is an appropriate point at which services must be terminated.

Yet another approach is to freely trade information. The payment record of current and prospective management is, by necessity, appropriate for regular discussion among engineers. Also germane is early news about station ownership changes. Even though this dialogue must remain informal for legal reasons, it should nonetheless occur.

One experienced TV engineer, saddled with a six-year-old $1800 debt from a local radio manager,sums it up by saying, "don't let them get too deeply into your pocket."

One giant step . . .

Perhaps the most encouraging news about receiving payment for work done comes from the contract engineer who was not only exhausted from chasing equipment problems, but also from time wasted trying to collect on past-due bills.

It may have been that fatigue bred inspiration when he informed his customers that payment would be required in advance. Clearly, he must be doing an excellent job, because he still has the same roster of clients.

Such a stance is not necessary for customers who are reliable. Once a manager has wandered away from this category, however, payment in advance becomes the only reasonable approach. Also, if a station sale is imminent, advance payment may be deemed necessary.

Unethical business activities can be viewed as a direct threat to contract engineers' survival. Individual survival depends on the degree to which the challenge is met.

Be on the alert for short-term profiteers who believe that they will be personally rewarded by shortchanging others. Such a manager may elect to pocket those dollars rightfully belonging to the engineer.

In hopes of improving the climate for contractors, let me suggest a few prompt payment principles:

- Owners and managers are considered pay-reliable (PR) until proven pay-unreliable (PU).
- The PR record of management is freely shared among engineers.
- Time spent collecting payments is fair billing to a PU-manager.
- Engineers ought not to allow debts to become excessive.
- All services are withheld from customers with debts owed longer than 30 days.
- Payment is required in advance for customers achieving PU status.

In locales where demand is soft or competition stiff, contractors may be skeptical about following such guidelines for fear of losing business. Thus, some engineers will be tempted to take risks in hopes of eventually getting paid. Clearly, each contractor must individually arrive at such critical decisions.

■ ■ ■

Tim McCartney is a contract engineer in Bemidji, MN. He is an SBE Senior AM/FM Broadcast Engineer, a former radio station engineering director and general manager, and has a master's degree in human resources management. He can be reached at 218-751-1680.

An AES/EBU Interface Resource

by Mel Lambert

Studio City CA Just under a year ago within these hallowed pages, I discussed in some detail the differences between the "professional" AES/EBU digital interface, and the "consumer-grade" S/P DIF-compatible I/O (now, more usually, and generically, referred to as "IEC Type II")

During the past year I have also described possible interface problems that might be encountered during the routine use of AES/EBU ports between hardware separated by more than a few feet, or in situations where intermediary patch panels and tag blocks might compromise the 3.072 megabit per second data streams.

Against this background, I recently came across a new publication that I would recommend highly to anyone

DIGITAL DOMAIN

who is experiencing problems with utilizing AES/EBU interfaces, or who simply wants to be brought up to speed with current developments.

During September last year the British section of the Audio Engineering Society organized a fascinating gathering in London, entitled (appropriately enough) "The AES/EBU Interface Conference." The conference's book of proceedings, which runs to 150 pages, including appropriate schematics and block diagrams, has just been published here by the AES. (Call 212-661-2355 for information and availability.)

A dedicated conference

The two-day conference was divided into two sections. The first day was devoted to standards and circuit design, while the second day's sessions covered using the interface and future developments.

There are enough good discussions within these conference proceedings to make them essential reading even if you think that you are reasonably well versed in the intricacies of digital I/Os. For example, a succinct overview by John Emmett, of Thames Television, probes the important differences between the professional AES/EBU interface and its consumer cousin, including the Channel Status Data Format.

Of significant practical value is a very thorough treatment by Neil Gilchrist of the BBC Research Center, which considers various methods of sending coordinating signals between program sources and destinations in the auxiliary section of the AES/EBU format.

As Gilchrist reports, CCIR Studio Group 10 has adopted this technique as a standard; basically, the four aux bits

(continued on page 42)

Springtime Tradition

(continued from page 36)

inside the tower legs, attacking the metal from the inside.

(If you are new to the station, here's a tip: Check to see the weepholes are at the *bottom* of each section. Occasionally tower sections are installed wrong way up!)

Additionally, check out the tower fence and gate. Are they really secure? At this point, the local flora have yet to fully reassert themselves, so it's usually a lot easier to clear those areas before they get filled by grass or weeds.

And, since the towers just stand there year after year (we hope), what about the tower paint and lighting? How far away can you clearly see your tower?

If the tower is not clearly visible to approaching aircraft due to fading or peeling, you can be liable for a fine, not to mention the potential legal liability in case of a crash.

In fact, the FCC now makes this a priority check item during inspections. Also meriting attention is the photocell system. Is it turning the tower lights on early enough at dusk?

Meanwhile, back at the ranch . . .

Just like at the transmitter site, the exterior of the studio building deserves a full inspection, as do the various STL, RPU, satellite and other antennas.

Inside the studio may be the easiest part of your inspection, as you may have been indoors all winter, fixing everything in sight, making sure all the wiring is in phase for stereo.

On the other hand, how long has it been since your last mock FCC inspection? Start with the FCC checklist. Is your paperwork trail sufficient to prove that your operation is legal?

Permits posted? Operator's manual current? Public file up to date? Often only the station engineer really knows what is required.

That creates an excellent opportunity to show the GM your value in these days of escalating fines. As at the transmitter, don't forget the air conditioning system and air filters.

While overheated DJs do not fail like transmitters, they do become rather crabby when their overload relays trip; it's easier to work with them if the studio is comfortable.

It's obvious that regular maintenance is essential for heavily used gear, such as in the control room. If you haven't already set up a schedule, do so now.

A stack of 5×8 index cards can hold schedules or a maintenance history of each item in the station. If you have a computer, that can be a big aid in keeping track.

Horrors!

Sometimes, it seems that when you open the console, or look under the cabinet, an ugly mass is discovered there looking like nothing so much as a vat of dried spaghetti covered with grey paint.

Some stations do a root canal on their wiring and find that eliminating excess wire can significantly reduce hums, buzzes and RF in the station audio chain.

Even if you are a careful technician, how is your documentation? Have you made sure the wiring diagrams for the station are up to date?

Look at it this way: You'll likely want a vacation some day. Whoever stands by for you will appreciate accurate wiring records.

After you've determined that all the studio equipment is working well, is aligned to an actual standard and the nicotine has been scraped from the control room windows, etc., you may want to poll the disc jockeys to see what can be done to make control room operation easier.

Perhaps moving a source from one pot to another will help, maybe adding a new remote button. In any event, knowing what the staff thinks about the operation will help you in planning a better, more functional facility.

As you go by the control room, be generous: pass out some cotton swabs and cleaner to the staff. They may even get used!

Obviously, it's impossible to mention here everything that may need attention. So, look around your facility, talk to other engineers and create a maintenance program that works for you.

List the points that you've found valuable in helping keep your facility running at optimum efficiency. The main thing is to follow through with whatever repairs or adjustments are needed.

You'll be rewarded with months of smooth, solid operation.

■ ■ ■

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

$233.00 per MONTH

Price shown based on console purchase price of $8995.00 and 60 month lease • First and last payments are due on signing • $1 buy-out option • No financial statements or personal guarantees are required, if you have been in business for at least 2 years • 48 hour loan turn-around guaranteed • Simple, one page loan application • No processing or filing fees • Other terms and payment plans are available • Terms and rates subject to change without notice

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

Circle 75 On Reader Service Card

Staying Abreast of AES/EBU

(continued from page 40)

per subframe are used to provide voice communications and/or cueing. The 192 kbits/second would provide a 12-bit word length at a sampling frequency of 16 kHz for voice quality cue and reverse-feed coordination channels of just under 7 kHz bandwidth—more than adequate for the majority of communication applications envisioned for the interface.

Channel Status discussions

Several papers presented at the AES Conference discussed the importance of ensuring stable clock and synchronization sources; others focused on applications of Channel Status bits.

Serge de Jaham, of Digitec, France, provided a detailed description of two new A-to-D and D-to-A converters that allow CS data to be encoded/decoded as part of the AES/EBU digital bitstream.

Acknowledging that the Channel Status can be used to carry various data to identify system configurations, source/destination labels, timecode, etc. within the 96 kbits per second, de Jaham described several ways in which this useful information might be entered into a PC and added to the digitized audio data.

A companion paper by Alain Komly, of Telediffusion de France, described a new packet-based technique for adding Program Labels to the digital bitstream, such information being carried within the User Channel.

Two basic types of labels are being proposed: Static Data and Dynamic Data.

Typical applications of Static Data might include the labeling of program material, copyright sources, accompanying text—possibly introductory cues and/or related script materials—plus other low-priority messages.

Dynamic Data might include editing information (edit-decision lists and the like), plus CD subcodes, TeleText and signal-processing data. (One proposal is that the User Channel be used to carry dynamic companding information.)

Cornucopia of applications

While more work needs to be done in this area, there is certainly a cornucopia of applications to which such data, once standardized, could be put.

Paul Evans of Thames Television described his company's experience with carrying AES/EBU-format signals around a large broadcast facility, and also the necessary evils of large distribution matrices to route signals between production areas.

Of particular importance, he stressed, was the use of buffer amplifiers or similar devices on longer cable runs, or where differing characteristic impedances are cascaded. These units would restore signal level and could also be set to reclock the digital data via a phased-locked crystal oscillator.

An extremely useful paper by Richard C. Cabot, of Audio Precision, entitled "Measuring AES/EBU Interfaces," described techniques for checking the electrical and electronic performance of digital I/Os, including the ports and the cables used to interconnect them.

As Cabot points out, the AES/EBU standard calls for a transmitter output impedance of 110 ohms, and a receiver input impedance of 240 ohms. This inherent impedance mismatch, allied with the fact that the RS422 electrical specification limits the recommended cable length to 145' (best case!), drastically reduces the ability of a digital output to drive long lines.

The up side

But it's not all bad news, he offers. Cabot has successfully run an AES/EBU interface over 320' of conventional microphone cable with zero errors, although this ability does depend on the interface design.

Accessories for the Audio Precision System One test set now allow error rates of an AES/EBU interface to be measured using one of three different waveforms: constant, but sweepable, hex or decimal values; a walking-bit pattern; and a pseudo-random number sequence.

Tim Shelton of the BBC Research Department turned to the thorny subject of synchronizing various digital bitstreams within a multiple-room or multimachine production environment. Shelton provided an invaluable overview of the primary considerations, as well as the effects of clock instability and jitter on sonic performance.

On a similar tack, Phil Wilton, of Sony Broadcast & Communications, described the proposed MADI (Multichannel Audio Digital Interface) format, which provides a data capacity of 56, 24-bit AES/EBU-compatible channels via a coax or fiber-optic conductor.

MADI represents a major savings in cabling and system complexity when a large studio production area needs to be linked birectionally to a master control room, for example, or a workstation is connected to a companion multichannel recording system.

Companding techniques

One of the conference's final papers came from Christer Grewin, of the Swedish National Radio Company. Titled "A Format for Contribution of Digital Studio Quality Sound Signals," it provides a unique overview of the various companding techniques currently being considered by European Broadcasters to carry digital signals over long distances.

Grewin identified three current techniques using 32 kHz sampling frequencies—A-Law, an instantaneous 14-bit to 1-bit companion system; NICAM, a near instantaneous 14-to-10 companding system with a 1 ms companding block; and DS1, a floating-point companding system that involves 16-to-14 conversion with 2 ms companding blocks. He argued that for compatibility with 48 kHz AES/EBU-format signals, the European Broadcasting Union is currently considering the use of an H1 channel (1,920 or 1,536 kbits/second).

His paper detailed the various transcoding and error correction schemes available to ensure compatibility with 16/20/24-bit AES/EBU data bitstreams.

I would advise anyone seriously interested in current and future applications of the AES/EBU Digital Interface within the broadcast environment to secure a copy of this report from the AES. You will thank me later, I can assure you.

■ ■ ■

Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for the past dozen years. Now principal of Media & Marketing, a consulting service for the professional audio industry, he can be reached at 818-753-9510.

How the newest AM transmitters earned one of the oldest names in radio.

GATES

Introducing the Gates Line of 1, 2.5 & 5 kW Solid State AM Transmitters.

Gates. It's more than a name — it's a tradition of quality and value. To earn that name. these affordable new transmitters had to meet the highest industry standards in five key areas:

Value

- Overall efficiency of up to 72% cuts power costs.
- Multimeter plus PA voltage, PA current, and forward/reflected power meters standard.
- Output tuning included as standard.
- Remote inputs compatible with both TTL and relay-type remote systems.

Durability

- No tube failures, time-consuming adjustments or replacement costs.
- Modular construction with easily accessible socketed MOSFETs.
- "Chimney design" air handling keeps transmitter clean and dust-free.
- 100% solid state "soft-failure" power amplifiers.

Simplicity

- Six independently adjustable power levels accommodate virtually all PSA/PSSA requirements.

- Color Stat™ front panel with signal flow block diagram and red Fault LEDs shows transmitter status at a glance.
- Rugged, dependable discrete logic controller.

Reliability

- Automatic overload power cutback keeps the transmitter on the air at the highest safe power level.
- Bandpass output network has proven its lightning survival capabilities in the field.
- Automatic instant AC restart.
- Battery backed-up controller memory.

Performance

- Patented Polyphase Pulse Duration Modulation technology.
- Unsurpassed reach with 130% positive peak capability.
- Minimal distortion, overshoot and ringing for crisp, "ear grabbing" sound.

Original circa-1946 Gates transmitters are still on the air to remind us that value, durability, simplicity, reliability, and performance are as important right now as they ever were. So if you want an affordable solid state transmitter with all the "old-fashioned" advantages, call Harris today for more information on the newest AM transmitters — and how they earned the proudest name in radio.

HARRIS

Harris Broadcast Division
Marketing Department
P.O. Box 4290. Quincy. IL USA 62305-4290
Tel (217) 222-8200 Ext. 3408
Fax (217) 222-7041

Circle 61 On Reader Service Card

New Name-Same Great Cart!

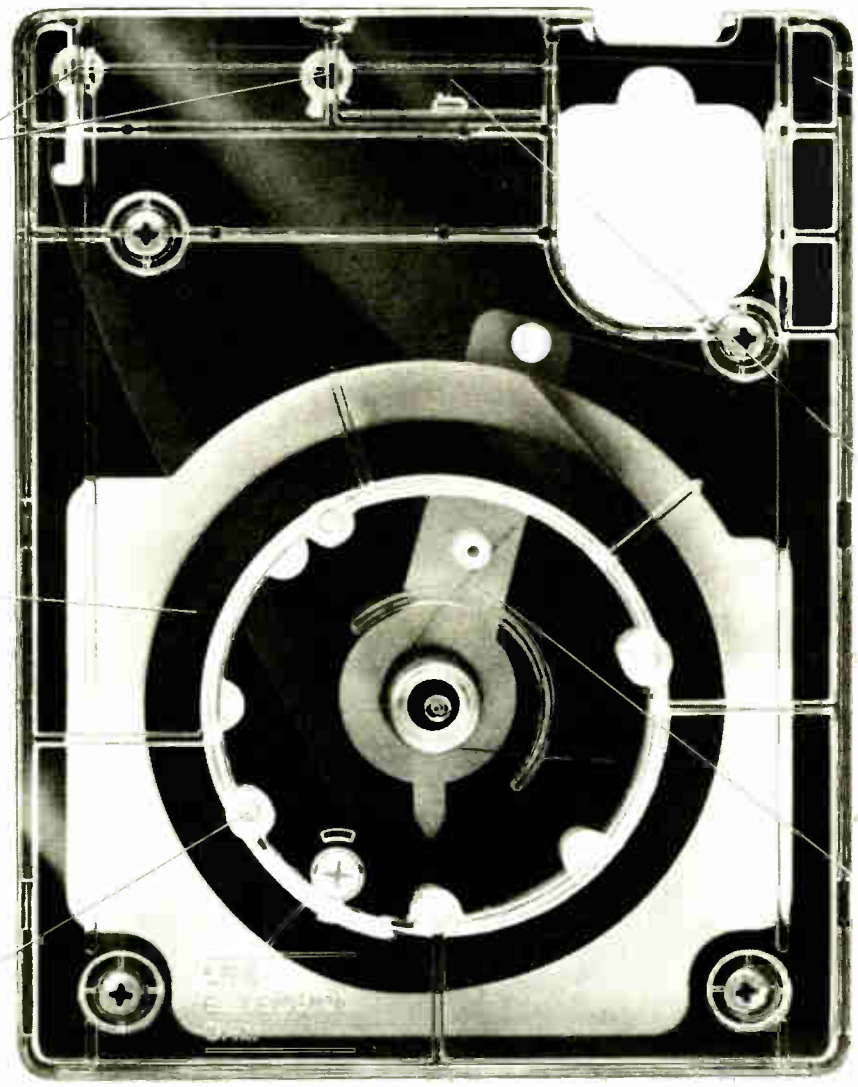
The ITC Cart II Cartridge, formerly ScotchCart® II

WHY YOU SHOULD PAY MORE FOR LESS.

Less phase jitter caused by poorly tracking tape, because the naturally lubricated concave guides gently position the tape and allow the cartridge machine to perform critical guidance.

Less tape noise and signal loss with our 100% laser-inspected, high output, low noise tape which delivers better frequency response and keeps signal-to-noise ratio high, harmonic distortion low.

Less wow and flutter or stop cue overshoot, because there's no rotating hub to wear out, warp or rattle.



Less chance of the cartridge cracking or breaking, because the tough polycarbonate cover withstands repeated use and abuse.

Less head wear, tape steering and modulation noise, because there aren't any pressure pads to add friction.

Less chance of tape destruction, because our patented dynamic tension control system ensures proper tape-to-head contact, and provides constant tension to control looping and prevent twisting.

The ITC Cart II Cartridge, formerly ScotchCart®II

With broadcast cartridges, like everything else, you get what you pay for. With ITC Cart II cartridges, you get a revolutionary design that delivers trouble-free operation, superb sound quality and a life expectancy that's second to none.

We have renamed the cartridge due to trademark considerations, but only the name has changed, the cartridge and tape are the same. New name, same great cartridge and performance.

For a complete listing of ITC Cart II dealers, call ITC toll-free at 800-447-0414 (in Illinois, call collect 309-828-1381.) Or write to ITC at P.O. Box 241, Bloomington, IL 61702-0241.

Because a cheaper cartridge may be more trouble than you can afford.

ScotchCart®II is a registered trademark of 3M

it

Circle 46 On Reader Service Card

Occupied Bandwidth: Early Data

by Eric Small

Brooklyn NY Recently there has been a great deal of interest in the bandwidth of program-modulated FM broadcast signals.

The main concerns have been the interference potential of different kinds of audio processing and the way various methods of measuring bandwidth fit into the regulatory scheme.

Because several of its products have an impact on bandwidth, Modulation Sciences, Inc. recently began a research project to investigate occupied bandwidth by doing controlled studies of the effect of varying program content, signal processing and SCA presence.

The work is far from complete; however, because the data is of current interest, these preliminary results are being made available to the industry in the most rapid manner possible.

Figure 1.

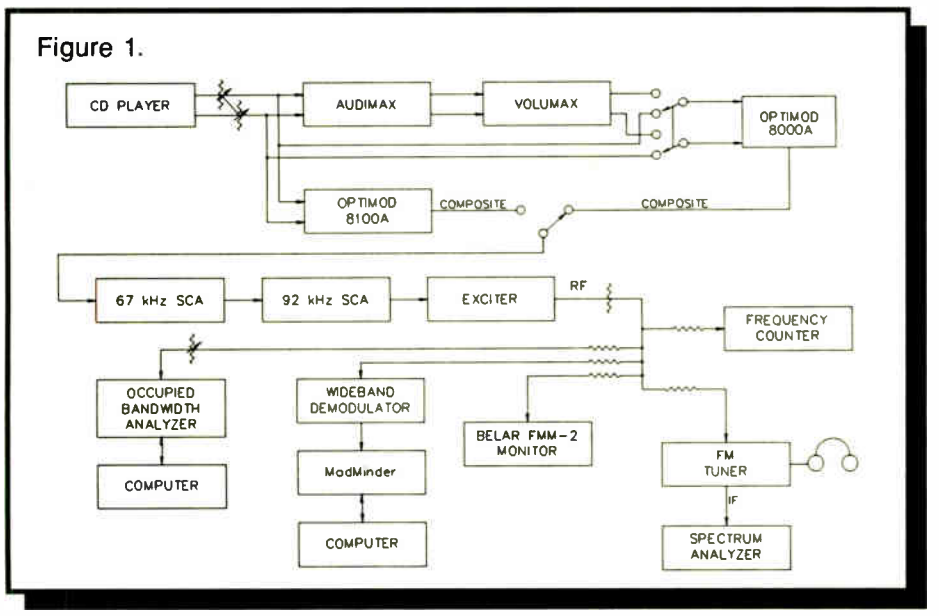
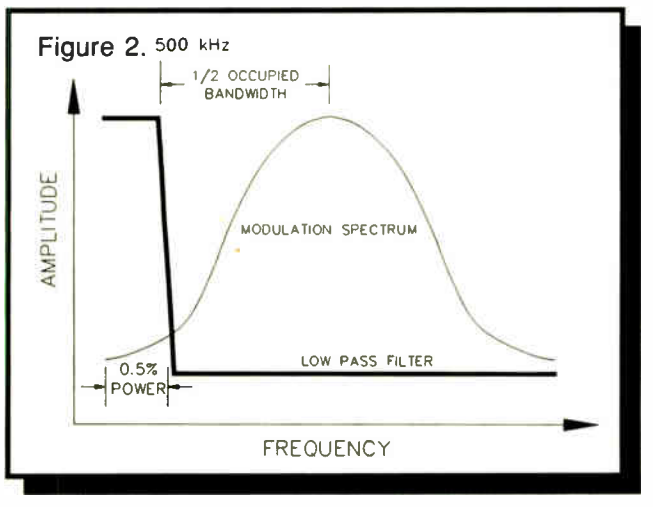


Figure 2. 500 kHz



The data presented here was created in strict adherence to CCIR recommendations and, where applicable, to International Radio Regulations (IRR).

The United States is signatory to the International Telecommunications Union treaties, whose definitions were made a part of FCC Rules in Volume 2 of Title 47 of the Code of Federal Regulations.

The key parameter in determining the potential of a signal to cause interference is its occupied bandwidth. Great confusion has surrounded the definition of occupied bandwidth.

Fortunately, both the FCC and IRR are specific here, providing a precise definition: the occupied bandwidth of a randomly frequency modulated signal is that bandwidth containing 99.0% of the power.

The critical question is how to measure the bandwidth containing 99.0% of the power of a signal while it is being modulated by real stereophonic program material.

It is a common misconception that a spectrum analyzer can provide useful information about occupied bandwidth.

A conventional (scanning type) spectrum analyzer is useless for determining the occupied bandwidth of a program modulated FM broadcast signal because all it can do reliably is to determine the occupied bandwidth of a carrier modulated by a sine tone.

Several other fundamental problems exist with using a spectrum analyzer for measuring the occupied bandwidth of a high deviation, complex and non-periodic modulated signal such as a stereo FM broadcast signal.

1. Because a spectrum analyzer scans a narrow filter across the band, it is likely to miss infrequent or non-periodic peaks.

2. If the bandwidth of a spectrum analyzer is made wide enough to avoid the problems described above, the resolution is typically so reduced as to add unacceptable error to the results.

3. The storage or peak-hold feature of various analyzers are not characterized with respect to measuring occupied bandwidth of dynamic signals.

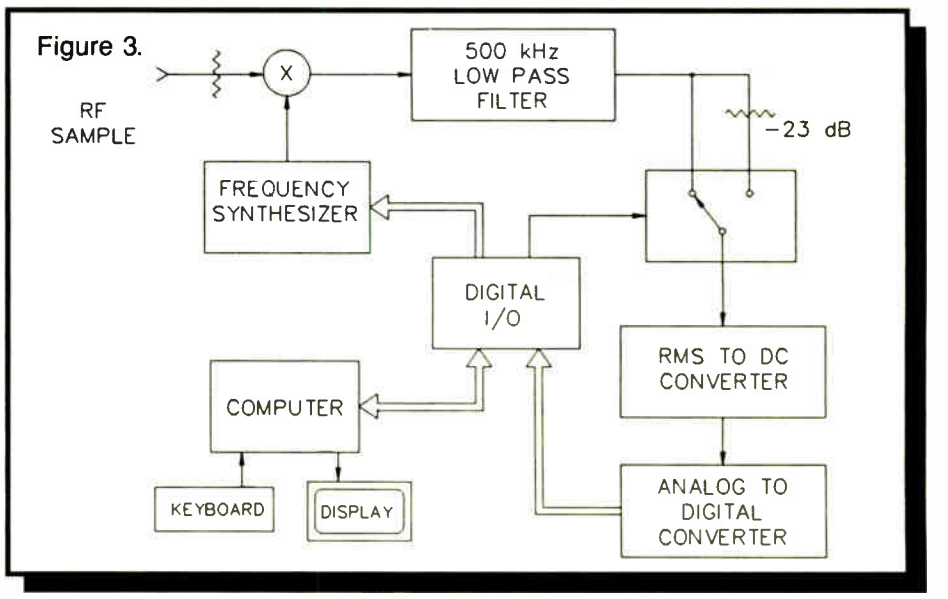
The final value displayed depends on the storage technique employed by the particular analyzer. Often the characteristics of storage or peak-hold function are not even part of the published specifications of the instrument.

In the author's experience, errors from this source can be as great as ±50% of the correct value.

4. The detector in commercially available spectrum analyzers is a peak voltage type, not a power detector. Both the FCC and IRR define occupied bandwidth in terms of power.

A true RMS detector (either calculated or thermal) is necessary. As far as I know, there are no commercially available spectrum analyzers with RMS detectors.

Figure 3.



Another issue that often arises in discussions of the interference-causing potential of signals is the validity of using protection ratio measurements.

Protection ratio data is a necessary ingredient in any new or modified table of allocations. However, by their nature, protection ratio measurements are highly statistical with large standard deviations.

The effort involved in using protection ratio data to reach defensible conclusions about small changes in interference would be enormous.

First, a statistically significant number of different receivers would need to be acquired. They would then have to be characterized using the protection ratios on which our current table of allocations are based.

In addition, any deviation from strict adherence to CCIR standards for doing protection ratio measurements would need to be validated against CCIR procedure, potentially a very time-consuming process.

It is important to remember that many years of effort have gone into creating and validating the CCIR procedures and they cannot be lightly dismissed without raising serious doubts about the value of the new work.

Finally, protection ratio measurements are never defined in the FCC Rules, let alone discussed, in contrast to occupied bandwidth, which is carefully defined in Part 2 and then comes up in almost every other Part of Title 47 (The FCC Rules).

Recently, CCIR published a major revision of its *Handbook for Monitoring Stations* which devotes an entire chapter to bandwidth measurement.

A technique for automatic measurement of the occupied bandwidth of an arbitrarily modulated signal is presented at the block diagram level.

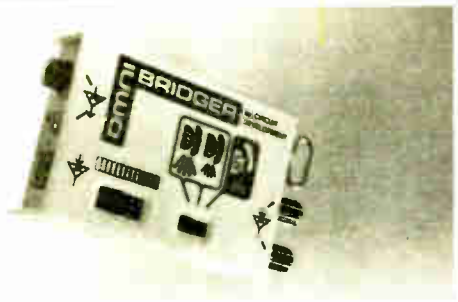
This is the design Modulation Sciences followed in building an Occupied Bandwidth Analyzer. Figure 1 illustrates the principle of operation of the Occupied Bandwidth Analyzer.

The RF sample is heterodyned to approximately 500 kHz by a computer-programmed frequency synthesizer. The modulated signal then passes through a very sharp cutoff 500 kHz lowpass filter.

(continued on page 48)

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



Headset amplifier

The Omnibridger headset amplifier from Circuit Development Co., Inc. is a line level bridging device.

The Omnibridger allows the user to bridge telephone or other high level balanced circuits for cue monitor or maintenance purposes.

The Omnibridger has low distortion, high input impedance, high level low impedance output and wide bandwith characteristics as well.

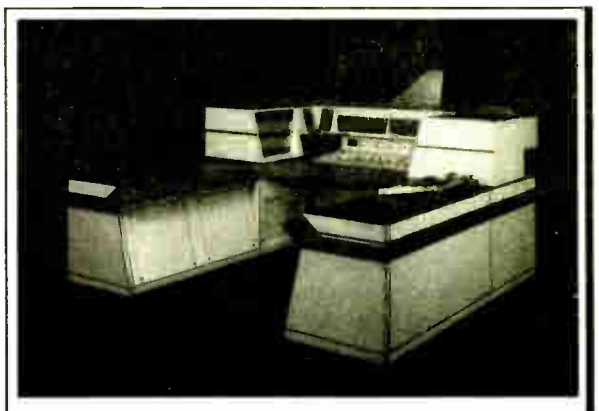
For information, call **Charles Sanfilippo at Circuit Development Co., Inc: 718-768-4555** or circle **Reader Service 70.**

Station controller

Kingdom Technology introduces The Station Controller which provides flexibility for live assist or fully automated programming.

The Station Controller features relays to control the devices and input circuits from the devices for monitoring various external conditions.

For information, call **David Benoit at Kingdom Technology: 904-664-6492** or circle **Reader Service 26.**



Furniture system

The Express Group Series 6000 is a modular furniture system that is designed with vents to maximize passive air flow for efficient cooling.

The 6000 positions 14″ of rack space in two bays directly in front of the user.

It can accommodate 6 cart machines. Each module is designed with access panels and quarter-turn panels.

For information, call **Bob Burns at The Express Group: 619-298-2834** or circle **Reader Service 133.**

Digital audio terminal

Corporate Computer Systems Audio Products Division has introduced its Micro64 digital audio terminal.

The Micro64 digitizes audio information and interfaces it to the digital telephone network.

It allows broadcasters to deliver 7.5 kHz audio over a single 64-kbit/s digital phone circuit.

64× oversampling in the A-D converter and 8× oversampling in the output D-A converter helps to produce a clear signal.

For information, call **David Lin at Corporate Computer Systems: 201-946-3800** or circle **Reader Service 97.**

Station monitor

The CIA-1 from Russco Electronics is an automatic monitoring device which allows the user to monitor the commercial airtime of other stations.

For information, call **Russell Friend at Russco Electronics: 209-291-5591** or circle **Reader Service 56.**

Clamping knobs

The Beta and Omega Series clamping knobs from Rogan Corp. are sold with either threaded inserts or threaded studs, and are available in lengths ranging from 1.12″ to 3.50″.

They are available with molded domes, flat tops or decorative inlays.

For information, call **Don Pelletier at Rogan Corp.: 800-423-1543** or circle **Reader Service 78.**

SUBSCRIPTION/READER SERVICE FORM

Radio World

June 13, 1990 Issue Use until September 12, 1990

FREE Subscription/Renewal Card

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
A. Commercial AM station
B. Commercial FM station
C. Educational FM station
E. Network/group owner
F. Recording studio
G. TV station/teleprod facility
H. Consultant/ind engineer
I. Mfg, distributor or dealer
J. Other _____

II. Job Function

A. Ownership
B. General management
C. Engineering
D. Programming/production
E. News operations
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	023	045	067	089	111	133
002	024	046	068	090	112	134
003	025	047	069	091	113	135
004	026	048	070	092	114	136
005	027	049	071	093	115	137
006	028	050	072	094	116	138
007	029	051	073	095	117	139
008	030	052	074	096	118	140
009	031	053	075	097	119	141
010	032	054	076	098	120	142
011	033	055	077	099	121	143
012	034	056	078	100	122	144
013	035	057	079	101	123	145
014	036	058	080	102	124	146
015	037	059	081	103	125	147
016	038	060	082	104	126	148
017	039	061	083	105	127	149
018	040	062	084	106	128	150
019	041	063	085	107	129	151
020	042	064	086	108	130	152
021	043	065	087	109	131	153
022	044	066	088	110	132	154

ADVERTISER INDEX

This listing is provided solely for the convenience of our readers. *Radio World* assumes no liability for inaccuracy.

Page No.	Advertiser	Reader Service No.
49	AKG/Orban	63
06	Allied Broadcast/ITC	11 & 102
16	Allied Broadcast	17 & 114
32	Allied Broadcast/ Alpha Audio	29 & 100
38	Allied Broadcast/ Gentner	141 & 10
40	Allied Broadcast	148 & 71
48	Allied Broadcast	51 & 4
30-31	Arrakis Systems	21
7	ATI	117
27	Audio Broadcast Group	94
9	Audiopak	152
19	Auditronics	39
36	Belar	9
3	Bradley Broadcast	50
3	Broadcast Electronics	92
20	Broadcast Electronics	146
21	Broadcast Services	5
8	Broadcasters General Store	41
23	BSW	2
4	Burk Technology	31
33	Cencomm	19
33	CCA Electronics	120
35	Comrex	73
48	Conex	77
10	Continental Electronics	27
45	Continental Electronics	125
24	Cortana	81
22	CRL	138
39	CRL	6
28	Dataworld	143
18	Delta	37 & 90
1	Fidelipac	36
36	Flightline	85
50	Full Compass	65
15	Gentner	59 & 140
43	Harris	61
34	Hnat Hindes	108
16	IGM	129
44	ITC	46
10	J.N.S.	54
7	Jampro	105
26	Logitek	67
23	Marti Electronics	25
26	Marti Electronics	62
34	Microwave Filter	60
12	Moseley	13
42	Murphy Studio Furniture	33
37	Northeast Broadcast Labs	55
13	Orban	122
25	Otari Corp.	124
17	Pacific Recorders & Engineering	110
58	Peter Dahl Co.	30
29	QEI	43
41	Radio Systems	75
24	RF Specialties	111
11	Schmid Telecommunications	82
39	Sescom	18
22	Sono-Mag	89
21	Sony	–
14	Studer Revox	57
47	Studer Revox	40
28	Tannoy	14
57	Transcom	127
2	Wheatstone	15
59	Wheatstone	80
60	Wheatstone	101

Advertising Sales Representatives:

East Coast, Art Constantine: **800-336-3045** Fax: **703-998-2966**
Midwest, Art Constantine: **800-336-3045** Fax: **703-998-2966**
West Coast, Pat Macsata: **415-786-2198** Fax: **415-786-2754**

REVOX OPEN REEL RECORDERS.
HIGHER QUALITY. LOWER PRICES.

THE C270 SERIES This exciting new line of recorders provides you with all the traditional Studer Revox benefits—mechanical precision, electronic sophistication, supreme sound quality and superior support—adding up to state-of-the-art analog recording technology. The C270 is available in 2, 4 and 8-track versions with or without remote/autolocator.

BEST BUY Compare the "street" price and performance of any C270 Series machine with the competition, and you'll find there is no competition. The die-cast deck plate and head block, the precision mechanics and a host of powerful features tell you any C270 Series machine will last as long as you need a reel-to-reel in this emerging era of digital work-stations. And in the digital future, you'll need analog recorders that will sound good—for a long time. That's why your last reel-to-reel should be a Studer Revox.

TIME CODE . . . OR NOT The C270 2-track version offers optional center track time code for effortless synchronization to picture or sound. The C274 4-track and C278 8-track are both equally adaptable to production or post. The optional remote/autolocator stores 18 start/stop addresses and provides full transport and channel remote control to fit into any professional studio environment.

LOGGING TOO For station logging applications, special super low speed versions of the C274 and C278 are available with built-in time/date code generator and reader with search capabilities, providing up to 25 hours of continuous audio on one reel of tape.

C270 Remote/Autolocator

Call your Studer Revox Professional Products Dealer—or Studer Revox direct—to discuss all the details. Or simply call **800-366-4900** to receive our C270 series color booklet.

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 Canada Ltd., Toronto (416) 423-2831
Circle 40 On Reader Service Card

Occupied Bandwidth Method

(continued from page 45)

The output of the filter drives a true RMS detector. Under control of a computer, the frequency of the synthesizer is slewed until 0.5% of the total signal power is within the passband of the low-pass filter.

Figure 2 shows the relationship of the signal to the filter passband. The cutoff point of the filter marks the edge of occupied bandwidth.

The processing and source material for these tests produced a symmetrical power distribution about the carrier, as would most material. One band edge marker therefore accurately describes these signals.

Since some processing schemes or distortion could cause asymmetrical modulation, the local oscillator can be tuned to the other side of the signal under test and the opposite sidebands may be tested to determine the symmetry of the occupied bandwidth.

The entire device may be calibrated by switching in the 23 dB attenuator following the filter.

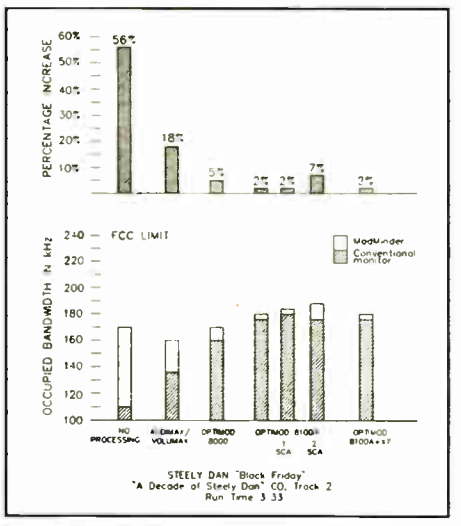
The heterodyne frequency is shifted so the entire signal is within the passband of the filter. This will pass the whole signal into the detector.

Since 23 dB of attenuation is a power ratio of 0.5%, a reference level is set that is independent of the linearity of the detector.

Although the design and validation of the occupied bandwidth meter will be the subject of a separate paper, it is worth touching on some aspects of the validation here.

Low frequency modulation is in many ways a worst case test. The occupied bandwidth of several low frequency modulating sine waves was calculated using Bessel functions to determine the sideband structure.

Then a power summation of sidebands was done until the sum equaled



0.5% of the total signal power. The frequency offset from the carrier to this 0.5% power point is one-half the occupied bandwidth.

The same signal modulated an FM exciter and its occupied bandwidth was measured using the instrument described above. In most cases the measured data agreed with the calculated data to within 3 percent.

The setup used to gather the data presented here is shown in Figure 3.

The diagram is self-explanatory except to note that the Orban Associates 8000A is switched into "proof" mode to operate as a stereo generator only when fed from the Audimax and Volumax.

Modulation levels were set when using the Belar FMM-2 monitor by adjusting the modulation so that between 1 and 3 peak indications per minute were noted during the test selection.

A similar procedure was followed when the level was set using the ModMinder. The Peak Threshold was set to the desired modulation.

The modulation level was then adjusted for from 1 to 3 occurrences per rolling minute. The highest peak modulation was recorded as well as the overmodulation count.

Data Presentation Data is presented for two selections: Steely Dan *Black Friday* and Shostakovitch *Symphony* #5, except for the Orban XT, which was not measured with the Shostakovitch. Each selection was subjected to increasingly greater processing, both with and without SCA.

The bar charts included show the results of the test. There is a graph for each response time with a great deal more data plotted than is displayed on the bar charts. Several more music selections were used.

Several conclusions can be drawn from the data.

First, under no conditions of processing or SCA usage does any signal come anywhere near filling its allocated bandwidth. Significantly, this conclusion agrees well with a study done by Tell and Nelson in 1976 employing entirely differently methodology.

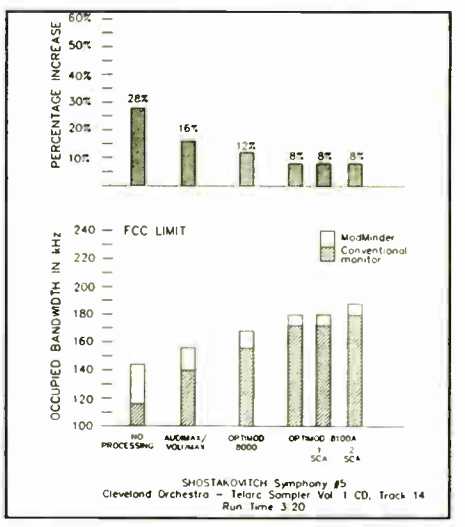
Secondly, changing the peak flasher response time from 200 to 900 μseconds will cause only a statistically insignificant increase in occupied bandwidth for heavily processed signals, while unprocessed signals will make more efficient use of the spectrum.

For any given peak flasher response time and program material, lighter processing will result in less occupied bandwidth than heavier processing.

And finally, the correlation between peak deviation and occupied bandwidth increases as the peak flasher response time is increased from 200 to 900 μseconds.

These are the initial results of occupied bandwidth tests. There will be more data available as the measurements continue.

There are a number of footnotes and



references relevant to the information presented here which space considerations prevent me from including. They are included in my full paper.

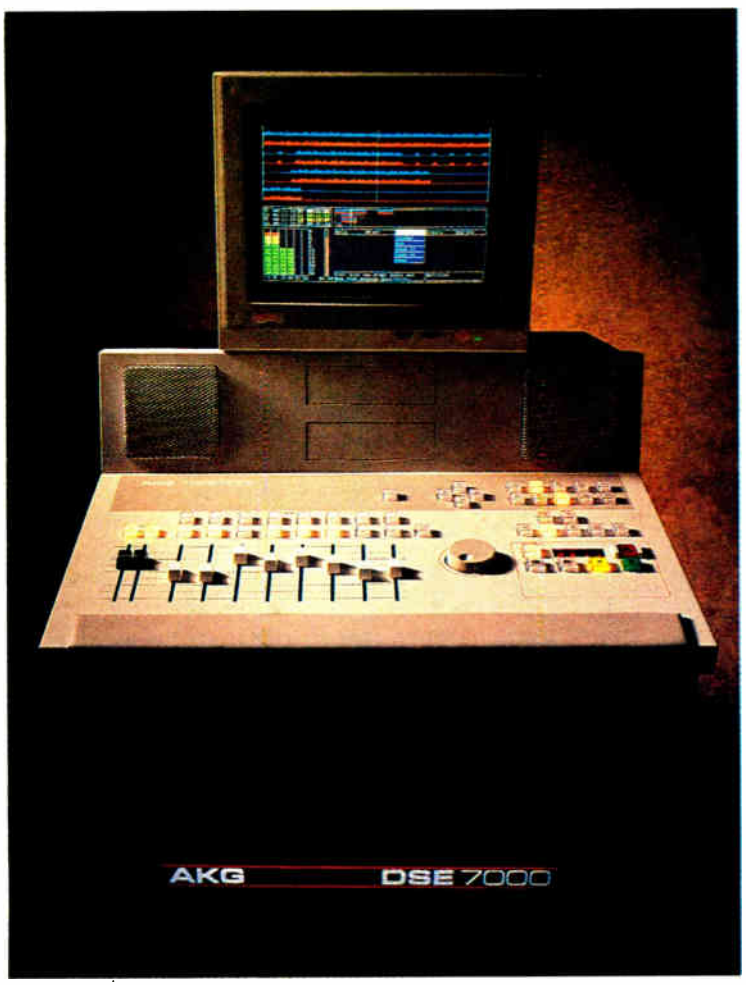
For a copy of the full paper call Modulation Sciences at 800-826-2603.

■ ■ ■

Eric Small is VP Engineering of Modulation Associates.

HE SAID, 

"You can write almost anything you want about this machine and put my name under it." SO WE DID.



THE DIGITAL SOUND EDITOR. STATIONS FROM BOSTON TO SAN DIEGO ARE MAKING IT THE HOTTEST BOX IN RADIO.

Dan McCoy was the first production director in radio to use the DSE 7000, and he saw it revolutionize the way production is done at WZOU-FM, 

one of the top stations in Boston. A spot that used to take an hour to produce now takes 20 minutes. Without tape. Without razors. Without a single dB of generation loss. Even agency dubs now go right to the DSE for levels, sound enhancement 

and tags; then onto carts. Creativity has exploded, too. With the DSE's instant UNDO feature, the fear of trying new things is gone. You simply try another take, assemble a different edit, or test a new effect. If you don't like the results, UNDO it instantly. No wonder WZOU has designed their production facility around the DSE. 

And no wonder Dan McCoy calls this machine "the most impressive thing that's ever happened to radio." His words, not ours.

AKG acoustics

1525 ALVARADO STREET, SAN LEANDRO, CALIFORNIA 94577, USA. (415) 351-3500. FAX: (415) 351-0500

DSE 7000 • THE NEW SPEED OF SOUND

Circle 63 On Reader Service Card

RadioWorld®

Broadcast Equipment Exchange®

AMPLIFIERS

Want to Sell

Ampro TP-5 TT preamps (2), (3) Sparta Tep 35, (2) Shure M64, all worked when removed from service, $50/ea/BO. M Black, Hobart William Smith College, Geneva NY 14456. 315-781-3456.

Nakamichi 620 audiphile pwr amp 100 W/chnl, mint cond, w/circuit documentation, $350. K Heyne, 415-664-0163.

Crown PSA-2 500 W stereo power amp, rack mtg, excel cond, $650/BO. W Laughlin, 753 Ruth Ln, Hurst TX 76053.

Crown IC-150 pro stereo preamp, rack mountable, excel cond, $125. W Laughlin, 753 Ruth Ln, Hurst TX 76053.

MacIntosh MC40 mono tube amps (2), excel cond, $1000/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Dynakit Stereo 70 gd tubes $100/BO or swap for MKIII w/70 V out or MKIV; also PAS preamp, $35/BO or swap. K Smith, Box 579, Gorham ME 04038. 207-854-3079.

Opamp Labs 360 BM mic preamps (8) plus additional line amps & mono amps, $25ea/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

LEL DA-8 dist amp, never used, $125; Gates Courier 70 2-chnl remote amp w/AC pwr supply, needs work; Gates Attache 70 3-chnl remote amp w/AC pwr supply, needs work. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

Amps including Hafler DH500, MacIntosh 250, API 705, Yamaha M40, SCS 2350, Soundcraftsman A2801 & Sunn Concert, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Scott 121-C preamp, mono, mint cond, minor input modification, $75. B Leslie, Pro Recording Srvs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Telex MC Series record amps (2), mono. M Young, WJON, St Cloud MN. 612-251-4422.

McIntosh MC-2500, sealed, BO; MC-240 (2), $1175; MC-40 (4), MC-225 (2), $575 ea. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Crest P3500 power amp, 400 W/ch at 4 ohms, 2 spaces, $675. R McMillen, 3235 SE 39th, Portland OR 97202. 503-239-6070.

Crown power amps DC-300 (2), $450; DC-300 II (2), $490; PS-400 (2), $650, all in excel cond. P Mobley, 300 Main St, Brookings SD 57006. 605-697-5326.

Bogen 30 W stereo tube type integrated amp, vgc, no case, $75. M Saady, First City Recd, 141-60 84 Rd, 3E, Briarwood NY 11435. 718-846-2062.

Want to Buy

Tube amps, all models preamps & amps by Marantz. D DeForest, 7441 Wayne Ave 10-D, Miami Bch FL 33141.

Tube amps & remote mixers incl RCA OP-6, OP-7, BN-2 BA series, 80 series, etc. W Davies, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

RCA, WE & Altec tube amps, mixers, mic's, turntables & recorders. R VanDyke, 2 Squires Ave, E Quogue NY 11942. 516-728-1327.

WE, Marantz, Fairchild, Westrex, etc, amps, preamps, signal processors w/vacuum tube electr. D deForrest, 7441 Wayne, Ste 10-0, Miami Bch FL 33141. 305-866-5401.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 1131 Virginia Ave, Campbell CA 95008. 408-866-8434.

ANTENNAS & TOWERS

Want to Sell

ERI FMCP-10 recently removed, 10 bay on 101.1 MHz, BO. M Cooney, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

Phelps Dodge 3 bay at 105.5 MHz w/radomes, $1300. R Martin, Box 5668, Colorado Springs CO 80931. 719-392-4219.

Phelps Dodge CFM LP-2 2 bay FM 94.5, complete, ready to ship; dummy load 50 kW RCA type 6000 & coax reducer, 3 1/8 to 4 1/16 w/gas pass & blocking rings, BO. L VanDam, WUPQ, Newberry Ave, Newberry MI 49868. 906-293-8522.

Rigid line 3 1/8", 440', 20' sections, some hangers & 90° sections, $4000. C Haynes, 1850 Lynch, Jackson MS 39203. 601-948-1515.

LeBlanc & Dick tower 1329', 7' face, designed for 2 TV & 5 FM ant's w/comm level at 1100' that will support 12 2 bays, wind load 65lbs/ft 2 RS 222 specs includes EEG high intensity strobes & red lighting, right light contactor & strobe status controller included, BO. M Fields, 6760 Corprate Dr #340, Colorado Springs CO 80919. 719-548-1528.

Rohn 14" face, 200', on ground, $500; Jampro JLPC 3 bay 98.3, $600; Andrews 1 5/8" air dielectric, 200', $800. D Crisp, Box 1280, Seaford DE 19973. 302-629-6636.

Hughey & Phillips TI-2035 3500 W isolation transformer, 115/230 V primary, 117/120 V secondary, $900. N Winter, 210 W Cota, Shelton WA 98584. 206-473-3462.

Cablewave FCC15850J air dialectric cable, 320' of 1 5/8", in gd cond, have connectors to sell w/cable, on spool & in easily accessible location for pick up, $800/FOB. D Rozek, 475 South Ave, Beacon NY 12508. 914-831-8000.

Shively 4-bay w/radomes, tuned to 103.1, 3 yrs old, perfect cond, $1400/BO. T Cranford, FM97, POB 1465, Grand Island NE 68802. 308-381-3697.

Celwave LP FM 3 bay antenna, in service, ready for sale, tuned to 92.1 MHz, BO. K Diebel, 1207 Louisa, Rayville LA 71269. 318-728-4915.

Jampro JSCP antenna bays (5), no heaters, gd cond, orig 105.9 MHz, also inter-bay line avail, $1000 ea/BO. G Ogonowski, 213-465-3171.

FM antenna, 500', 12 bay w/de-icers, 98.7 MHz, 4 bay FM, 95.1 MHz. J Stevens, WLAU, 601-649-1840.

Custom made 900 MHz & 450 MHz STL's, all yagi's new & used. J Woddell, 1412 Mohave, Parker AZ 85341. 602-669-2483.

Shively 6810 10 bay, high power, tuned to 101.1 MHz, 2.5 yrs old, vgc, $10,000/BO. A Baxa, WAVV, 11800 Tamiami Tr E., Naples FL 33962. 813-775-9288.

Scala HDCA-10EB yagi antennas, 75 ohm, 104.1 & 106.9 MHz. D Leinen, Independent Resources, POB 23498, Oklahoma City OK 73213. 405-728-2525.

Phelps Dodge CP 2 2 bay CP, 100.9 MHz, gd cond, $1000. A McCartny, KUIC, Fax: 707-446-0122.

Cablewave HCC 158 1-5/8" coax, 75', no connectors, $8/foot. R Biever, KDOM, 1450 N Hiway 60, Windom MN 56101. 507-831-3908.

RCA 10 bay tuned to 92.9, approx 900' of 4" coax, both on ground ready to ship, will sell separetely, $12,000/BO. M O'Brien, KTGL, 3201 Pioneers Blvd Ste 208, Lincoln NE 68502. 402-483-6814.

Phelps Dodge CP-1000-4 4-bay, circular, 102.3, all connectors, just removed, freq change. T Donnelly, KRJH, 111 N Main, Hallettsville TX 77964. 512-798-4333.

Cablewave 750' 5" heliax, spooled. D Bischoff, KKCW, 12655 SW Center, Beaverton OR 97005. 503-643-5103.

Rohn 65G 300', 3 yrs old, guys, bolts, beacon, side lights, on ground in 20' sections ready for shipping, $12,000. M Blakemore, WCVP, Peachtree/Central, Murphy NC 28906. 704-837-2218.

Rohn 65G 90' in 4-20' sections & one 10', complete w/guy wire, insulators, bolts, anchors, will sell or trade for self-supporting tower. C Freinwald, KBSG, 1739 Minor, Seattle WA 98101. 206-343-9700.

Jampro 7 bay FM, JLCP-7/106.3 MHz, pwr gain 3.65, documentation, 200' of 1-5/8" Prodelin Spiroline w/EIA connectors, $4900/all. B Dickerson, WEAG, Starke FL 32091. 904-964-5001.

Comark 4-bay horizontal, tuned to educ band, gain 3.8, power input up to 1 kW, gd cond, $1800. R Franklin, Super Snd Stds, 211 Virginia, Norristown PA 19401. 215-277-7112.

Magnum 24" x150' w/guys & (3) fiberglass insulators, BO. S Hess, KDUC, 29000 Radio Rd, Barstow CA. 619-256-2121.

Phelps Dodge 3 bay CP FM tuned to 99.3 MHz, $1200 plus shpg; Jampro single bay CP tuned to 99.3 MHz, $400 plus shpg. B Downs, KISX, Box 131869, Tyler TX 75713. 214-593-4444.

Heliax, 6" eliptical waveguide in various lengths, 100' lengths, some up to 200', BO. K Diebel, KTJC, 1207 Louisa, Reyville LA 71269. 318-728-4915.

Phelps-Dodge 3-bay Class A, 107.1 MHz, gd cond, $1500; Heliax 1-5/8" approx 90' w/flange connectors. B King, KLBU, 500 Leland, Austin TX 78704. 512-832-4061.

ERI/Harris FMH6AE 6-bay high pwr FM Rototiller tuned to 94.9 MHz, $6000. W Boller, WGIL, 154 E Simmons, Galesburg IL 61401. 309-342-5131.

ERI FMC-3E 3 bays on 95.9, working when removed for pwr increase, $1000. R LaFore, WQPW, POB 1327, Valdosta GA 31603. 912-244-8642.

ERI 4 bay CP FM w/deicers, rebuilt recently by ERI on 95.3, for sale due to upgrade, $2500. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

ERI G4CPH-10, 10 bay CP tuned to 96.1 MHz; Jampro Penetrator 10 bay CP tuned to 93.1 MHz, both in gd cond & avail now in Eugene OR, call for price on both systems. C Murray, KMGE, 503-484-9400 or R Sparks Scott, KSND, 503-686-9125.

Antenna 92.1, exciter, Optimod 8100A, 1-5/8" coax, Schafer 903E, 5 kW trans & other equip for new KITE FM in Kerrville TX. R Whitlock, 512-792-4560.

Scala CA-4VV 2-bay w/(2) CA-2 antennas & matching harness for vertical polarization spacing, tuned low-band group, original 92.1 MHz, 50 ohms ea bay, 50 ohms harness input, gd cond, $450/complete. TX Valley Translator, 6903 Spring Garden, San Antonio TX 78249. 512-696-5615.

Andrew 7/8" foam LFD5-50A, 175'/$450, 275'/$750; Andrew 1/2" foam LFD4-50A, 300'/$300, 330'/$325. E Burkhardt, WLEE, 121 Wyck, Ste 300, Richmond VA 23225. 804-232-0300.

Phelps Dodge ECFM-2 w/radomes 92.1, BO; Phelps Dodge ECFM-2 94.3, BO; Phelps Dodge ECFM-2 98.3, BO. Howells Audio, POB 6184, Kingman AZ 86402. 602-753-4915.

Gates/ERI Cycloid 3-bay, circularly-polarized w/input & interbay sections & de-icers, tuned to 95.3 MHz, BO. F Weller, KVNU, POB 267, Logan UT 84321. 801-752-5141.

Scala FMO-4 4-bay, plus pwr divider & coax cables, $550. S Lawson, KAK Prod, 928 Hyland, Santa Rosa CA 95404. 707-528-4055.

RCA TFU 30J Pylon antennas, one for ch 19, one for ch 46, both are down & ready to go, $25,000 ea or will consider exchange for production equipment or up & running used 60K on ch 19; need TBCs, VTRs & more powerful xmtr, are small market Christian UHF TV station. J McFarland, WLCN, 27 Grapevine, Madisonville KY 42331. 502-821-5433.

1 5/8" line 90 degree elbow, w/EIA flanges, $75. N Beaty, 2116 Osman Lane, Greenfield IN 46140. 317-326-3620.

Harris/ERI FML-3E 3 bay CP FM on 99.3 MHz; 370' Andrew HJ7-50A 1-5/8" harness line, both less than 3 yrs old, avail in June. T Stine, KTXI, 106 Farrar, Cape Girardeau MO 63701. 314-335-9099.

Swap 500' of Rohn 45 tower for 500' of Rohn 80 tower or other tower that will stack 500' high, BO, will pay cash for difference. K Diebel, KTJC, 1207 Louise St, Raysville LA 71269.

Want to Buy

Tower, 350' & CP FM high pwr antenna on 93.3 or near by freq. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Class A 3-bay on 98.9 plus or 2 chnls; also need a 10 kW FM xmtr in gd cond w/ 6-bay antenna on 98.9 MHz. J Maxton, KGGF, POB 1087, Coffeyville KS 67337. 316-251-3800.

Self-supporting tower, 100'; ERI 2-bay rototiller, low pwr antenna. E Sutton, WOKI, 1900 Winston, Knoxville TN 37919. 615-531-2000.

High power circular 8 bay FM antenna at or near 107.7 MHz, also 3" line & fittings. T Smith, KSXM, Box 340, Pendhston OR 97801. 503-276-1511.

Rigid transmission line, 400' of 3.125". J Coursolle, WGGQ, 414-324-4441.

2 or 3 Bay tuneable to 96.3, radomes. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Coaxial switch, 4 port 1-5/8" EIA flange, needs to be automatic type in gd working order; also need any type 87R 1-5/8" flange or equiv. JP Connor, WSBY, Salisbury MD 21801. 301-742-5191.

24" face, 400' tower, also need coax. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Air-dielectric cable, (2) 200' sections of 1-5/8", 500' of 7/8" used Heliax or other low loss cable. K Diebel, KTJC, 1207 Louise St, Raysville LA 71269.

AUDIO PRODUCTION

Want to Sell

Lexicon 1200 mono, audio time compressor/expander, excel cond, $700/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

AKG BX 20E reverb w/remote, excel cond w/spare 2nd unit for pts, custom modified for smoother decay, $250. K Heyne, 415-664-0163.

Tascam PE-40 4 band, 4 chnl parametric EQ unused, $250. D Lerner, 115 W 23rd, New York NY 10011. 212-463-0795.

Low power AM medium wave radio station complete w/McMartin audio console; (2) Spotmaster PB cart machines; Ampex tape reproducer; Shure mic mixer; TT's, mics, speakers and much more, all equip is ready for broadcast service, buyer must supply own shipping & handling (negotiable), all equipment must be sold by June 1990, $9000 negotiable. A Krasowski, 1196 Tivoli Dr, Deltona FL 32725. 407-860-1219.

Ramko DA280 10x8 dist amp in rack mount w/pwr supply, $400/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Harris ME-1 modulation enhancer, rack mount w/manual, $125. L LeBlanc, WKXL, POB 675, Concord NH 03301. 603-225-5521.

Orban 111B stereo reverb, brand new, BO. R Sundell, POB 734, Upland CA 91786. 714-985-0701.

Rane ME-15 stereo 2/3 octave graphic EQ, new cond, $250. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

Outboard processing equip including dbx 187, Yamaha R1000, Eventide PS-101, Quad-B N8-120, Orban 111B, Deltagraph EQ-10, Furman LC3, Immedia BB23B, Altec A322C, Gates SA-398 & Eventide 1745, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

ART DR1 digital reverb w/remote, MIDI. S Wytas, 165 Linden, New Britain CT 06051. 203-224-1811.

Eventide H-949 harmonizer, changes pitch & has prod effects built-in, $2250. W Waldron, KSOS, Layton Hills Mall, Layton UT 84041. 801-546-1722.

Shure M63 EQ, filter, $50. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Various pieces of equip including ITC RP R/P cart machine; (2) 47" equip racks; 5 element Yagi antenna; (3) Switchcraft 96 jack patch panels; SMC 521 PB cart; MCI JH-110 & (3) Ampex AG600B R-R's; (5) RCA BFC antenna bays w/radomes; Heath GC1000 most accurate clock; (2) Marti RPT1/150K xmtrs; Scala PR-450U paraflector. M Young, WJON, St Cloud MN. 612-251-4422.

Dolby 361 A NR (2), $450/ea plus shipping. M Holwin, Anamnesia Studios, 49 S Oxford, Brooklyn NY 11217. 718-852-7630.

Shure M610 graphic mic EQ, $75. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Orban 674A stereo para-graphic EQ, $575. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Audio Digital TC 2 DDL digital delay/effects, 18K bandwidth, 2.25 second extended memory, 2 outputs, $575/BO; Dolby 361 A type NR SR ready, $1475/pr; Scamp mini rack, studio outboard gear w/F300S expander/gate, S01 compressor, S04 parametric EQ, S23 stereo autopanner, Anvil case, pwr supply, TT patchbay, $800/BO. R McMillen, 3235 SE 39th, Portland OR 97202. 503-239-6070.

Sony PCM 701, $1000; Lexicon 200, $2000; Scully 280B, $1300; Shure EQ's & room analyzers. D Kocher, DLK Snd Std, 1901 Hanover, Allentown PA 18103. 215-432-0520.

UREI 575A 1/3 octave mono, $350; AKG 1291E1 stereo echo, $300; Inovonics 375 mono electronics, $200; ITC 854 mono electronics, $150; ESE 112LS slaves, $40/ea. E Burkhardt, WLEE, 121 Wyck, Ste 300, Richmond VA 23225. 804-232-0300.

Used, Demo, Returns, Tradein's, Overstock, Scratch and Dent— Limited Quantity, First Come, First Served Terms: Payment with Order

AKG D1200E MIC	$125
AKG D190ES MIC	85
ATI P1000-1 PREAMP	295
ATI DA2016 DIST AMP	975
BARCUS BARRY 202a PROCESSOR	295
BENCHMARK DA 101 DIST AMP	250
BENCHMARK mda101 DIST AMP	275
CRL SGC-800 STEREO LIMITER	1400
EV SENTRY 100A SPEAKERS	195
EV PL10 MIC	150
EV PL20 MIC	354
EV RE15 MIC	225
~~EXCALIBUR CD-1 AUDIO INTER-FACE~~	77
JBL 4312 SPEAKER	225
JBL 4401 SPEAKER	115
LUXO COPY STAND	55
~~MARANTZ HE62 SPEAKER~~	~~40~~
~~NOMAD TIN AMNT AM RCVR~~	~~33~~
MICROTRAK 10P	95
MICROTRAK TELEFILE	125
MOD SCI CP-8C3 COMP PROC	1025
MOD SCI SCA 186 SCA GEN	2800
MOD SCI MODMINDER	2155
~~MOSELEY IBC-3A IBOOOUPLER~~	~~375~~
OMNIMOUNT 101-SWA	37
~~ORBAN 424A SOMPRESSOR LIMITER~~	~~695~~
~~ORBAN SOMP. 150. AM/FM~~	~~795~~
~~ORBAN 672 S BAND PROCESSOR~~	~~1795~~
OTARI MTR 12-1 ½" 4 CH RECORDER	8900
~~OTARI MX5050 MKIII 8-[illegible]~~	~~3995~~
OTARI CTM 10 CARTRIDGE PLAYER	1850
OTARI CB109 REMOTE CONTROL	1225
~~OTARI MX5050B TAPE PLAYER~~	~~999~~
RADIO SYSTEMS DA-8 AMP	275
REVOX B77 TAPE RECORDER	1895
REVOX PR99 R/R ROLL AROUND STAND	350
RUSSCO STUDIO PRO TT	325
SANSUI CDX701 CD	410
SANSUI CDX711 CD	695
SHURE SM7 MIC	350
~~SHURE 589 DEMO MIC~~	~~449~~
~~SONY PCM2510 DAT RECORDER~~	~~2999~~
SONY CD5 PROII CASSETTE RECORDER	650
SONY TCD-D10PRO PORTABLE DAT RECORDER	2200
SONY C48 MIC	700
STRAIGHT WIRE AUDIO DA CARDS 195.00 PWR SUPPLY	40
TAPCO 4400A REVERB	125
~~TASCAM 112R CASSETTE RECORDER~~	~~595~~
TECHNICS SP 15 TT	490
TECHNICS SP10MKII TT	795
TECHNICS SLP 550 CD	195
TECHNICS SLP1200 CD	935
~~TECHNICS SLP 1600 CD~~	~~1295~~
~~TECHNICS SLP 900 CD~~	~~995~~
~~TECHNICS SLP 5 CD~~	~~495~~
~~TECHNICS SAFEMIC SPEAKERS~~	~~899~~
~~TECHNICS SLP770 CD PLAYER~~	~~350~~
~~TECHNICS SL1200MKII TT~~	~~349~~
~~TELEX WIRELESS MIC FMR 2~~	~~995~~
TELEX PH75 HEADSET	85
UREI SR1 RACK MOUNT	20

NORTHEAST BROADCAST LAB
(518)-793-2181/(215)-322-2227
(603)-483-1002/(214)-612-2053

AUDIO PROD...WTS

Used equip inventory incl Texar Audio Prism w/Phoenix AM upgrade, $1500; Carousel 248-II & Carousel electr for parts, $350/BO; IMP-3 tri-band AM audio processor, needs work, $350/BO; Ampex 600 w/rack mount & Ampex 600 transport for parts, $400/BO; Magnecorder 1021 transport/electr in gd shape, & one for parts, $450/BO. M Johnson, KGAL, POB 749, Albany OR 47321. 503-451-5425.

dbx 140A NR units (2), $300 ea or $550/both. T Cochran, KNOM, Box 988, Nome AK 99762. 907-443-5221.

Studio Sound S-305 passive filter sets (2), matched pair, rack mount, very rare, $250/BO/ea. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Klark-Teknik DN 405 EQ 5 band studio EQ, new cond, never rack mounted, $300. R Hull, 918-254-0464.

Tascam M-30 mixer, one intermittent chnl, otherwise gd cond, $495/BO; Delta Labs DL-4 effect processor, mint cond, $200/BO. C Fries, KSQY, 666 Main, Ste D, Deadwood SD 57732. 605-578-3533.

Want to Buy

WE/RCA speakers, amps, mixers, mics, TT's, on-air lights, equip magazines, catalogs, manuals & any tube equip. R Van Dyke, Caffrey House, Squires Ave, E Quogue NY 11942. 516-728-1327.

W A N T E D
DEAD OR ALIVE!
PULTEC EQ'S

Fairchild & Teletronix Limiters; Neumann, Telefunken, AKG, RCA, & Schoeps microphones. Tube McIntosh or Marantz amps & pre-amps. Sontec, ITI, & Lang EQs. Neve or API equipment. Boxes of old tubes; Urei, Orban, United Audio, DBX, & other outboard gear. Ampex ATR102s or 104s. Parts for MCI JH110/114 recorders. Altec 604s/crossovers/Tannoy speakers, JBL 2231; Altec 288h drivers; Misc. equipment of all types.

Please Call:
Dan Alexander Audio
2944 San Pablo Ave.
Berkeley, CA 94702
1-(415) 644-2363
FAX: 1-415-644-1848

Digital delay unit for talk format or combo digital delay & production unit. A Roycroft, POB 1602, Hilo HI 96720. 808-935-6858.

Marshall Electronics AR-300 tape eliminator all analog tape delay simulator. A Gregory, 3003 20th, San Francisco CA 94110. 415-285-1953.

AUTOMATION EQUIP

Want to Sell

IGM Basic A automation system, all or part, Audicord network delay, (5) Revox PR-99 PB's, (4) 24 cart Carousels, (3) Audicord cart PB's, logging, BO. C Gustafson, 590 W Maple, Kalamazoo MI 49008. 616-345-2101.

IGM EC Controller w/IGM 48 tray Instacart, gd cond, $7000. B Croghan, KCEE/KWFM, POB 5886, Tucson AZ 85703. 602-623-7556.

Gates 25 Hz tone detector & R-R controller (3), $75/ea. E Moody, 216 N Main, Bentonville AK 72712. 501-273-9039.

Harris System 90 brain, switcher & (2) IGM 42 tray Go-Carts, will sell together or in parts, BO. R Lafore, Box 1327, Valdosta GA 31603.

Wegener 1601 mainframe inc all audio, tone decoding & receive translating cards for SMN Starstation affiliates; Harris 6529 sat video rcvr, $1300/BO. H Bundrick, 1115 Washington, Natchifoche LA 71457. 318-352-9696.

Cetec/Schafer 903E 19 sources & 4 random access sources & RAS manual control, program console, pwr supply & rack, missing memory otherwise complete, $2000/BO. B Glenn, 11 S Benton, Kennewick WA 99336. 509-586-4165.

BE 1600S stereo sequencer, 16 event w/books; (2) SMC TACtime announce control, BO. L VanDam, WUPO, Newberry Ave, Newberry MI 49868. 906-293-8522.

Sono Mag DP-2, DS-20 (6) 350 stereo Carousels, (4) AR1000 Otari R-R, DS 20 switcher, DP2 brain w/upgrade card in gd cond, $14,000. P Swint, 2620 Dogwood, Joplin MO 64801. 417-624-1310.

Sono-Mag SMC RP-1000 brain, DS-20 switcher, PDC-3A timer flag unit, pwr supply, TS-25 tone snesor, (4) Otari ARS-1000, (4) BE auto rewinds, (4) SMC 350-RSB Carousels, (3) racks w/doors, manuals, spare parts, $14,000. D Denton, 405 E Norman, Montgomery City MO 63361. 314-564-2275.

Gates KSP10 & RA10 automation programmer, sub programmer, clock, source cards & cables, gd for parts, $500. E Moody, 216 N Main, Bentonville AK 72712. 501-273-9039.

BE Control 16 totally computerized system w/network join, 4 reels (2), Otari fixed carts, (3) Carousels, remote start, gd cond, $12000/BO. A Sutton, POB 1380, Moultrie GA 31776. 912-985-0960.

Sono-Mag RAS Pro, (4) 350RSB Carousels, racks, power supply, remote control, audio switcher, memory, clock, extender cards, spares for all, complete books, $7K. D Dunsmoor, KRRZ, 216 S Bdwy, Minot ND 58702. 701-852-4646.

IGM dual 25 Hz tone detector. H Kneller, 813-639-1112.

SMC DPI-C automation system complete, includes: (4) 350 RSB Carousels, (4) SMC/Otari R-R PB decks, SMC dual cart, single play deck, (4) matching equip racks, logging w/X-tel printer, digital programmer w/brain & remote encoder w/monitor, all manuals. D Kulbel, POB 886, Carroll, IA 51401. 712-792-4321.

ATC fade start unit w/manual, $20; Gates ATC time announce control mdl TA w/manual, $15; ATC 55A silence sensor w/manual, $35. J Feasel, W64BG, 13549 Morse Rd, Pataskala OH 43062. 614-927-2592.

Sono-Mag Carouosel, worked when removed from service, $600/BO. A Lane, WEHB, POB 2892, Grand Rapids MI 49501. 616-451-9904.

Colorado Magnetics NS-200-B Transtar network switcher, mint cond, w/fanout board & instruction manual, $600. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Schafer 8000 automation controller, minicomputer w/CRT terminal, loggers, 3 rack cabinets, complete extra system for backup, $1500/both plus spare parts; SMC Carousels if purchased w/Schafer 8000 (4), $500 ea. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

IGM 90 Cart 42 tray, $1200/BO. R Maxwell, 114 S 4th St, Yakima WA 98901. 509-457-8115.

IGM 78 tray Go-Cart stereo bi-directional, BO. Howells Audio, POB 6184, Kingman AZ 86402. 602-753-5352.

SMC ESP2 w/remote controller, (4) Carousel 350's & (4) reels, $7000/BO. J Flynt, WSGY, 200 John Howard Way, Tifton GA 31794. 912-382-1101.

SMC 352 RS Carousels (6), $800 ea/BO plus shpg. B Downs, KISX, Box 131869, Tyler TX 75713. 214-593-4444.

SMC 12 chnl (2) rack automation w/(2) bi-directional Carousels, set up for satellite automation & complete w/DAS-12 audio switcher; MSP keyboard; (2) 721 twin carts; (2) 452 bi-directional Carousels; MSP 12 programmer; monitor, excel cond, 18 mos old, $23,000/BO. J Hansen, KKSR, POB 699, St Cloud MN 56302. 612-253-9600.

Shafer 903 w/(3) Carousels, dual cart machine, network card for satellite, plus extras, $6000. Tom, 509-522-9412.

Satellite automation unit, complete in roll around rack, w/(3) Carousels, 1000 event Satmaster programmer, wired into 19" rack 84" high, in use now, $7500/BO. B Tolby, WMKO, Box 1129, Milten GA 30442. 912-982-5695.

Harris SC-90 brain/switcher, (2) IGM Go-Carts, (4) ITC 750 R-R decks, all in gd cond, BO. R LaFore, WQPW, POB 1327, Valdosta GA 31603. 912-244-8642.

Cetec/Schafer 902 1/2 2000 event; 3 Revox A-77, 2 Audiofile 2A; 3 equip racks, printer w/all cables, I/O cards & spare pts, avail in July, $7800. B Spitzer, POB 460, Rapid City SD 57701. 605-343-6161.

SMC ESP-2 w/(4) Carousels, (2) SMC single play cart decks & (9) Otari reel PB units w/25 Hz sensors, $31K. M Ball, KWKL, POB 650, Wichita KS 67201. 316-265-1065.

Broadcast Products 2000 event automation system w/all cables & spares, $500/BO. R Maxwell, 114 S 4th St, Yakima WA 98901. 509-457-8115.

IGM Stereo Instacart 48 tray, $4000/BO. R Maxwell, 114 S 4th St, Yakima WA 98901. 509-457-8115.

SMC 20 chnl (2) rack automation unit w/(3) 350 Carousels, twin cart unit & set up for satellite automation including DP-1 Brain, $4500/BO. J Hansen, KKSR, POB 699, St Cloud MN 56302. 612-253-9600.

IGM Instacarts, one mono & one stereo, both 48 trays, $300/both; Otari ARS-1000 R-R reproducer, near mint, w/25 Hz sensor, $1000; Schafer Blue equip rack, $100; IGM 12 tray Instacart, $750. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

Schafer 7000 Level 2 sys w/3 stereo Audiophiles & 2 add'l input cards, CRT terminal, logger, 3 racks, $9000. V Argo, POB 2277, Missoula MT 59606. 406-728-5000.

BE SAT 16 w/4 racks, 2000 event memory, Go-Cart, (3) Carousels, (2) Instacarts, (2) monitor racks, keyboard, printer, used w/SMN. G Magill, WHPA, POB 464, Hollidaysburg PA 16648. 814-695-4441.

Harris 9002 automation system, 2 CRT terminals, racks, (4) Otari ARS-1000 R-R's, (2) IGM Go-Cart 24, spare parts, fully loaded, super clean, $7500. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

SMC Carousels (2) 250's, (1) 350, $800/BO. R Maxwell, 114 S 4th St, Yakima WA 98901. 509-457-8115.

Otari ARS-1000 DC (4), $800/ea, Persons programmer 3A, $425, Conex CG-25 25 Hz tone generator, $200, entire package for $3500. S Speheger, WCFY, 108 Beck Ln, Lafayette IN 47905. 317-474-4436.

MSP-1 10 chnl switcher/programmer for satellite, $2500/BO; interface, $2500/BO. J Hansen, KKSR, POB 699, St Cloud MN 56302. 612-253-9600.

Want to Buy

Any commercial video insertion system, small to mid-range tape capacity, prefer 3/4" or 1". J Worrall, 4618 Gabriel Dr, New Orleans LA 70127. 504-241-6634.

25 Hz tone generator & R-R easy listening music library. E Moody, KJEM, 216 N Main, Bentonville AK 72712. 501-273-9039.

Schafer 800 manuals & clock for 800 Series. E Stanley, Standey Bdcts, Box 161X, Jeffersonville NY 12748. 914-482-3158.

Insta-carts or Go-carts or Carousels. C Mandel, KAMP, POB 1018, El Centro CA 92244. 619-352-2777.

IGM 48 tray Instacart, call or write, prefer seller within 200 miles driving distance. C Leasure, WTBO, POB 1644, Cumberland MD 21502. 301-722-6666.

CAMERAS (VIDEO)

Want to Sell

JVC BY-110 3-tube camera w/S-VHS upgrade, Fuji 16X lens, MK50 shotgun mike and KAM-50 mic grip, A/C adapter/charger, (2) DC11U NiCad batteries, VF400 4" B&W viewfinder, studio zoom & focus controls, (2) cables, custom case, service manual, high resolution & top quality performer, like new cond, $3495. B Hines, IPS, RD 1 Box 413A, Export PA 15632. 412-468-4115.

Hitachi KP-C100U color chip CCTV w/16mm auto iris Rainbow lens, lw hrs, $300. P Russell, Bowdoir College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Panasonic WV 6000 2/3" high band tube, 420 lines hor resolution, 2 line vert enhancer, 12X servo zoom lens, RCU w/cable, $1000. W Watrous, 739 S Orange, Sarasota FL 34236. 813-366-3316.

Ikegami HL-79D 3-tube camera ENG configuration w/Canon J13×9BIE lens, w/(3) NiCad batteries, (3) chargers, hard case, AC adapter, (2) cables for power & Sony 4800 recorder, $18000. N Lindquist, POB 14920, Columbus OH 43214. 614-888-4788.

Panasonic WV 360 P B/W camera, pushrod zoom, $100. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Panasonic WVCD 20 B/W security camera, new, w/25mm & 8mm lens (2), $1900. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Sharp XC-800 3-tube bdct color camera, Fuji 12X lens w/2X ext, 2L image enhance, road case, etc, excel cond, $3600/BO. R Jensen, Racine Telecable Corp, 5812 21st, Racine WI 53406. 414-632-3131.

JVC KY 2000B 3-tube color camera, case, AC pwr supply, Anton Bauer battery bracket, mic holder, multipin cable for EFP, 10-100 Tamron zoom, $1000. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

JVC KY 1900 3-tube color camera, case, EFP AC pwr supply 10-100 Tamron zoom, $900. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Panasonic WV 340 P B/W camera, pushrod zoom, $100. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Philips PCP-90, minicam, complete w/backpack CCU, lens, set-up panel & camera support harness, (3) 1" plumbicons, BO. G Spiller, BES Teleproductions, 6829 E Atmore, Richmond VA 23225. 804-276-5110.

Ikegami 305 w/24-400mm lens, CCU, cables, gd tubes, BO. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

Hitachi FP10 cables, AC pwr supply, 10:1 zoom hard shell case, manual, $1500/BO. D Garcia, 69 Pine, Waterberry CT 06710. 203-574-4857.

Sharp XC-800 3-tube broadcast color camera, Fuji 12x lens w/2x ext, 2L image enhancer, road case, etc, excel cond, $3600/BO. R Jensen, 5812 21st St, Racine WI 53406. 414-632-3131.

RCA TK44B studio cameras (3) w/full CCU, $3500/all. C Almasian, Tri-Core, 27503 Five Mile Rd, Livonia MI 48154. 313-427-8784.

Want to Buy

JVC BY-110U & any related access, in particular, lens & mic access, send item & parts list. R. Lawrence, Moonshadow Video, 4260 Reston, Roseburg OR 97470. 503-679-8966.

Old Norelco, RCA, Bendix, Ikegami portable cameras, HL-33, HL-35, PCP-70, PCP-90, etc. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

Old tube type RCA, Dumont, GE, Marconi, etc, & tripods. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

CART MACHINES

Want to Sell

ITC PDII (2) players, (1) recorder, mono, gd cond; Ampro CT2501 player, $100ea/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Tapecaster 700 RP mono RP in gd cond, $300. J Morrs, 3911 S First, Abilene TX 79601. 915-676-7711.

Audicord A (3) side by side in 19" rack, mono, gd cond, BO. C Gustafson, 590 W Maple, Kalamazoo MI 49008. 616-345-2101.

BE 2100 stereo RP, brand new, BO. R Sundell, POB 734, Upland CA 91786. 714-985-0701.

ITC PD II R/P gd cond, mono, $950; ITC PD II play, gd cond, mono, $700, or $1300/both. G McCoy, Box 100, Central City NE 68826. 308-946-3816.

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.
10:00AM-6:00PM EST
804-974-6466 **1305-F Seminole Trail**
FAX 804-974-6450 **Charlottesville, VA 22901**

ITC RA record amp, for use w/3D, 3 tones, gd cond, $500. M Brown, 3740 SW Comus, Portland OR 97219. 503-245-4889.

Gates Criterion I record amp, one mono rack mount & one stereo, rack mount; ATC/Gates Criterion I PB w/150 Hz tone detector. H Kneller, 813-639-1112.

ITC PD-II cartridge R/P's (3), gd cond, mono, $500/ea/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Tomcat Pacific Recorders PB (2) w/19" rack & manual, great for spares, $2650. M Barley, 1846 Roseneade #250, Carrollton TX 75007. 214-601-1294.

Harris Criterion Compact 90 mono, R/P, $795. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5349.

Fidelipac CTR 14 & ESD 10 stereo R/PB & elect splice detector, both units must be sold together, slight head wear, $1800. R Smith, 3407 W Olive #108, Burbank CA 91505. 818-367-6335.

BE 1070 stereo cart players, one used for parts, & a 1070 stereo R/P. H Kneller, 813-639-1112.

Audi-Cord A Series dual R/P cart machine, working order, BO. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

Sparta 4520 (2) single cart players, operational & functional when removed, $100 ea; Tapecaster 700-P (2), $200 ea & 700RP, $350, no tones, in service, w/manuals. W Waldron, KSOS, Layton Hills Mall, Layton UT 84041. 601-546-1722.

MEI Digisound digital hard-disk cart recorder, great for automation, inc (2) 332 meg hard disks, (2) remote keyboards, tape drive, software & manual. System configured for 15 kHz stereo/mono, 76 minutes of stereo, 152 minutes mono storage or any combo, fully functional, low hrs, $10000. J Addie, WFMT, 312-565-5033.

ITC PDII mono play excel cond. G Beeker, 4110 W Bank Ave, Tampa FL 33624. 813-960-8153.

Tapecaster 700-P in gd cond, $100; Gates R/P (2) in gd cond, $175/ea plus shpg; Spotmaster PB, gd cond, $100. J Lee, BCI, 2139 10th Ave N, Lake Worth FL 33461. 407-547-0600.

Spotmaster 505, $250; Sparta delay, $150; Gates Criterion, needs work, $75; (2) BE 2000 RP, $750. J Phillips, WZOM, 408 1/2 Clinton St, Defiance OH 43512. 419-784-1059.

ITC 3 deck stereo, excel cond. J Arzuaga, POB 980, Quebradillas PR 00742. 809-895-4198.

Harris Criterion (2) triple deck repro, 10 yrs old, gd cond, $700/both. T Stine, KGIR, 106 Farrar, Cape Girardeau MO 63701. 314-335-9099.

ITC Delta record unit new, $650. R Thomson, 1167 W Javelina, Mesa AZ 85202. 602-897-9300.

ITC Delta record unit, new, record electr only, $650. R Thomson, KDKB, 1167 W Javelina, Mesa AZ 85202. 602-897-9300.

RCA 4-Spot cart decks (2), $400 both/BO; Spotmaster Model 500 GRP (3); one Model 500C play only; Tapecaster Model 700 (2); one RP, one play only, BO. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

ITC RP cart recorder, $850; ITC cart machine rack mounts, will work w/Premium series cart machine such as RP, WP, etc, $20. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

Dynamax CTR10, new, BO. Howells Audio, POB 6184, Kingman AZ 86402. 602-753-4915.

Broadcast Electronics 2100 RPS stereo R/P, $1650; BE 2100 PS stereo PB (3), $950/ea; BE 3200 RP/DL mono R/P w/optional delay, $1250, all very low hrs, like new. G Jones, POB 229, Uvalde TX 78802. 512-278-1545.

Tapecaster X-700 mono RP in gd cond, $200. T Stine, KGIR, 106 Ferrar, Cape Girardeau MO 63701. 314-335-9099.

Rackmount for single unit ITC-3D. E Mitchell, Dallas TX, 214-343-0813.

Want to Buy

ITC 3-D or equiv, 3-stack stereo cart machine w/record amp, 3 tone; ITC ESL-IV splice locator/eraser or equiv. H Kneller, 813-639-1112.

Stereo R/P in gd working cond, BE, Tapecaster, ITC preferred. H Bundrick, 1115 Washington, Natchifoche LA 71457. 318-352-9696.

R/P cart machine w/tones, mono preferred, will trade for 6' equip racks. A Lane, WEHB, POB 2892, Grand Rapids MI 49301. 616-451-9904.

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.

IRP MAGNETIC SCIENCES
249 Kennedy Road
P.O. Box 121 • Greendell, NJ 07839
Tel (201) 579-5773
Fax (201) 579-6021

CART MACH. . .WTB
ITC PB & record. S Jeffries, Hwy 14 East, Mankato MN 56001. 507-345-4537.

Erase/splice finder should be in gd cond, will consider unit in repair. B O'Connor, 4001 Brandywine St NW, Washington DC 20016. 202-364-3982.

ITC-SP & RP, must be in gd cond. E Stanley, Standey Bdctg, Box 161X, Jeffersonville NY 12748. 914-482-3158.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Scully 270 reproducers (2) stereo, gd cond, $200/BO; Scully 270 reproducers (2), stereo, gd for parts, BO; Magnecord 1024 stereo (2), $150ea/BO. R Fess, POB 250, Macomb IL 61455. 309-833-5561.

Revox PR-99 2 speed PD, excel cond, BO. K Diebel, 1207 Louisa, Rayville LA 71269. 318-728-4915.

Automation starter set ITC 770 PB (4), gd cond, $700 ea or $2400/all; ITC 770 R P/B w/custom rack, gd cond, $1700, or all for $4000. J Torsitano, KNIS, 6363 Hwy 50 E, Carson City NV 89701. 702-883-5647.

Sony PCM-F1 2 trk digital processor, 14 & 16 bit, A/C pwr supply, batteries, Kiwi case, excel cond, $1500. S Rosenthal, 3145 Geary Blvd Ste 344, San Francisco CA 94118. 415-584-5614.

Otari MX-5050B II (2), $2000/ea; Otari MX505 BQ, $3000. C Monk, 1301 Atlantic, Atlantic City NJ 08401. 609-344-2020.

Ampex AG-440B 1" 8 trk multitrack, roll-around console, gd cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

3M M79 4 trk, 1/2" ATR, excel cond, w/resolver, $750/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

ITC deck stereo 3 yrs old, gd cond, $1350. J Arzuaga, POB 980, Quebradillas PR 00742. 609-895-2725.

Inovonics 375 (3) R/P elect, solid state for Ampex recorders, $150ea/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Fostex Model 80 8 trk, 7" R-R, 15 ips Dolby C, gd cond, $1200. S Wytas, 165 Linden, New Britain CT 06051. 203-224-1811.

Scully 280 automation PB's, gd cond (2), $750/both. B Watson, 1551 E Amar Rd, W Covina CA 91792. 714-949-6249.

Nagra IV-S sync pilot tone, 7" reel case, leather case, A/C pwr pack, handle, strap, excel cond, $4800; Nagra QGB 10 1/2" reel adapter, excel cond, $750. S Rosenthal, 3145 Geary Blvd Ste 344, San Francisco CA 94118. 415-584-5614.

Ruslang R-R roll around wood consoles (3), $150/ea. R Shroyer, 215 N 4th St, Yakima WA 98907.

Ampex 440C w/servo, 1/2 trk, roll around cabinet, vgc, $1500. S Rosenthal, 3145 Geary Blvd Ste 344, San Francisco CA 94118. 415-584-5614.

Otari ARS 1000, (2) P/B decks, very little use, $1200. A Baxa, WAVV, 11800 Tamiami Tr E., Naples FL 33962. 813-775-9266.

Ampex ATR-700 10", 2 trk, 7 1/2", 15 ips, $995. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5349.

MCI JH-110 4 trk stereo w/remote gd cond (2), $4000/ea or $7000/both. B Watson, 1551 E Amar Rd, W Covina CA 91792. 714-949-6249.

Marantz C0207LP like new, 3 heads, $165/BO. R Zimmer, 3055 N Tyndall, Tucson AZ 85719. 602-623-2933.

Ampex 602 FT gd cond, $200. D Ibel, 2600 N Highway, Spencer IA 51301. 712-262-1240.

Fostex 4030/4035 external synch for any R-R w/remote, mint cond, $1000. S Wytas, 165 Linden, New Britain CT 06051. 203-224-1811.

Ampex AG 350-2 PB electr, 3 3/4"-7 1/2" speeds, $350 inc shpg & manual, tube PB fully functional. G Meloon, 28 W Scribner, DuBois PA 15801. 814-371-1330.

Tascam 32, 2 trk 7 1/2-15 ips in excel cond, some head wear, $500. R Smith, 3407 W Olive #108, Burbank CA 91505. 818-367-6335.

Nagra IV LE FT portable, 7.50 ips w/crystal sync & resolver, case, ATN pwr supply & manual, recently overhauled, $2800/BO. R Barwig, Barwig Recording, 5254 W Agatite, Chicago IL 60630. 312-283-2820.

Sony PCM-2500A, PCM-2500B R-DAT, used very little, $5,000/BO. T Noordyk, WSHN, POB 190, Fremont MI 49412. 616-924-4700.

Studer A80 operation/service-parts manual for 1/4 to 2/" versions, $60 pls shpg. R Cannata, Cantrax Recorders, 2119 Fidler, Long Beach CA 90815. 213-498-6492.

Pioneer 1020L 3 3/4" - 7 1/2" ips, 1/4" 2 chnl lots of 10" reels of tape included, w/editing supplies, $400. B Ford, POB 1052, El Granada CA 94018. 415-726-4786.

Tape recorders including Otari MX7800, Teac 3340S, Scully 280, Revox A77, Hitachi D-E10, Nakamichi 550 & Sony TC124, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Tapesonic stereo 2 trk 10.5 reels, 3 speed, $350; Crown 5X844 4 chnl R/P, 3 speed, mint cond, $700; Teac A4010S (2) 1/4 trk stereo, auto reverse, gd cond, $200 ea or $350/both; Telex 1422 2 trk stereo plus 1/4 head for PB (2), $350/both. J Parsons, 10375 Cannas, No Huntingdon PA 15642. 412-863-9590.

Scully 270 (4), PB only, $300 ea. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Telex CD2M & CD2S slave unit, 2 mos old, like new, duplicates 5 tapes at a time, $1700. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

Tascam FP 70 ft SW for 3440 & 40 Series machines, $25; Tascam 44-460B extender service board, new, $20. R Cannata, Cantrax Recdrs, 2119 Fidler, Long Beach CA 90815. 213-498-6492.

Presto 800/908 7.5-15 ips professional plus rack, pick up in NYC, $1000. B Rose, Program Rec, 228 E 10th, NY NY 10003. 212-674-3060.

Pioneer 1020L 3.75-7.50 ips, 1/4" 2 chnl, lots of 10" reels of tape included along w/editing supplies, $400. B Ford, Turbo Sound, POB 1052, El Granada CA 94018. 415-726-4786.

Sony PCM 701 ES, 14/16 bit, 2 chnl processor, turns any VHS/Beta recorder into a 2 chnl digital audio recorder, $1400/BO. B Ford, Turbo Sound, POB 1052, El Granada CA 94018. 415-726-4786.

Ampex AG-350 FT in console, 7.50 & 15 ips, gd heads, service manual, vgc, $600/BO. R Barwig, Barwig Recording, 5254 W Agatite, Chicago IL 60630. 312-283-2820.

Fostex 4030/4035 audio-for-video synchronizer, mint cond, $1000/BO. S Wytas, 165 Linden, New Britain CT 06051. 203-224-1811.

Otari MX 5050 BII, less than 1 yr old, perfect cond, complete w/tilt back sides, buyer pays freight, $2200; Otari MX 5050 4 trk 1/4"older unit but in great cond, heads like new, left brake needs slight adjustment, complete w/dbx NR, pre-wired, buyer pays freight, $2200. B Hanson, Reel Trax Prod, 209 E El Cortez, Columbia MO 65203. 314-449-8433.

Telex 3 plus 1 high speed portable cassette duplicator, duplicates 3 cassettes at a time, $450. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

Century 21 Auto Seque for CD players, like new cond, works great, $3250; Revox PR-99 PB units (2) w/25 Hz tone detectors, $900 ea. W Waldron, KSOS, Layton Hills Mall, Layton UT 64041. 801-546-1722.

Duplicators including comp Kaba cassette duplication system, Recordex DUP II, Pentagon C4322 7 Wollensak 2770AV, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Ampex 351-2 2-trk, mint cond, one has original tube electr, other has Inovonics, both in roll-around, one walnut, one plywood. R Nelson, Tropical Bdct, 14093 SW 142 St, Miami FL 33186. 305-238-5024.

Roberts 720 1/2 & 1/4", vgc w/case, $90 plus $10 S&H. P Salois, KPCR, POB 1 Hwy 54E, Bowling Green MO 63334. 314-324-2283.

Otari ARS 1000 (2) in excel cond, $1500/both. M McAnalcy, WEKC, Williamsburg KY 40769. 606-549-3000.

Otari MX5050 MK III 2 trk w/roll around stand, manual & remote, less than 60 hrs use, mint cond, C.O.D. pick-up only, $1400. G Finerman, Fintronics, 18 W Maple, Suffern NY 10901. 914-357-5419.

Fostex 250 porta studio replacement motor, $50 or trade for Revox A77 remote. E O'Brien, Imperial Sound, RR 31 Box 405, Terre Haute IN 47803. 812-877-2663.

Ampex 440-B R/P in Russlang cabinet, gd cond, $375. J Lee, BCI, 2139 10th Ave N, Lake Worth FL 33461. 407-547-0600.

3M M79 1/2" 4 trk in excel cond w/synch resolver, $750. G Zelinger, KCET, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Revox A-77 3.75-7.5 ips, has record amps (3), $700/ea plus shpg. B Downs, KISX, Box 131869, Tyler TX 75713. 214-593-4444.

Tascam 44 4 trk 1/4", excel cond, $650, C.O.D. pick-up. G Finerman, Fintronics, 18 W Maple, Suffern NY 10901. 914-357-5419.

Ampex 440-C R/P, mono, Ampex electr, recently removed from srvs, gd cond, $650. B Norman, KFLI, 3200 N Willow Creek, Prescott AZ 86301. 602-776-3785.

Teac Syncaset 124, $200 plus $10/UPS. N Mishaan, POB 335, Lynbrook NY 11563. 516-582-1338.

Pioneer RT1020L 2 speed 10.5" 1/4 trk w/4 trk PB head, w/$200 in tape, some unopened, gd cond, recently tweaked, $400. B Ford, Spunk Prod, POB 1052, El Granada CA 94018. 415-726-4786.

TEAC 90-16 16 trk in excel cond, $7000/BO. B Kaplan, POB 644, St Cloud FL 56302. 612-253-9600.

Ampex 440B (4) mono, complete, (2) roll around units, BO. J Stanford, WYLD, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Otari ARS1000 7.5/15 ips w/tone detect, clean & complete, $900/BO. B Webster, WLIT, 150 N Michigan, Chicago IL 60601. 312-329-9002.

Otari MX-5050B-II-2 tape decks w/stands (2), well maintained, very low hrs, $2250/ea plus shpg. D Glasser, Airshow Inc, 7021 Woodland, Springfield VA 22151. 703-642-9035.

Ampex 350 full trk transports w/Inovonics solid state R/P electronics & floor cabinets (2), $500/ea. G Liebisch, POB 29521, Raleigh NC 27626. 919-876-0674.

Revox PR 99's (2) reproduce only; automation controller, all used only a few months, excel cond, BO. K Diebel, KTJC, 1207-1/2 Louisa, Rayville LA 71269. 318-728-4915.

Crown & Ampex CR tube decks (2); (2) Ampex AG-500 solid state; Ampex 350 stereo tube, $200 ea. C Elmasian, Tri-Core, 27503 Five Mile Rd, Livonia MI 48154. 313-427-8784.

Otari 5050 B II 2, rack mounted, $1775; Panasonic SV 250 mini DAT, 1 yr old, low hrs, perfect cond, $1800. R McMillen, 3235 SE 39th, Portland OR 97202. 503-239-6070.

Teac X-300 1/4 trk, 3 motor transport, 3 head, mic/line mix, record mute, tape/source monitor select, new cond, $625. B McCue, WEXL, 317 E Eleven Mile, Royal Oak MI 48067. 313-544-2200.

Ampex 350 mono R/R w/Inovonics solid state rack mount, $500. A Baker, 804 E 38th, Indianapolis IN 46205. 317-925-7371.

Studer Revox port case for A77 w/mon spkrs & pwr amps, excel cond, $275/BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Studer Revox HS-77 Mk IV special fact order FT mono, 15/7.5 ips, only 10 hrs use, wood case, mint cond, $575/BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Scully 270S (5) used very little, BO for one or all. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Ampex AG 350 mono R/R w/solid state electronics rack mount, $800. A Baker, 804 E 38th, Indianapolis IN 46205. 317-925-7371.

Studer A80 1" 8 trk, 7.5/15 ips, 1100 hrs use, $8000. 212-645-6319 & leave message or B Mason at 212-242-2100.

Scully 280B 4 trk half inch, gd cond, $995/trade. G Liebisch, POB 29521, Raleigh NC 27626. 919-876-0674.

Scully 255 reproducer 1/2 trk stereo, BO. Howells Audio, POB 6164, Kingman AZ 86402. 602-753-4915.

Revox A77 (2), one rack mount, one not, $350/ea or $500/both. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Ampex 440 deck w/Schafer stereo solid state PB electr, $250; Teac/Tascam 32-3 2 trk, stereo, dual capstan recorders, factory rack mounts, (4), virtual new cond, $750 ea. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

Otari MX-5050 Mark III-8 8 trk w/ext control input, excel cond. L Runge, WOI-TV, Communications Bldg, Ames IA 50011. 515-294-3880.

Revox A77 top-shape factory rebuilds. All wearable parts brand new, all formats. $500-$800, send needs, practical maintenance, manual, $25. J Clark, JM Tech Arts, POB 8156, Hermitabe TN 37076.

Want to Buy

Teac/Tascam 3340/80-8 remote controls; foot or console top operation. J McCallum, 3311 E Bruce Randolph Ave, Denver CO 80205. 303-388-8548.

2-chnl electronics for Scully 260B R-R. R McDonald, 5231 Horton, Mission KS 66202. 913-722-2677.

Technics RS1500 or **1520** must be in gd cond. S Pai, 1100 Rancho Conejo Blvd, Newbury Pk CA 91320. 605-373-7777.

Nakamichi 480 2 head, non-monitoring version perferred. J Lauria, 1153 38th, Brooklyn NY 11218. 718-633-3010.

Ampex AG500 for parts. D Ibel, KICD, 2600 N Highway Blvd, Spencer IA 51301. 712-262-1240.

ITC 750 PB-only decks for standby use, parts (2). K Browall, Box 608, Riverton WY 82501. 307-856-2922.

ITC 850 service manual. K Scheffel, 9 Cougar Rd, Edwardsville IL 62025. 618-692-9798.

Ampex MR-70 working 2 trk in original cond. D deForrest, 7441 Wayne 10-D, Miami Beach FL 33141. 305-866-5401.

Otari 4 or 8 trk. S Jeffries, Hwy 14 East, Mankato MN 56001. 507-345-4537.

Tascam 32 1/4" 2 trk in new or reconditioned reel motors, reasonable, will consider cash &/or trade AT&T Comkey 416 phone system, complete w/cables, punch block & box. H Hart, Media Prod, 9440 Montego, Shreveport LA 71118. 318-687-6745.

Instructions/manual for Eumig FL-1000 cassette recorder, also interested in buying used FL-1000. B Harwell, Compact Disc Jockey, 2409 Wynncrest Crs, Ste 6104, Arlington TX 76006. 817-633-8462.

Revox A77 remote control. B Berry, Karavan Bdct Srvs, 13 Montgomery Pl, Conroe TX 77384. 409-273-2601.

Revox A-77 remote control, rack mounting housing & roll-around/tilting rack. B Harwell, Compact Disc Jockey, 2409 Wynncrest Crs, Ste 6104, Arlington TX 76006. 817-633-8462.

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.

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

CONSOLES

Want to Sell

Teac 144 4 trk portable cassette, excel cond, $250/BO. R Fess, POB 250, Macomb IL 61455. 309-833-5561.

Fostex 450 8 in 4 out production mixer, excel cond for production sound reinforcement, $500. R Smith, 3407 W Olive #108, Burbank CA 91505. 818-367-6335.

RCA BC-6B early 60's tube-type workhorse, mint cond, used in educational TV station & in storage 15 yrs, $500. B Hayes, POB 429, Siler City NC 27344. 919-742-2135.

Autogram AC-6 excel cond, $2400/BO; AC-8, excel cond w/timer, $3400/BO; Sparta A-15B 5 chnl mono, gd cond, $400. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Sparta AS-30B stereo/mono, 4 chnl w/pwr supply, gd cond, $350/BO. M Black, Hobart William Smith College, Geneva NY 14456. 315-781-3456.

8BEM100 dual-chnl mono, 8 mixers, gd cond, some updated 3600 series electr, $850. B Hayes, POB 429, Siler City NC 27344. 919-742-2135.

LPB Alpha series 8 chnl, 24 input console w/3 inputs set up for mic level, program & mono mixdown output busses, in board monitor amp, in board pwr supply, 3 yrs old, $2500/FOB. D Rozek, 475 South Ave, Beacon NY 12508. 914-831-8000.

Ampro AC-8D dual-bussed mono, 8 chnl, 4 inputs per chnl, 32 inputs, manuals, $995. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

BE Spotmaster 8BEM100 8-chnl, dual-bussed mono, w/Daven step-attenuators, 16 inputs, $695. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

Sparta A-20 solid-state mono, 8 chnl, w/manual, fair cond, $500 plus shping. M Hagans, 218 W Hampton, Mesa AZ 85210. 602-964-3100.

Harris M-90, Auditronics 110 Grandson, mono & stereo inputs, 4 or 2 chl outputs, max 18 modules, test osc, stereo 8 pos, input sel, plus much more, BO. J Geogiades, WRRO, 216-373-1440.

Sound Workshop 1280-B 12 in 8 out recording console, vgc, 8x2 stereo mix w/8x1 musicians mix, 3 band EQ, tri-light LED, complete w/wires, $1500. P Zeleniuch, Tapes Inc, 5733 S Park Blvd, Parma OH 44134. 216-886-6679 aft 5PM.

Harris Stereo 53 mic inputs, 9 stereo line level inputs gd cond, BO. R Lafore, Box 1327, Valdosta GA 31603.

Studiomaster 16 input mike chnls 4 or 2 ouptut chnls, BO. L Shew, Techni Sound, 9731 Acacia No 14B, Garden Grove CA 92641. 714-530-9490.

Tascam 10, 12 in 4 out, $550. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

Auditronics Series 110-4 6 input mod 4 output comes w/3' prod table, 2 trk Scully 260, all working, BO. J Caracciolo, WORE, 1600 Stewart, Westbury NY 11590. 516-832-9400.

Consoles including API 2042, Altec 250T3 & Damon 5200, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

LPB S515A 8 input mono Signature II console, gd working order, $950/BO. K Kushnir, Empire Comm, 2120 Bluebell Dr, Santa Rosa CA 95403. 707-545-8300.

Sparta A-10B mono 4-chnl board, excel cond, w/manuals. B Weiss, KJLA, 3435 Broadway, Kansas City MO 64111. 816-753-7707.

Gates Diplomat M5700 program amps (3); M-6034 pre amps (3); M-6035 cue amps, misc parts (3), BO. D Dorwart, 570 N Plymouth Blvd, Los Angeles CA 90004. 213-468-8883.

Ampro AC-10 dual mono board, mint cond, low use, $950. J Kreines, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Gates Gatesway 80 in gd cond, $700 plus shpg. J Lee, BCI, 2139 10th Ave N, Lake Worth FL 33461. 407-547-0600.

CONSOLES. . .WTS

Wheatstone Audioarts 8X recording prod console, factory patch bay, excel cond, $11,500. D Kocher, DLK Snd Std, 1901 Hanover, Allentown PA 18103. 215-432-0520.

Sound Workshop Logex 8 20 chnl board w/complete EQ controls, console desk w/heavy metal stand, $2500. D Coffman, WSOR, 940 Tarpon, Ft Myers FL 33916. 813-334-1393.

Gates II consoles (2); (4) Ampex 440 C recorders; (2) Metrotec 500 PB & one for parts; QRK TT w/arm & control; (2) UMC/Beau cart machine; UMC/Beau R/P, large quantity of spare parts for all this equip, $1150/all, FOB Ft Pierce. F Sherwood, WDKC, POB 1330, Ft Pierce FL 34954. 407-464-1330 or Fax: 407-464-8578.

Bi-Amp 1642 16 chnl, 4 sub masters, 2 masters, parametric EQ, stereo pans, phantom mic pwr, rack mountable, pwr supply, flight case, $850. B Hurley, Audio Chicago, 100 E Ohio Ste 618, Chicago IL 60611. 312-467-0170.

BE 4550 4 chnl stereo refurbished & ready to go, $455. R Bronte, WWNT, POB 1828, Dothan AL 36302. 205-792-2161.

Ampro AC 85 8 chnl stereo dual, $1800; BE 150A 8 chnl, new, $1750. J Phillips, WZOM, 408 1/2 Clinton St, Defiance OH 43512. 419-784-1059.

Broadcast Electronics 4 BEM 50 4 channel console, BO. J Sidote, POB 949, Welch WV 24801. 304-436-2131.

Quantum QM-8, 8 inputs, 4 busses, quad & stereo mon, etc, excel cond, $775/BO; Speck 16 inputs, 8 busses, etc, excel cond, $775/BO; Snake, 16 phantom-pwrd inputs w/ext ps, 250' Belden 19-pair cable w/mil connectors & stainless-steel strain reliefs, etc, excel cond, $750/BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Teac/Tascam 2, slide pot, 6 chnl, $150. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

Gately 16x8 w/EQ 4 effects buss, quad monitoring Canon connector for line & Mic inputs & Canon connectors for outputs, $2800. A Baker, 804 E 38th, Indianapolis IN 46205. 317-925-7371.

CCA FM-AM 10 chnl radio studio board, $150. Roger, Master Promotions, 5792 E Edison, Tucson AZ 85712. 602-886-1853.

Harris Stereo 5 3 mic inputs & multiple line level inputs, gd cond, BO. R LaFore, WQPW, POB 1327, Valdosta GA 31603. 912-244-8642.

CCA/QRK Futura Six slide pots fair to good, still in service, BO. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Want to Buy

Gates Executive complete. D Ibel, 2600 N Highway, Spencer IA 51301. 712-262-1240.

Auditronics 110, still need one mic input module w/EQ, Mdl 110-IME for Auditronics 110 Grandson. D Payne, WZPL, 317-637-8000.

Manual for RCA BC-6B Consolette, need block diagram & schematics for renovation. N Priest, 212-924-3119.

RCA & WE tube consoles, mixers, amps, TT's, speakers, mics, on-air lights, literature. R Van Dyke, Caffrey House, Squires Ave, E Quogue NY 11942. 516-728-9835.

Sparta Centurian II stereo mixer modules, write w/price per module, will consider mixers which need work. D Proctor, WCPE, POB 828, Wake Forest NC 27587.

Literature, manual, schematic for RCA console BC-2B, 1952 mdl. B Leslie, Pro Recording Srvs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Howe 10,000 parts, cards, faders, new or used. A McCartny, KUIC, Fax: 707-446-0122.

Gates Dualux II power supply. D Ibel, KICD, 2600 N Highway Blvd, Spencer IA 51301. 712-262-1240.

Harris Stereo 80, 994-6867-002 manual or copy. J Meredith, WYTH, Box 635, Madison GA 30650.

DISCO & SOUND EQUIPMENT

Want to Sell

Klipsch La Scala speakers, horn, road cases, fiberglass finish, excel cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

Ampex-by-JBL unmounted 12ohm speakers (2) for Ampex 620, 620-F, 622 speaker-ampls, ex cond, $60/ea. J Newman, 401-848-7133.

Sony SB-200 echo adaptor, $30; Lafayette DNR-50 Dolby stereo unit, $50; Pioneer SR 202W stereo spring reverb unit, $50; Shure M688 stereo mic mixer, $100, all in gd cond w/manuals. P Zeleniuch, Tapes Inc, 5733 S Park, Parma OH 44134. 216-886-6679. Aft 5PM.

DOD/Digitech 831-C graphic EQ, 31 band, as-new cond, $175. B Leslie, Pro Recording Srvs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Alembic 2 ch guitar preamps (2), Hiwatt L100R & Music Man 210, call for details & prices. E Boucher, EAB Recdg, POB 958. Lewiston ME 04243. 207-786-3476.

Roland TR-626 digital drum machine, programmable, mono/stereo/individual outputs, like new, $250. M Osborne, WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

JBL 4502, JBL C50SM & Earth B12HC, call for details & prices. E Boucher, EAB Recdg, POB 958. Lewiston ME 04243. 207-786-3476.

Guitars including ESP strat copy, Hamer electric, Applause AA14-1 & Fender F230 acoustic 6-string, Royce banjo, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Keyboards including Arp string ensemble, Hammond C3, Hohner D6 clavinet, Fender Rhodes piano & Dubreq stylophone, call for details & prices. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Klipsch MCM-1900 3-way, $1800/BO. J Flannery, 8395-A Shallowcreek Rd, Liverpool NY 13090. 315-622-9199.

JBL 4695, 4622 & 2445J 3 way Cabaret series PA system, excel cond, $2400. P Mobley, 300 Main St, Brookings SD 57006. 605-697-5326.

Peterson strobe tuner mdl 400, new cond, $250; Yamaha electronic piano mdl CP30, new cond, $795, formerly Gospeltrax recdg std, out of business. Twila Stoller, 2320 Eade, Ft Wayne IN 46805. 219-484-7390.

Fostex 765 studio reference monitors, like new, $225/pr. K Thomas, Rebel Recdg, POB 207, Atlantic Bch FL 32233. 904-388-7711.

dbx Boom Box subharmonic synth, regenerates super low bass, $125; JBL K140 15" speakers (2), $225. R McMillen, 3235 SE 39th, Portland OR 97202. 503-239-6070.

Community Light & Sound RS440 (1 pr) 4-way speakers w/Community VB790 bass bins, in Anvil cases, excel cond, $1600. J Kreines, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

JBL 4311B loudspeaker. R McDonald, 5231 Horton, Mission KS 66202. 913-722-2677.

WE & RCA speakers & tube equipment, disc recorders & reporducers & blank recording discs, catalogs, manuals, 16" transcriptions. R VanDyke, 2 Squires Ave, E. Quogue NY 11942. 516-728-1327.

LIMITERS

Want to Sell

Orban 8000A Optimod rebuilt, tune up & upgrade, $1750. L VanDam, WUPQ, Newberry Ave, Newberry MI 49868. 906-293-8522.

Orban/Optimod FM 8100 wking when removed, $2500. L Selzle, Box K, Greeley CO 80631. 303-356-1310.

Spectra Sonic C compliimiter, excel cond; $250/BO. J Zelinger, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

Optimod 8000A.
Good condition. $1750.
414-482-2638

CBS 4110 FM Volumax gd cond, recent cal to factory specs, $300. G Ogonowski, 213-465-3171.

Collins 26V-I compressor limiter, gd cond, BO. M Black, Hobart William Smith College, Geneva NY 14456. 315-781-3456.

Volumax, Gates, Spotmaster all kinds of old processing, call for info. S King, 1703 Avondale, Amarillo TX 79111. 806-355-9777.

RCA BA6A tube compressors (2). R Robinson, 203-269-4465.

Orban 9100A Optimod perfect cond, $1800/BO; Orban 9000A Optimod, like new, $1500/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

CBS Audimax III mono AGC; CBS Volumax FM 410 mono peak limiter; Harris MSP-90 AGC, stereo wide band; Harris MSP-90 Tri Band AGC, stereo; dual MSP-90 AM peak limiter, (2) mono units in one chassis. H Kneller, 813-639-1112.

Optimod 8000A worked perfect when removed from service 2/90, $1700. M Cooney, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

Orban 8100ST studio chassis for Optimod 8100 dual STL configuration, gd cond, $400. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Volumax 400 peak controller, AM, $100; Audimax III automatic level controller, AM, $100; FM Volumax 411 stereo peak controller, FM, $125. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

CRL SGC800 AGC w/Dynafex NR, excel cond, $1250. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

CRL SMP 850 stereo limiter, current mdl, excel cond, $1250. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Optimod 8000A, BO. Howells Audio, POB 6184, Kingman AZ 86402. 602-753-4915.

McMartin audio processor & McMartin stereo gen, $250 ea or $400/both. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

CRL SEP-400B/PMC-300A, excel cond, both only 3-1/2 yrs old, $1100. T Stine, KGIR, 106 Farrar, Cape Girardeau MO 63701. 314-335-9099.

Harris/Gates AGC-994-6629-002 & M6631 Solid Statesman mono AGC & Solid Statesman mono FM limiter, both working when removed, w/manuals, $400/BO. J Durall, WJNZ, POB 494, Greencastle IN 46135. 317-653-9717.

Dual UREI LA-4 limiters in rack mount, $300. G Liebisch, POB 29521, Raleigh NC 27626. 919-876-0674.

Modulation Sciences CP-803 Composite Clipper, $500/trade. G Liebisch, POB 29521, Raleigh NC 27626. 919-876-0674.

Spectra Sonics Complimiter, mono compressor/limiter, gd for dialogue, $150. G Zelinger, KCET, 4401 Sunset Blvd, Los Angeles CA 90027. 213-667-9310.

UREI BL-40, $295; Comex bleepmate 675, $499; Lake patch bay, $79. C Dube, WSPR, POB 1270, Springfield MA 01102. 413-732-4182.

CBS Audimax 4450, BO; CRL APP-300, BO; (2) CBS Volumax 411, BO. Howells Audio, POB 6184, Kingman AZ 86402. 602-753-4915.

Aphex Type II aural exciter, BO. J Stanford, WYLD, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

RCA BA-147 FM mono limiter, $200. G Liebisch, POB 29521, Raleigh NC 27626. 919-876-0674.

Texar/Gentner Audio Prism latest Model w/PR-1, new cond, never rack mounted, $1300. R Hull, 918-254-0464.

Want to Buy

Orban/Optimod 8100A in gd cond. M Cooney, 610 N Kiwanis, Sioux Falls SD 57104. 605-336-2706.

UREI LA-3A or LA-4 production compressor/limiters. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

dbx 163X compressor/limitor. B Tidwell, POB 338, Valdosta GA 31603. 912-244-5180.

CRL SEP400 or SEP800. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Altec 436 A, B, C, cheap. J Ganguer, 415-644-2363.

Texar Audio Prisms wanted pair plus RCF-5 audio card for Orban 8100-A. J Bahr, 154 Guajataca St, Crown Hills, Rio Piedras PR 00924.

MICROPHONES

Want to Sell

Neumann U-67 vintage tube mic, excel cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

RCA 77DX vintage ribbon mic, excel cond, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7625.

Electro-Voice RE-20 gd cond, $100/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Neumann U87, one pair, excel cond, $1000 ea. G Heitmann, 914-266-4141.

Fostex M22RP MS stereo studio mic, excel cond w/aluminum carrying case, $400. Don, 3142 Market Place, Bloomington IN 47403. 812-339-4446.

RCA 77DX, needs repair, $25. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

EV RE-20, never used, $250. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

Beyer M-160 double ribbon mic in perfect cond, $180. J Wayne, Silverdisc Prod, 405 Tarrytown Rd, Ste 444, White Plains NY 10607. 914-591-5240.

Schoeps CMC-55U (2) Colette Series 48V condenser mics w/switchable cardioid/omni, matched stereo pair w/addtl MK8 figure-8 capsule & suspensions for M-S recording, mint cond, $2650. J Wayne, Silverdisc Prod, 405 Tarrytown Rd, Ste 444, White Plains NY 10607. 914-591-5240.

EV 1957 collectors edition 667 w/adjustable EQ preamp system, gold plated head & fittings, custom cables & mahogany case, documentation, new cond, $395. D Miller, Airborne Audio Prod, 11647 W 83rd Terr, Lenexa KS 66214. 913-492-8822.

RCA 44-A velocity bi-directional diamond shaped ribbon mic, a classic, yoke & shock mount intact, $550. R Franklin, Super Snd Stds, 211 Virginia, Norristown PA 19401. 215-277-7112.

Telefunken tube CM-61, very rare, uses std plug-in tube, mint cond w/custom ps, BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

Bruel & Kjaer 4007 high intensity, omni mic, phantom power, never used, still in wood box, ruler flat, $750/firm. B Ford, Spunk Prod, Box 1052, El Granada CA 94018. 415-726-4786.

Neumann KM-88, rare 3-pattern w/nickel capsule, hot-setup percussion mic, mint cond w/orig case, $875/BO; Neumann KM-86 3-pattern, mint cond, $675/BO. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

RCA ribbon mics including (1) 44-BX; (1) 77-D; KU3A10,0001; BK-11; BK-5; SK-46; WE639A, will trade for other high quality condenser, dynamic, ribbon mics & audio equip. Tracy Eaves, 615-821-6099 (evenings).

Want to Buy

RCA 77-DX working model in nice shape, mount w/stand desirable. E Esser, 2000 Riveredge #797, Atlanta GA 30328. 404-953-9369.

Vintage Mic's for museum carbon condenser, dynam ribbon, parts, stands, call letter plates, on- air lights, broadcast literature. R VanDyke, 2 Squires Ave, E. Quogue NY 11942. 516-728-1327.

RCA 44's, 77's & other ribbons, working or not, WE 639 etc. W Davies, 5548 Elmer Ave, N Hollywood CA 91601. 818-781-9831.

RCA 44BX or 77's vintage ribbon mics, BO. R Kaufman, POB 462247, Garland TX 75046. 214-271-7825.

Vintage tube condenser mics, Neumann, Telefunken, Schoeps, AKG & classic ribbon mics, RCA 77s, 44s; Telefunken ELAM 250s or 251s, any cond; AKG C12s & C24s, any cond; Neumann U47, U46, M249B, KM56, U67, etc, any cond. J Kreines, Demott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Altec M-20, M11 mics, capsules, windscreens shock mounts; Ampex ATR100 & AC-500 tape recorder field engr bulletin sets, booklets/ads. D Bisbee, 685 S Roys, Columbus OH 43204. 614-279-6163.

RCA 77DX/44BX non-working cond is ok. M Brooks, POB 106, Toccoa GA 30577. 404-886-2191.

RCA top dollar and/or trade old RCA movie mikes for RCA (pre-4AA) ribbon-field coil mikes such as PB-17 or PB-31 etc. J Webb, 15117 Hamlin, Van Nuys CA 91411. 818-769-6738.

Will buy or trade for RCA 4 AA condensor mike no major missing parts please. J Webb, 15117 Hamlin, Van Nuys CA 91411. 818-769-6738.

MISCELLANEOUS

Want to Sell

Heathkit ID-4001 weather computer, gd cond, $200; (4) RCA 7' equip racks, $100ea; Maxitel sports remote amp, gd cond, $250/BO; Pulse Dynamics M-288 sports remote amp, average cond, $100/BO; (4) Astrolite sportscaster headsets, gd cond, $100ea/BO; Audiolab TD-1A bulk tape eraser, gd cond, $50/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Metal cart racks, mounts on wall, each holds 25 carts, appx 50, $5 ea. L Selzle, Box K, Greeley CO 80631. 303-356-1310.

Paradyne DCX-825 12 chnl cable data modem w/manual, excel cond, w/2 external Bell type line drives, $1500/BO. B Shaffer, 2923 S Western, Marion IN 46953. 317-668-5461.

Broadcasting Yearbooks 1950's thru 1985, BO. A Wilkerson, POB 340, Lenoir City TN 37771. 615-986-7536.

Gates ACC-2 chassis, less pwr supply & speaker amps; Heath AR-15. H Kneller, 813-639-1112.

Nortronics 2 trk 9202 PB heads (3), new, $35ea; Nortronics 2 trk 9200 head in mount, new, $35. R Shroyer, 215 N 4th St, Yakima WA 98907.

Complete 5 kW radio station all equip must go, cart machines, TT's, furniture, monitoring equip, xmtr, etc. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

IMS computers, (2) terminals, hard drive, floppy drive. Datacount software installed, $4995. B Dunnavant, WZYP, POB 389, Athens AL 35611.

Nidec NAH-1202F6 motors (3) for Audi-Cord cart machines removed for shaft burnishing, otherwise in excel cond, $100ea. R Shroyer, 215 N 4th St, Yakima WA 98907.

DISTRIBUTOR DIRECTORY

The following distributors serving the broadcast industry would be glad to help you with any of your requirements.

CONSULTANTS

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 AFCCE

W. LEE SIMMONS & ASSOC., INC.
BROADCAST TELECOMMUNICATIONS CONSULTANTS
1036 William Hilton Pkwy
Ste 200F
Hilton Head Is., SC 29928
(803) 785-4445

SOFTWARE
FM CHANNEL SEARCH
FM Database pool
MSDOS
EGA Graphics-Color
Broadcast Technical Consulting
V Doug Vernier
Broadcast Consultant
1600 Picturesque Drive
Cedar Falls, IA 50613
319-266-8402

MAGRILL ENGINEERING
Radio Engineering Consultants
FCC Applications - Upgrades
Pre-purchase evaluations
Station planning & Design
Turnkey systems - Field service
Experienced, Economical & Fast
(904) 591-3005
Barry Magrill, President, Member IEEE
P.O. Box 1010, Fairfield, FL 32634

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)631-1338 "Member AFCCE"

Studio & Transmitter Site Designs
Turnkey Installations
F.C.C. Applications
Automation
Field Service, R.F. & Audio
Superior Audio Imagery
Nationwide Service
Bill Elliott, Consultant
48 Imperial Avenue
Pittsfield, MA 01201
413-442-1283

Huntsville Antenna Engineering
There is hope for AM radio! AM station unipole antennas with circular polarization & beam tilt. Broadband your present AM tower Series R shunt fed.
205-353-9232 205-353-6747
Kenneth Casey
Consulting Radio Engineer

This Space Available
Call Simone Leeser at
1-703-998-7600

RADIO SYSTEMS ENGINEERING
FCC Applications • Design • Installation • Field Service
Experienced & Affordable
4289 Roanridge
Las Vegas, Nevada 89120
24 Hr: (702) 454-2085
FAX: 702-458-2787

new station construction
field service AM directionals
RON KROB
broadcast technical consultant
4910 Four Star Court
Fort Collins, CO
80524 303 484 2704

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 AFCCE

TENCO TOWER
Lic. No. 357096
Installation & Maintenance of Broadcast & Communications Towers & Antennas
Donald J. Tenns
9723 Folsom Blvd. Suite A
Sacramento, CA, U.S.A. 95827
(916) 362-6846 (916) 638-8833
FAX: (916) 638-8858

DISPLAY YOUR CONSULTANT'S CARD HERE AND BE SEEN BY OVER 21,000 READERS
Call Simone Leeser at 800-336-3045

SERVICES

BRENTLINGER BROADCAST ENGINEERING, INC.
Charles Jayson Brentlinger
President
COMPUTERIZED REPORTS
ALLOCATION STUDIES • AM • FM
AM DIRECTIONALS • AUDIO • STL
SATELLITE COMMUNICATIONS
4338 East Acoma Drive
Phoenix, Arizona 85032
(602)867-0181

HARMON'S TOWER SERVICE, INC.
Maintenance, Painting, Antenna & Equipment Installation, Winch Services
435 B Broadway
Columbus, GA. 31901
(404) 327-1074

ENGINEERING SERVICES
REGISTERED PROFESSIONAL ENGINEERING STAFF
• STRUCTURAL • CIVIL• MECHANICAL •
Tower and Antenna Support Systems Analysis, Inspection, Modification, and Appraisals.
division of
CENTRAL TOWER INC.
P.O. Box 530, Newburgh, IN. 47630
Phone: 812-853-0595

BROADCAST COMPUTER DATABASE BBS
300 to 19200 Baud
N-8-1
Multi-Node System
(713) 937-9097
FCC Information
On-Line Call Sign Search
On-Line Engineering Formulas
Messages, Conferences, Files, Doors

BROADCASTING & ELECTRONIC SERVICES LABS
PO BOX 178
NEWTON, UT 84327
801-563-3088
BROADCAST EQUIPMENT REFURBISHED & REPAIRED
AUDIO, VIDEO, RF, DIGITAL
15 YRs EXPERIENCE

TOWER SERVICES
Light Replacement
Routine Maintenance
Ground Systems
Painting
20 years Experience
John Nix
PO Box 13244 Salem, OR 97309
503-581-4056
1-800-321-4056

SPECIALIZING IN ERECTION, REPAIRING, PAINTING AND MAINTENANCE RADIO, TWO-WAY, T.V. TOWERS AND FLAG POLES
ASTEEPLEJACK CO.
PAINTING AND STEEPLEJACK CONTRACTORS
FULLY INSURED FOR YOUR PROTECTION
OON HIGHLEY 713-462-6105
3722 ROMA HOUSTON, TEXAS 77080

MIRKWOOD ENGINEERING
Rural & Remote Site Field Engineering
50 Park Ave.
Claremont, NH 03743
603/542-6784

PARAMOUNT COMMUNICATION • SYSTEMS
INSTALLATION AND SERVICE OF BROADCAST ANTENNA SYSTEMS/TOWER MAINTENANCE & ERECTION
WESTMONT, NJ (609) 869-0222

BSG Phone or Fax
(919) 968-4200
Broadcast Support Group, Inc.
109 Conner Drive
Wilshire III, Suite 105
Chapel Hill, NC 27514
AM/FM, Studio, Transmitter Installations

R.F. Systems
Installation Checkout Optimization
Donald "Donny" Millar
President
916-644-7055
5874 Rose Court
Pollock Pines, CA 95726

Contact Radio World Newspaper for availabilities.
P.O. Box 1214 • Falls Church VA • 22041

SONEX-SOURCE
58 NONOTOCK ST.
NORTHAMPTON, MA. 01060
'Your Source for Sonex Acoustical Foam'
WIN RIDABOCK
(413) 584-7944

MISCELLANEOUS. . .WTS

Vikron PB heads (3) for Audi-Cord series E cart machines, new, stereo, $75ea; mono (2), $35ea; Dummy (3), $5ea. R Shroyer, 215 N 4th St, Yakima WA 98907.

Extel teleprinters (2), (4) boxes spooled paper, both excel cond, BO. R Fess, POB 250, Macomb IL 61455. 309-833-5561.

Onan 40 kW 3-phase diesel generator for emergency operation, $4500. Smokey, KMMC, 1703 Allondale, Amarillo TX 79106. 806-355-9777.

60kW DIESEL GENERATOR
Complete with 225AMP Transfer Switch
Engine — 6V71 Detroit Diesel — Rebuilt
Generator — LSA44M2 Leroy Somer — New
Transfer Switch — Westinghouse — New
Complete — Ready for Standby Operation
Connect fuel and seven wires
$340.00 per month for 60 months
(Subject to local taxes)
Call us for your generator needs. *Norac*
U.S. and Canada 1-800-366-3912
Maine 1-800-526-6722
(207) 657-3579

ADC 2X 48 point 1/4" front patch bays, one normaled, one reg, $25 ea. R Cannata, Cantrax Audio Recdg, 2119 Fidler, Long Beach CA 90015. 213-490-6492.

Wilkinson SIA3 240V, 3 phase surge protector, mint cond, $1800. G Gilbreath, KNPR, 5151 Boulder Hwy, Las Vegas NV 89122. 702-454-2085.

PJ7 ADC stereo patch cords (4), $20. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

Executone Equity telephone system, 20 phones & parts, $1000. A McCartny, KUIC, Fax: 707-446-0122.

Audio Engineering audio magazines, various issues 1947-1960. B Leslie, Pro Recording Srvs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

Closing/liquidating AM station. all studio inventory, production room inventory, xmtr/tower equip inventory and lots of misc equip inventory must go, call for all the details & prices. J Clinton, WMLC, 601-268-7892.

Tascam FP 70 FT SW for 3440 & 40 series machines, $25. R Cannata, 2119 Fidler Ave, Long Beach CA 90815. 213-498-6492.

Pro-Co cable, 500', 40 pair indv shielded, $1250. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Tascam 44-480B extender service board, new, $20. R Cannata, 2119 Fidler Ave, Long Beach CA 90815. 213-498-6492.

ADC 48 point patch bays, brass 1/4 jack's balanced & 1 is normalled, gd cond, $25/ea. R Cannata, 2119 Fidler Ave, Long Beach CA 90815. 213-498-6492.

Jingles that sing K-95 FM & 3-40,000 bumper stickers that say I LOVE K95FM, BO. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Tellabs 4008 equalizer modules (2) w/Tellab 1911 single card housing & transformers, $100/ea. N Beaty, 2116 Osman Lane, Greenfield IN 46140. 317-326-3620.

AT&T Comkey 416 telephone system, one base unit, 2 extension units, 2 incoming lines & 1 intercom path, expandable to 5 lines w/2 i/com & total of 16 stations, w/cables, punch terminal & box, $321.27 or trade for Tascam 32 reel motors. H Hart, Media Prod, 9440 Montego, Shreveport LA 71118. 318-687-8745.

Radio Systems TM-2R new, in original boxes, studio timers, $125/ea. K Thomas, Rebel Recdgs, POB 207, ATL Bch FL 32233. 904-388-7711.

Alden Electronics C2000R weather radar, 16 pgs of memory, telephone access to site, full color graphics, composite video or RGB interface to monitor. W Rossini, WLQR, 125 S Superior, Toledo OH 43602. 419-244-8321.

Data Signal MTI-700 modular telephone interface, BO; (3) RCA Tactec programmable trunking mobile telephone radios, BO; 3M fax machine, BO. Howells Audio, POB 6184, Kingman AZ 86402. 602-753-4915.

Equipment inventory including Commodore 64 w/monitor & FSD-1 floppy disk drive, $150/BO; stereo monitor amp, gd cond, 30 W tube type, $75; Gra-Lab photo electric timer, $25; part of Gatesway manual & schematics, BO; Miratel Conelrad rcvr, BO. M Johnson, KGAL, POB 749, Albany OR 47321. 503-451-5425.

Elgar HIT-H7.5 7.5 kW isolation transformer, perfect cond, 120/240 V, $2600/firm. A Reis, TNL Resources, 308 Eastgate Court, New Lenox IL 60451. 815-485-7388.

Trompeter original gold J13-75 patch jacks, PN2BE-75 paralleling, PNS3/625 & PNS4/625, TPC-9-75. O Berliner, SounDesign, Box 921, Beverly Hills CA 90213. 213-276-2726.

Misc equip inventory including several hundred feet of RG-8U coaxial cable on reel (2), new, $50/reel; Gates 14425 audio transformer, BO; 4000' of #10 bare copper wire, 1000' rolls, $125/roll. M Johnson, KGAL, POB 749, Albany OR 47321. 503-451-5425.

Hammond REFK19035-24 rack cabinets (2) w/locking solid front door & louvered rear door w/lock, dual squirrel cage blowers w/filter for clean cabinet pressurization, Hammond RAVB-290 blowers, 35" vertical panel space & threaded rails in racks, gd cond, $350/ea. TX Valley Translator, 6903 Spring Garden, San Antonio TX 78249. 512-696-5615.

Standard rack cabinets (3) 6' military spec, $75/all. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

Grampian disc cutter heads 1D feedback; lead screws for 6N presto cutter; patch bays 24 inputs, patch cords; manuals for Ampex/Pultec/Altec etc,; 40 new tubes & resistors left; Sencore transistor & diode tester; Edital blocks 1/4" & 1" for tape splicing: Daven 600 ohms attenuators (silent);other items. Mr Oliver, 212-874-7660 in afternoons.

Let the Government finance your new or existing small business. Grants/loans to $500,000. Free recorded message: 707-449-8600. (MN8).

Presto 6N cutter lead screws; Capps disc cutting needles, new; heating stylus ampere boxes w/VU meter & control; Meissner mixer, 5 inputs battery operated; Canon plugs, 3-prong, male & female; Harmon-Kardon DPR7 mixers, new; Lafayette sine wave audio generator. Mr. Oliver, 212-874-7660 in afternoons.

Want to Buy

Bdct software, non-engineering, bdct related that runs on Radio Shack Mdl III/4 computers. E Ford, KBPK, 321 E Chapman, Fullerton CA 92634. 714-992-7418.

Ross 31M or 15S either 31 band mono or 15 bands stereo model. S Pai, 1100 Rancho Conejo Blvd, Newbury Pk CA 91320. 805-373-7777.

Schematic for Integral Systems pwr amp or at least numbers for the output transistors. P Rebmann, WEZY, 813-682-3143.

Vintage equipment manuals, catalogs & related literature, especially want Fairchild, Langevin, Altec, etc & RCA broadcast equipment books. B Leslie, Pro Recording Srvs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

ARRL Radio Amatuer handbook, 1948 edition, gd cond, will consider 1947 & or 1949. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Manuals to convert Pioneer multi-play home units CD players to interface w/automation equip for music source of automated radio stations. 703-935-4541 (days); 703-935-9230 (aft 7PM EST).

Telos 100 System, complete system which would include (3) Telos digital hybrids & switch console. H Reinders, WWDB, 5558 Hallie, Chippawa Falls WI 54729. 715-723-1037.

Manuals/catalogs for RCA, Dumont, GE sales. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

Maxitel 82 or any model telephone mixing unit remote bdct system. S Hess, KDUC, 29000 Radio Rd, Barstow CA. 619-256-2121.

WE any mdl amps, mixers, speakers, literature, Altec amps, speakers, top $ pd for WE amps. D deForrest, 7441 Wayne 10-D, Miami Beach FL 33141. 305-866-5401.

50's & 60's style radio station clock, naval observatory time w/red light that illuminated on the hour, would like to know mdl number if it had one. B Berry, Karavan Bdct Srvs, 13 Montgomery Pl, Conroe TX 77384. 409-273-2801.

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

Eastern Iowa/Western Illinois stations seek a chief engineer. Must have transmitter repair experience. RF knowledge a must. Studio engineering & microwave knowledge required. Excellent pay & benefits. EOE. Send resume & salary requirements to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 90-05-01RW.

Radio Ventures, based in Washington, DC, is seeking Chief Engineer for WMXB-FM (Class B) in Richmond, Virginia. Must be hands-on, self-motivated with excellent technical, administrative, communication skills. Requires good RF & studio maintenance skills. Good salary & benefits. Send resume & salary requirements to Radio Ventures, 5210 Auth Rd, Ste 402, Marlow Heights MD 20746. EEO.

Chief Engineer Minimum 3 years experience required. Must be proficient with State-of-the Art processing, microwave links, remote broadcasting equipment for CHR radio station. Great job at a great station. EOE. Resumes to
G.M., WPHR/Power 108
1510 Euclid Avenue
Cleveland, OH 44115

CE Wanted in West Texas for 2 Class C FM's in the market. Competitive salary & benefits. Send responses to: Radio World, POB 1214, Falls Church VA 22041. Attn: 90-06-01RW.

Chief Engineer w/hands-on experience needed for Class C facility in Oklahoma City. Salary commensurate w/experience. EOE. Reply to Paul Dulfer, 408-735-7094.

Pennsylvania AM/FM Group Owner is expanding & requires additional staff engineers. Studio-RF-Shop Work. Travel required. Send resume & salary requirements to: Director of Engineering, HGF Media Group, 1440 Hamilton, Allentown PA 18102. EOE.

POSITIONS WANTED

Talented, versatile, 13 yr vet announcer looking for a position w/C&W FM in NW NC or SW VA. R Wishon, Route 1 Box 545, Yadkinville NC 27055. 919-679-2379.

CE w/20 yrs exper in high pwr FM/AM directional, great w/audio & RF is seeking possible multi-station position. POB 1223, Cockeysville MD 21030.

Experienced, degreed professional seeking responsible career position in production/promotions, concept-to-completion experience, studio & remote, some Top-10, all offers considered. G Eaton, 4493 Major, Drayton Plains MI 48020. 313-623-1673.

Bdct Vet w/30 yrs exper, w/last employer 15 yrs, desire Southern US as project eng or corp eng, BSEE, SBE Pro Broadcast certi, NARTE master certi, NABER, FCC, extra ham. Write: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 90-04-03RW.

Production wiz w/14 yrs exper avail for NY area, writer, producer, engineer, will relocate for reasonable offer. B Ranes, 718-526-6501.

SBE sr engr FCC 1st/gen 15 yrs audio, RF, digital exper CE, Electronics Instructor, tech writer. Write to: RW, POB 1214, Falls Church VA 22041, Attn: 90-04-01RW.

Free tapes, free resumes, 5 yr pro wants you, hurry supplyies limited & avail only in the Midwest. Bill Csongradi, 605-882-3239.

Engineer w/17 yrs exper wants gd job, w/gd company, gd audio/RF & high pwr FM, serious offers only. 812-477-4946.

Exper sports announcer looking to become the next sports director for your station in IA or WI, will relocate. R Bertram, 319-652-6640.

Engineer seeking new challenges, 17 yrs exper in Detroit, 3 yrs in Florida, will relocate. 813-753-8889.

Quality entertainer, 33 yrs exper, marketable, special: Oldies/Big Band, 7/Midnight/all night. J English, 3440 Marinatown Ln, N Ft Myers FL 33903. 813-283-3910.

CE/Asst CE, FCC genrl, ham, ASEE, non smoker/drinker, heavy theory, former CE in Boston, Houston, Miami, Ft Lauderdale, avail now. M Gottesman, POB 1957, Pine Bluff AR 71613. 501-536-6100 X321.

Experienced/reliable announcer looking to become the next sports director for your station in Iowa or Wisconsin, PBP, production, will relocate. Robert, 319-652-6640.

Gospel radio chain on air personality get numbers, creative character voices, will relocate for correct response, offer. M Michaels, 3371 NW Jct, Ft Lauderdale FL 33311. 305-791-6729.

Creative copywriter w/degree in advertising & present copywriting position w/top 40/Country station seeks freelance work, SKD, 318 Cooper Ave, Hancock MI 49930.

Announcer/DJ '67 Marquette broadcasting major looking to relocate South/Southwest US, let me impress you with a tape. M McKenna, 708-636-0119.

Engineer/Businessman engineering, technical sales, communications sales/service, regional manager, teacher, need new challenge, presently DOE for nine station radio group. M Beasley, 1319 Heritage Place, Moberly MO 65270. 816-263-5800 or 5605.

On-Air production pro w/4 yrs exper seeks new opportunities, very strong on-air/prod presentation & great attitude. R Ray, 404 S Wisconsin, Ste 5, Gunnison CO 81230. 303-641-1258.

Production wiz up for grabs 14 year vet prefers NY area but will relocate for killer offer. Call B Ranes, 718-526-6501.

NAC PD with digital library considering a format change, serious inquiries only please. B Hallihan, Box 3125, Turlock CA 95381. 209-634-0318.

Producer/Writer/Engineer w/14 yrs syndication & broadcasting exper, available for any area, will relocate for good offer. B Ranes, 718-526-6501.

Design engineering position w/broadcast equip mfg looking ahead to a digital future. Digital logic/systems and/or firmware/software development. A Melnyk, POB 127, Kanona NY 14856. 607-583-4117.

Gen Op Dir w/top prod skills seeks bigger market/challenge in N England, MIDI & automation familiar. C Keach, 252 Union St, Littleton NH 03561. 603-444-0659.

Morning man/PD w/great leadership skills & 8 yrs exper seeks small/medium market oldies/AC AM/FM, prefer NE PA or Southern NJ. Mike, 814-676-3077.

FCC Gen/RT lic, 30 yrs exper AM/FM all phases, strong construction, studio & xmtr maint, FCC R7R, will relocate. D Walrod, 1245 Tower Dr, Logansport IN 46947. 219-722-1695.

Programmer/Engineer, 4 yrs exper as Chief, willing to relocate. P Jensen, 905B 46th, Niceville FL 32578. 904-678-6765.

Entry level position in LI NY area wanted for college freshman, 1 yr exper in announcing, engineering, post-prod, seeking challenging/creative opportunity. D Rothstein, 516-431-2928.

CE, FCC General Class Lic, 30 yrs exp AM/FM bdcsting, stong on FCC R&R, construction, RF & studio/xmitter maintenance. D Walrod, 1245 Tower Dr, Logansport IN 46947. 219-722-1695.

Graduating 5/20 w/(2) B.A. degrees, business admin & accounting, plus 15 yrs of bdct exper, seeking mgmt position, relocate anywhere. L Witt, 319-242-0400.

General or station mgr/operations director quality announcer avail, seeking job with quality owner, intending to stay around and serve comm, small medium large mkt background. J Banks, POB 2031, Sylvania GA 30467. 912-564-2922.

Production director w/14 yrs writing/producing/engr exper avail for your station or network. B Ranes, 718-526-6501.

Bell System RF engineer w/28 yrs exper, PE, 1st phone, w/Mt Washington exper seeks mountain-top station engineering position. G Pugh, 89 Trumbull Rd, Manhasset NY 11030. 516-627-2153.

Experienced announcer/degreed eng/SBE w/great top market voice seeks small/medium AC/CHR/Oldies station in New England area needing prof, reliable, mature announcer at reasonable rate. G.P. Brefini, 508-543-4213.

Looking for Music Director, programming or engineering position, wide music knowledge from Classical to Modern Rock, exper in LA & SF. Bruce, 415-388-8368.

Energetic, young, fast-learning DJ w/2 yrs on-air exper wants to improve himself & you, southeast FM AOR preferred, but all accepted. B Fredette, POB 642, Newport TN 37821.

MISCELLANEOUS. . .WTB

RCA On Air light old style in gd cond, cash or trade. F Beacham, 6201 Sunset Blvd #29, Los Angeles CA 90028. 213-462-2908.

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

General Radio 1931A & 1931B AM mod monitors. H Kneller, 813-639-1112.

TFT 730A SCA subcarrier mod monitor, $950. D Lerner, 115 W 23rd, New York, NY 10011. 212-463-0795.

TFT 753 AM mod monitors (2) gd cond, $200ea/BO; Potomac AM-19D digital antenna monitor, (2) towers, one pattern, gd cond, $500/BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Rust SFM-19 19kHz signal & freq monitor, 107.9 Xtal; CCA AMM-1T mod mon, needs work, BO. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

Delta amplitude mod controller, closed loop, w/optional Delta monitor board, excel cond, $1800. T Cochran, KNOM, Box 988, Nome AK 99762. 907-443-5221.

Belar RFA-2 AM RF on 1220 kHz, less than 1 yr old, mint cond, $400. T Stine, KGIR, 106 Farrar, Cape Girardeau MO 63701. 314-335-9099.

McMartin TBM3500B base band monitor w/low level card tuned & calibrated. Goodrich Ent., 11435 Manderson, Omaha NE 68164. 402-493-1886.

Want to Buy

TFT 763 mono FM mod monitor, working or repairable. N Herbort, KBEN, POB 335, Carrizo Springs TX 78834. 512-876-2210.

Any older McMartin mod monitors. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

MOVIE PROD EQUIP

Want to Sell

Auricon Super 1200 16mm sound, like new, complete w/(2) magazines opt & mag amp mic cases, cables, factory installed new mag head 12-120, zoom, $2200; GBC zoom 1.8 15-90mm, $175; Canon zoom 2.8 15-150, $225; Spirotone Fisheye 1.8 12mm, $90; Synchronizer 3 gang 35mm, new, $95 plus shipping. L Meister, 321 River, Nutley NJ 07110. 201-667-2323.

Nagra III internal xtal, rolloff filter, Sennheiser 805 w/KAT 15, leather case, ATN pwr supply, excel cond, $1450; & new Bell & Howell 70 DR w/Anvil case, 1" Comat, instructions, $325. J Kreines, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Eiki ST-OH 16mm sound movie projector, excel cond, $100; Schneider 360mm C-mount telephoto lens, marks on barrel, otherwise excel cond, $29. G Ormrod, GFO Prod, 432 East X St, Turnwater WA 98801. 206-352-8028.

Want to Buy

Mitchell 35 & 16mm cameras & accessories, other professional 16/35mm cameras, incl Arriflex, Aaton, CP, etc; optical printers, Research Products 1000, 1001, & Acme & Oxberry; cine lab equipment; upright Moviolas, especially 35mm. Westrex 35mm; optical recorders, & RCA & Maurer optical recorders; CP16s any condition; good cine optics (Zeiss, Ultra-T, Angenieux, Cooke, etc); also need Zeiss 9.5mm Distagon, reasonable, need not be mechannically mint. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

RECEIVERS & TRANSCEIVERS

Want to Sell

TFT EBS monitor w/FM receiver, Bet EBS monitor. Fine Tuning Assoc., 804-873-6832.

GE MUP radios (3) 25 W 2-way 450 MHz band, $750. E Moody, 216 N Main, Bentonville AK 72712. 501-273-9039.

GE Century II 25 W single chnl VHF tranceiver w/PL, $75. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Yamaha T760 digital AM/FM tuner auto search 10 pre sets, DX mode carton & manuals, excel cond, $75 pls shpg. R Cannata, Cantrax Recorders, 2119 Fidler, Long Beach CA 90815. 213-498-6492.

Marti RR30-150 dual freq rcvr. M Young, WJON, St Cloud MN. 612-251-4422.

HH Scott Stereomaster 387 AM/FM rcvr integrated amp 100 W/ch, $90 or will consider trade for classic mic. C Brennan, Brennan VCR Service, 661 Horseshoe Curve, Pike Road AL 36064. 205-272-0692.

Motorola MT-500 hand held radios, VHF band 150 - 160 Mhz, 4 chnl w/scan, $800/all. C Hoffman, 251 174th St #404, Miami Bch FL 33160.

Motorola HT-220 VHF, single chnl, 2 W handheld w/built-in 2-tone pager, w/charger, $125; GE Delta S UHF, mobile for parts, receiver OK, $40. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Harris 6550 satellite rcvr chassis, incl pwr supply & downconvertor, no demod cards, gd cond, $400. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Motorola Micor FM 2-way radio less access, mdl T43RXA1900AA, 162-174 MHz, 12 VDC, $150. B Dickerson, WEAG, Starke FL 32091. 904-964-5001.

ICOM R-7000 25 MHz-2 GHz all mode AM/FM/NB/WB/SSB communications rcvr, rack mount panel w/built in speaker, $1100 pls shpg (firm). B Coleman Jr, WIST, POB 460, Lobelville TN 37097. 615-593-2978.

ICOM R-71A 100 kHz-30 MHz all mode AM/FM/SSB long wave, medium wave & shortwave communications rcvr, w/rack mount panel & monitor speaker, $1100 pls shpg (firm). B Coleman Jr, WIST, POB 460, Lobelville TN 37097. 615-593-2978.

Want to Buy

Johnson Electronics ST-4A subcarrier receivers, converted for 4800 baud data reception, 92 & 67 kHz. D Leinen, Independent Resources, POB 23498, Oklahoma City OK 73123. 405-728-2525.

Telefunken multiband tube type auto radio. W Wilkes, Box 103, Brisbin PA 16620. 814-378-8526.

Sony SRF-A-100 AM stereo radio, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Sony SRA100 port rcvr, RCA on-air lights. K Anderson, 2358 S Main, Salt Lake City UT 84115. 801-466-3196.

Wegener mainframe equipped for Transtar service. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Motorola handheld radios UHF band, 460 MHz, models HT-600, MT-1000, or Radius P-200. C Hoffman, 251 174th St #404, Miami Bch FL 33160.

Motorola hand held radios, UHF band, 460 MHz, mdls HT-600, MT-1000 or Radius P-200. C Hoffman, 251-174 St, Ste 404, Miami Beach FL 33160.

TFT 760 or newer EBS rcvr-decoder & generator; Scientific Atlanta DAT 32 system satellite receiver & dish or Fairchild Dart system. S Hess, KDUC, 29000 Radio Rd, Barstow CA 619-256-2121.

REMOTE & MICROWAVE EQUIP

Want to Sell

Harris 9100 facilities control full ATS, logging, 16 status, 3 calculations, 8 analog, 16 control, 1 studio & 2 transmitter units, BO. J Georgiades, WRRO, 216-373-1440.

Gentner VRC-1000 control unit, fail/safe, command relay, cable accessory, cables, manuals, in use, like new, $3000. D Denton, 405 E Norman, Montgomery City MO 63361. 314-564-2275.

Marti RPT-25R portable xmtr; Marti R-50/450 RPT rcvr; xmtr antenna, base rcvr antenna, cables & manuals, $1295/all. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5849.

Marti STL 10mono, 950 MHz, excel cond, $2500. J Arzuaga, POB 980, Quebradillas PR 00742. 809-895-2725.

Advanced TC-8 remote control, xmtr/rcvr & antennas, 1 yr old, including manuals. B Carr, WRED, 1201 Fremont Pike, Woodville OH 43469. 419-837-4696.

Moseley 505 STL stereo composite, tuned to 949.000 MHz, excel cond, $3900. J Arzuaga, POB 980, Quebradillas PR 00742. 809-895-2725.

Moseley PCL 6010 STL, xmtr/rcvr & antennas, 1 yr old, w/manuals. B Carr, WRED, 1201 Fremont Pike, Woodville OH 43469. 419-837-4696.

Wegener 1601 mainframe w/1683-08, 1845, 1646 cards and PS, $1500; Microwave Associates VR4XS, $1800 plus shpng. M Hagens, 1705 N Queensbury, Mesa AZ 85201. 602-962-7130.

Rust RC1000 telco model, recently removed from service, $600/BO. A Lane, WEHB, POB 2892, Grand Rapids MI 49501. 616-451-9904.

MRC-1600 w/Moseley SCM-1 subcarrier generator. A Kord, WWRX, 401-732-5890.

Equatorial rcvr w/2' dish & LNA electronics, BO. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Motorola MT-500's (3), VHF band 150-160 MHz, 4 chnl w/scan, $800/all, write for info to: C Hoffman, 251-174 St, Ste 404, Miami Beach FL 33160.

Wilbert mast 7-30-357/367 heavy duty telescoping w/Dodge 150 custom van & 12 volt compressor, van interior customized w/deluxe RV front seats & carpeting, automatic transmission, cruise control, pwr steering, tilt wheel, AC, pwr heavy duty disc brakes, AM/FM stereo radio, all in gd cond, $8000. S Garfield, WYED-TV, 919-553-1700 —.

TFT 2601 10 channel digital remote control, excel cond, just removed from service, $1500. E Stokes, WCVR, POB 249, Randolph Ctr VT 05061. 802-728-4411.

Gentner SPH-4 telephone hybrid, lots of features, looks great, stored for 2 yrs, $450; Fon-Box telephone coupler, complete interface for bdctg, works fine, $150. D Doelitzsch, WDDD, 1 Broadcast Ctr, Marion IL 62959. 618-997-8123.

Comrex LXT, PLX, LXR, TLX, RLX, low freq extenders for cleaning up telephone transmission lines, $400-$800. R Meadows, Southeastern Sports Prod, 1203 Seaton Ste 117, Durham NC 27713. 919-544-1366.

Wegener electronics for Transtar radio satellite service including 1608, 1601, 1689, (2) 1610, (2) 1644 & 2046, $3000. D Doelitzsch, WDDD, 1 Broadcast Ctr, Marion IL 62959. 618-997-8123.

Scientific Atlanta 4.5 meter C-Band satellite dish, $1200. D George, WSSM, POB 4304, Madison WI 53711. 608-276-3541.

TFT 8600 narrow bandwidth on 951.5 MHz, excel cond, w/built-in subcarrier, $2000/both; Moseley subcarrier gen & demodulator, SCG-8/SCD-8 on 39 kHz w/conversion kit for 67 KHz, excel cond, $1700/both. T Cochran, KNOM, Box 988, Nome AK 99762. 907-443-5221.

Harris SCA gen card for MX-15 exciter, BO; Moseley SCG-4T subcarrier gen, BO; Moseley MRC-1600 remote control, BO; Moseley SCG-8 subcarrier gen, BO; Moseley SCR-8 subcarrier receiver, BO. Howells Audio, POB 6164, Kingman AZ 86402. 602-753-4915.

Comtech Transtar AC format system w/Colorado Magnetics network switcher, $1800. B King, KLBU, 500 Leland, Austin TX 78704. 512-832-4061.

Moseley MRC 1600 remote control, just back from Moseley for calibation, in factory cartons w/manuals, warranty, excel cond, $2500/BO. J Salov, 3431 W Houghton Lake, Houghton Lake MI 48629. 517-366-5364.

Wegener SCPC satellite rcvr for use w/SMN's The Heat format, avail 7/1/90. J Coursolle, WGGQ. 414-324-4441.

Modulation Associates complete SCPC recvr shelf incl pwr supply downconverter & demod, suitable for use on Westar 4 transponder 2D or 2X, $995/trade. G Liebisch, POB 29521, Raleigh NC 27626. 919-876-0674.

Potomac remote meter panel for ant monitor, BO; Moseley TRC-15AW xmtr unit only, BO. J Stanford, WYLD, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Marti RPT 15 dual freq UHF xmtr; Marti CR-10-2 dual freq UHF rcvr, 450.700 & 450.925 MHz, used on only a few remotes, like new, $1700/both plus UPS. G Jones, POB 229, Uvalde TX 78802. 512-278-1545.

Gentner VRC 1000 3 yrs old, exc cond, complete pkg incl relay panel, terminal strip, battery backup, qume computer terminal, TC 100 hybrid interface and printer, $1500/or trade for Moseley MRC 1. T Teagarden, 710 W 14th St, San Angelo TX 76902. 915-655-9879.

Moseley 1600, like new, $1950/BO. T Cranford, KMTY, POB 1465, Grand Island NE 68802. 308-381-3897.

Moseley TRC-15, CRL audio processing APP-300A & PMC-300A, Pacific Recorders Multimax MX/AM audio compressor/limiter, Belar AM-2 mod mon. C Mandel, KAMP, POB 1018, El Centro CA 92244. 619-352-2277.

Harris/Gates M5862 RDC-10C w/manual, works, but better used for parts or rebuilding, $100/BO. J Durall, WJNZ, POB 494, Greencastle IN 46135. 317-653-9717.

Wegener Panda II & satellite switcher. B Hearst, WWCH, POB 688, Clarion PA 16218. 814-226-8600.

Complete RPU system, Marti dual-freq xmtr & rcvr for 160 MHz band, w/(2) Scala Yagis w/interbay stacking, ASP whip, omni antenna, all in gd working cond w/manuals, $1050. T Spaight, WLRZ, POB 73, Peru IL 61354. 815-224-2100.

EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads at the flat rate of $25 per listing per month (25 words max). Payment must accompany insert; **there will be no invoicing**. Blind box numbers will be provided at an extra charge of $5. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for display rates.

POSITIONS WANTED: Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 3 issues of Radio World. Contact information will be provided, but if a box number is required, there is a $5 fee which must be paid with the listing (**there will be no invoicing**). Responses will be forwarded to the listee, unopened.

Mail To: BROADCAST EQUIPMENT EXCHANGE
PO Box 1214, Falls Church, VA 22041

REMOTE & MICRO ... WTS

Moseley MRC-1600, like new, latest software, $3700. C Leavens, 412-241-2985.

Moseley PCL 505 STL stereo system, w/manual, excel cond. J Arzuaga, POB 960, Quebradillas PR 00742. 809-895-4198.

Moseley PCL-505C STL system on 947.00 MHz, $3750. C Leavens, 412-241-2985.

Gates RDC-10 remote control unit in gd cond, spare Gates RDC-10 for parts, w/plenty documentation, $250/both. N Beaty, 2116 Osman Lane, Greenfield IN 46140. 317-326-3620.

MCI remote control 9 chnl digital, 450 MHz xmtr, studio-line, SCA cards, 1/2 price; Moseley RPU 161.67 & 166.25 xmtr & rcvr, BO. J Phillips, WZOM, 408 1/2 Clinton St, Defiance OH 43512. 419-784-1059.

Want to Buy

Cheap older non-type accepted STL transmitters & receivers in the 950 MHz range for ham radio public service project donations accepted. B Croghan, KCEE/KWFM, POB 5886, Tucson AZ 85703. 602-623-7556.

Pre 1985 STL 900-950 MHz to donate to missionary radio network which doesn't need FCC Rule 74.550 conformance. L Amstutz, 4526 Arlington, Fort Wayne IN 46807. 219-429-8366.

Satellite receiver for Transtar's Nitche 29 format. B Hearst, WMCH, POB 688, Clarion PA 16218. 814-226-8600.

Television satellite uplink, C-band or K-band, fixed or mobile, incl exciter, HPA, dish, etc. Ugly George Satellite TV, 314 W 52nd St, NYNY 10019. 212-677-2200.

STL electronics, dishes, hardware & Marti RPU xmtrs, receivers, antenna, repeaters on 161 & 450 bands. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Marti RPT 25/40, BR10/150 RPU remote pickup xmtr & rcvr on 161 MHz. S Hess, KDUC, 29000 Radio Rd, Barstow CA. 619-256-2121.

Marti remote equipment 160 or 450 band recvr & tran. S Jeffries, Hwy 14 East, Mankato MN 56001. 507-345-4537.

Marti RPT 30 or RPT 15 15 W or greater, must be in 455 MHz band, solid state, balanced input. K Scheffel, 9 Cougar Rd, Edwardsville IL 62025. 618-692-9798.

STATIONS

Want to Sell

AM station 10,000 W in Orlando FL market, original owner of 25 yrs is retiring, modern plant, 16 acres valuable land, masonry studio/xtmr bldg, twice the pwr of other Orlando AMs, priced to sell w/or w/o real estate. E Allmon, Box 555519, Orlando FL 32855. 407-425-0623.

Need interested buyer for 5000 W AM, we are bidding for the FM side of an AM/FM simulcast station, we may pay AM plus FM price to get the FM only, you could walk off with the AM (license, studio, four towers, X'mitter, buildings & land) for practically nothing! While we marry up two traditional competitors, you can step in and steal the remaining AM for a song and give us a run for our money! Serious inquiries only to: Radio World, POB 1214, Falls Church VA 22041. 90-04-02 RW.

AM 1 kW, FT, ND single station market, includes nice studio/transmitter property near town, established by owner in 1970. R Hobbs, 2009 Cromwell, Nashville TN 37215. 615-373-2351.

AM/FM combo 5000 W, AM non-directional, 6000 W FM non-directional, Southeastern NC low down payment, owner financing avail, $585K. Wayne, 919-965-4906 (nights).

First time opportunity, owner/operator, 1000 W, 24 hr clear channel AM 540 in Central Utah, $200K cash, $225K terms, serious responses only. M Halloran, POB 636, Delta UT 84624.

LPTV CP's & troubled stations, buy, trade or joint venture, send details w/price & terms or call. J Worrall, 4618 Gabriel Dr, New Orleans LA 70127. 504-241-6634.

FM 100,000W station in Utah, for more info: Fax 1-801-673-1546.

FM CP, class C3, 25 KW ERP, Pine Bluff AR, $55,000 or sell percentage. M Gottesman, Box 1957, Pine Bluff AR 71613-1957.

Class A soon to be C3 in Pacific Northwest, signal in large market, for info call Larry at 404-460-6159.

AM & or FM radio station in Central Arkansas, good area, excellent potential. Ask for Vivian, 501-470-1525 or 501-568-5448.

AM/FM combo in mountain area, 580 kHz, 2.3 kW day, 310 W night, ND, Class A FM, C1 applied for, 17 acres, 2 story building, positive cash flow, owner financing avail, would consider aircraft in trade, $260K/BO. Tracy, 605-745-3797 (evenings).

Sell your radio station. Pay no commission. Save thousands of dollars. Confidential notification of buyers nationwide. Call Broadcast Marketing Service, 205-734-4888 for details today.

Want to Buy

Seeking existing AM or CP in eastern or central North Carolina. L Afflerbach, CTC Media, 5550 Sterrett Pl, Columbia MD 21044. 301-621-5045.

LPTV CP's & troubled stations, buy or trade or joint venture, send details w/price & terms. J Worrall, 537 Ridgewood, Louisville KY 40207. 502-896-4513.

FM or AM/FM, gd terms, financially qualified, in NY, PA, Ohio, MD or IL or KY. E Stanley, Standey Bdctg, Box 161X, Jeffersonville NY 12748. 914-482-3158.

STEREO GENERATORS

Want to Sell

Modulation Sciences DSCA-188 data Sidekick SCA gen, 92 & 62 kHz. D Leinen, Independent Resources, POB 23498. Oklahoma City OK 73213. 405-728-2525.

Moseley SCG-8 subcarrier gen w/67 & 92 kHz cards, near new, $500/BO. K Browall, Box 608, Riverton WY 82501. 307-856-2922.

Want to Buy

CCA FM 10DS stereo generator. T Barnes, KRIL, 2735 E 8th Ste 45, Odessa TX 79761. 915-332-6870.

SWITCHERS (VIDEO)

Want to Sell

Panasonic WJ 540 P 6-input B/W switcher w/2 25 " multipin cables, $200. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Vital VIX-114-4A 3-M/E switcher w/all options & spare parats, built-in blackburst & color background, $3500. D Brichetto, 4700 Coster, Knoxville TN 37912. 615-688-3151.

CEL Model P169V 4x8 routing switcher, local or remote control, full instructions, mint cond, $1475. Chief Engr, Vidcom Consultants. 412-327-1333.

CoHu 9501 w/manual & broadcast sync generator model TSG3000 GL, $1000. D Garcia, 69 Pine, Waterberry CT 06710. 203-574-4857.

3M 1174 w/4 busses, mix to wipe, direct buss, take bar, ext, int keys, $850. R Jensen, Telecable Corp, 5812 21st, Racine WI 53406. 414-632-3131.

Want to Buy

Bdct school needs non-working Vital 114 switcher &/or Vital Squeezezoom for parts to keep existing system running, partial systems OK, can give tax receipt if donated. B Hodges, OSV Journalism Bdctg, 206 Paul Miller, Stillwater OK 74078. 405-744-8273.

TAPES, CARTS & REELS

Want to Sell

Capitol AA-4 music lengths 3 to 6 min, like new, $2.25ea. R Thomson, 1167 W Javelina, Mesa AZ 85202. 602-897-9300.

Audiopak A-2 carts (250), new & almost new, 40's & 70's. G Jablonski, WHMI, POB 887, Howell MI 48844. 517-546-0860.

Fuji T30 1/2" videotapes, approx 400, ea w/blk hard-cover case, $3.45 ea. D Murray, Murray Video Prod, 1918 Sloan, Latrobe PA 15650. 412-539-0465.

Tascam 32, 7.5-15 ips stereo up to 10" reels, very little use, $1200 pls shpg (firm). B Coleman Jr, WIST, POB 460, Lobelville TN 37097. 615-593-2978.

Ampex 642 1 mil tape, 100 reels, bulk erased, plastic reels, in boxes, $5/reel. T Moore, WBCO, POB 789, Bucyrus OH 44820. 419-468-2326.

Audiopak AA-4 hundreds of music lengths, like new, $2.25/ea. R Thomson, 1167 W Javelina, Mesa AZ 85202. 602-897-9300.

Ampex 406 10 1/2 " metal reels (10), new in sealed factory shpg carton, $100 $ UPS. G Jones, POB 229, Uvalde TX 78802. 512-278-1545.

Audiopak AA-2, AA-3 & AA-4, like new, 70 sec lengths & music lengths, BO. R Thomson, KDKR, 1167 W Javelina, Mesa AZ. 602-897-9300.

Want to Buy

2 & 4 trk open reel pre-recorded music tapes 50's, 60's, 70's vintages. R McDonald, 5231 Horton, Mission KS 66202. 913-722-2677.

Audiopak A-2's suitable for reloading. E Ford, KBPK, 321 E Chapman, Fullerton CA 92634. 714-992-7418.

Vintage 7" tape cards & reels, tape not important, Scotch, Audiotape, Irish, Soundcraft, etc. Boxes must be clean & usable, prefer Pre-1960. Especially wanted are audio tape colored reels from 1950's. B Leslie, Pro Recording Srvs, 13709 Maple Leaf Dr, Cleveland OH 44125. 216-662-1435.

TAX DEDUCT EQUIP

Bdct audio eng student in need of old retired audio & test equip. T Backer, 102 E Smith, Herkimer NY 13350. 866-9956.

College station seeks cart machines, TT's, mics & consoles & R-R's for on-air & production. K Fulk, WLHA, Holt Commons, Madison WI 53706. 608-262-1206.

Front line Christian TV station on US-Mexico border needs all types of video/audio equip. S Frahm, KSCE, 614 E Yandell, El Paso TX 79902. 915-542-0038.

Educational station seeks donation of automation equip for training program, will pick up & provide tax letter, need Brain, racks & accessories, repairable's OK. H Espravnik, WVCP, 1360 Nashville Pk, Gallatin TN 37066. 615-451-1640.

VHF/UHF/HF/CB amateur & comm equip desired, also packet controllers, remote based antennas/tower, etc. J Bondon, 10318 Missouri, Los Angeles CA 90025. 213-338-7356.

Need mics, cart machines & consoles. C Riddle, World For Christ Radio, 6046 Greenway Ct, Manassas VA 22111. 703-670-7764.

UPS/Battery back-up generators needed by university amateur radio club, willing to pay shipping for working/useable gear. J Bondon, 10318 Missouri, Los Angeles CA 90025. 213-338-7356.

Alabama A&M Univ seeks donation of radio equip for starting a non-commercial FM station, will issue tax deductible receipt. C Haygood, POB 324, Normal AL 35762. 205-851-5227.

Monte Vista Christian School, would appreciate any donations of used TV broadcast equipment. T Quinn, 408-475-0423.

Eng student desiring donation of old bdct equip (anything)in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

TEST EQUIPMENT

Want to Sell

Potomac RMP-19(204) remote meter panel for AM-19 phase monitor, mint cond, $400. N Winter, 210 W Cota, Shelton WA 98584. 206-473-3462.

Leader LAS-550 test set; Tek 1503 time domain reflectometer; Leader LBO-15 scope; Hitachi 7 MHz battery powered scope; HP 5383 225 MHz freq counter; HP 5384 freq counter; Telewave wattmeters (4); Potomac Instruments FIM-41 field intensity meter; Delta 5 amp meter & transformer; Loftech TS-1 (4); Bird power analyst & 3" flanged line section w/5 elements. Fine Tuning Assoc., 804-873-6832.

Simpson 458 oscilloscope old but in perfect shape w/manual, BO. R Fess, POB 250, Macomb IL 61455. 309-833-5561.

Tek 453 50 MHz oscilloscope w/book & probes, $300; Cushman CE-24A freq selective voltmeter, $1975/BO. R Nelson, Tropical Bdct, 14903 SW 142 St, Miami FL 33186. 305-238-5024.

Leader LDM 171, highly accurate, AC voltmeter/dist analyzer, brand new cond, less than 4 hrs use w/manual, $695. G Finerman, Fintronics, 18 W Maple, Suffern NY 10901. 914-357-5419.

Senior Voltohmist RCA w/AC-DC-ohms probe WC98C, $100/BO; Precision 660 tube & transistor tester, $50/BO; Heathkit IM-4160 FM deviation meter w/NiCad batteries & charger, $50; Heathkit 10-30 5" oscilloscope, needs work, CRT gd, $35; Heathkit IB-1103 freq counter, needs work, BO; Heathkit IM-21 ACVTVM, $35. L Wilson, 409 Hillaire, Hopkinsville KY 42240. 502-886-1678.

Sencore VA-62, NT64, VC-63, PR-57, all like new, $2500. L Clinton, KARN, POB 4189, Little Rock AR 72214. 501-661-7500.

Potomac FIM-21, $1800; Potomac AM-19 4 tower, $2300; Delta RG-3, $2900; (2) ITC 3 deck mono w/tones, $500-700; Belar AMM-1, $450; Belar AMM-3, $550; GR 1931A mod mon, $400. E Burkhardt, WLEE, 121 Wyck, Ste 300, Richmond VA 23225. 804-232-0300.

Potomac AT-51 test set, barely used. Includes carrying case & many accessories, $3500; Nems Clark 120E AM field strength meter, $650. RF Specialties, 206-546-6546.

Want to Buy

Motorola R2001 or R2400 communications system analyzer. C Hoffman, 251 174th St •404, Miami Bch FL 33160.

Motorola R2001 or R2400 communications system analyzer. C Hoffman, 251-174 St, Ste 404, Miami Beach FL 33160.

Bird 4712 in-line wattmeter, 5 kW element, 1 5/8" line. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

GR Telephone CG-3 service instructions/schematic for counter-generator, buy or pay for copy. M Kaplan, Puget Snd, Naval Shipyard, Bremerton WA 98314. 206-476-7419.

McCurdy 14023 extended range audio meter, will consider other devices. J Beahn, 4001 Brandywine St NW, Washington DC 20016. 202-364-3868.

Used field intensity meter; Nems Clark 120 series or RCA WX series; Potomac FIM-21 or 41; used Delta Electronics Operating Impedance Bridge, OIB-1 or OIB-3. N Beaty, 2116 Osman Lane, Greenfield IN 46140. 317-326-3820.

Yamaha DX-27 synthesizer, FM pro model, programmable, MIDI compatible, excel cond, $375. M Osborne WKSQ, POB 9494, Ellsworth ME 04605. 207-667-7573.

TRANSMITTERS

Want to Sell

Sparta 680 solid state exciter on 96.7 MHz, used one time, excel cond, $1200. K Diebel, 1207 Louisa, Rayville LA 71269. 318-728-4915.

McMartin BF 25 kW FM, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Collins 831 D-1 FM 3 kW, excel cond, w/all access & tubes, $6000. P Cahill, POB 400, Wanchese NC 27981. 919-473-3434.

RCA BTA-5T 5 kW AM, gd cond, BO. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Collins 830F 10 kW FM on 98.5, BO. J Stanford, 2228 Gravier, New Orleans LA 70119. 504-822-1945.

Collins 310Z-2 FM Exciter excel cond w/STL interface & extender, will tune to freq, $2000. G Ogonowski, 213-465-3171.

Collins 820 D-1 AM, 1 kW, gd cond, inc all access & tubes, $4000. P Cahill, POB 400, Wanchese NC 27981. 919-473-3434.

QEI 675 FM bdct exciter w/changeable freq & companion stereo gen, $1695/both. B Mountjoy, POB 1240, Elizabethton TN 37644. 615-543-5649.

Will trade 5 kW FM xmtr for 2 to 3 kW FM xmtr. J strongquist, 2816 Haghers, Duluth MN 55811. 218-722-3017.

Harris FM 10H clean, working, w/wo BX 15 exciter, BO/may trade. A Branch, Box 1979, Decatur GA 30031. 404-325-7847.

RCA BTA-521 on 1010 kHz; Collins 21E; Bird Wattwatcher, excel cond, $10,000. S King, 1703 Avondale, Amarillo TX 79111. 806-355-9777.

RCA BTA-56, 15 yrs old, supr cond, stable ampliphase, 5 kW AM, $10,000; Collins 21-E 5 kW AM, $4500. Smokey, KMMC, 1703 Allondale, Amarillo TX 79106. 806-355-9777.

CCA FM 10 DS power supply; CCA FM 10 DS equip rack for exciter & power supply. T Barnes, KRIL, 2735 E 8th, Ste 45, Odessa TX 79761. 915-332-6870.

Collins 831 1 kW FM, hybrid exciter, 4 tubes, excel cond, w/manuals, $7500. W Waldron, KSOS, Layton Hills Mall, Layton UT 84041. 601-546-1722.

Bauer 607A 1 kW w/660 exciter, needs work, complete gd spare xmtr, BO. K Kushnir, Empire Comm, 2120 Bluebell Dr, Santa Rosa CA 95403. 707-545-8300.

CCA FM40E exciter, freq programmable, $1600. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Rockwell Intl 528-0629-001 400 MHz RF amp, new, 60 W, uses 4631-S tube, less pwr supply but otherwise complete, $50. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Harris MS-15 exciter, $2500; TTC X exciter, new, $4500; TTC FM-300J solid state 300 W FM, new, $7500; Sintronic 10 W solid state FM exciter, $850. G Gaskey, KWHO, 261 Main, Ste 6, Weed CA 96094. 916-926-5946.

Harris FM3.5K exciter, on air, excel cond, one spare tube, spare semiconductor parts kits, SOLA constant voltage transformer built-in. J Beatty, WOKZ, 1070 Market Tower, 10 W Market St, Indianapolis IN 46204. 317-236-1040.

Versa-Count V-322 FM translator, 10 W output, tuned for 99.5 MHz input, 92.1 MHz output, AM code identifier built-in, uses F connector on receive input & N female on RF output, gd cond, $1800. TX Valley Translator, 6903 Spring Garden Dr, San Antonio TX 78249. 512-696-5615.

Harris MW5A 10 yr old AM xtmr, new spare final, mint cond, tuned to 1420 kHz, $21000. H Connellan, WACT Radio, 3900 11th Ave, Tuscalousa AL 35402. 205-349-3200.

210/240 V Pri-3000 V 1 A sec plate transformer, $250/BO; 240 V Pri-3000V sec George Sturley plate transformer, BO. M Johnson, KGAL, POB 749, Albany OR 47321. 503-451-5425.

GE 50 kW AM, small size, 3 cabinets mdl BTC-50-C in super clean cond, 1510 kHz, well maintained. J Perez, 315-673-1070.

QEI 645, 7 mos old, avail after 5/20/90, bdct exciter, changeable freq, built-in mod-monitor, mod-control & composite clipper, $4195. K Fitzgerald, WKGB, POB 792, Great Bend PA 18821. 717-879-9925.

TRANSMITTERS . . . WTS

Energy-Onix 25 kW excel cond avail in 90 days, 25 kW only 2 yrs use; Energy Onix FM xmtr tuned to 100.7, ready to sell at a good price, new final tube included. J Bahr, 154 Guajataca St Crown Hills, Rio Piedras PR 00924.

Bird Termaline 8745-677 20 kW water cooled dummy load w/3 1/8" EIA flange, $750. G Liebisch, POB 29521, Raleigh NC 27626. 919-876-0674.

TTC XL-102 FM translators, BO; CSI 100 W amp, BO. Howells Audio, POB 6184, Kingman AZ 86402. 602-753-4915.

Collins 830-D 1000 W, in service w/spare parts, stereo gen to be replaced this month due to pwr increase, $4500. J Anderson, WKCU, 2192 Hwy 72 East, Corinth MS 38834. 601-286-8451.

CCA FM-10D 10 W FM complete w/pwr supply, metering & instruction book, worked when removed, $1000. R Franklin, Super Snd Stds, 211 Virginia, Norristown PA 19401. 215-277-7112.

Energy-Onix MK 15 FM, 15000 W, single phase pwr, 2 yrs old w/CSI EX 20F exciter tuned to your freq, $20,000/BO. P Moore, KXFX, POB 2158, Santa Rosa CA 95405. 707-523-1369.

RCA 10 kW BTA-10H PCB free, completely rewired, $11,000. C Stone, 234 E Meadow, Eden NC 27288. 919-623-9966.

Harris MW-1 1 kW AM in excel cond, on 1300 kHz. M Ripley, KOZE, POB 936, Lewiston ID 83501. 208-743-2502.

Sintronic SI-F-5 5 kW FM w/10 W Sintronic exciter, used 5 yrs, exciter gd, xmtr PA cavity needs work, on 103.5 MHz, you ship, BO. G Savoldi, WCOL, 195 E Broad, Columbus OH 43215. 614-221-7811.

Elcom Bauer 605C 5 kW FM, one tube, single phase, brand new, minor shipping damage, $27,000/BO. V Michael, WHTO, 575A Montgomery Pike, S Williamsport PA 17701. 717-323-8200.

RCA 50 kW BTA-50H excel condition, PCB free, $16,500. C Stone, 234 E Meadow, Eden NC 27288. 919-623-9966.

Bext Demos, sale, full warranty: 20W exciter & 500W amplifier. Bext, 619-239-8462, Fax: 619-239-8474.

LPB TX2-20, LA 2-20 complete carrier current system w/20W xmtr, 20W linear amp, includes limiter board, T-8 power line interface, manuals, 600kHz, excel cond, $900/BO. T Wood, 404-791-3782.

Want to Buy

250-1 kW amp to go w/TE3 exciter, 93.1 MHz, old but in gd cond. K Browall, Box 808, Riverton WY 82501. 307-856-2922.

Modulation transformer 300 to 1000 W, prefer multimatch type similar to CVM-5. C Iannace, 239 St John's Ave, Yonkers NY 10704. 914-476-2172.

AM transmitter 500 to 1000 W, will take old Gates, Collins, RCA. C Iannace, 239 St John's Ave, Yonkers NY 10704. 914-476-2172.

For standby 1 to 2.5 kW FM. B Stuart, 3015 Johnsonville Rd, Susanville CA 96130. 916-257-2121.

Translator any 10 W. J Strongquist, 2816 Haghers, Duluth MN 55811. 218-722-3017.

RCA BTE-10C schematic &/or service manual for exciter. J Woddell, 1412 Mohave, Parker AZ 85341. 602-669-2483.

FM 20 or 25 kW. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

RCA BTA 1S or similar AM xtmr, for missionary radio station, gd cond. L Amstutz, 4526 Arlington, Fort Wayne IN 46807. 219-429-8366.

FM xmtr, 250 W or less or FM RF amp w/100 W output, exciter/stereo gen not needed. M Ross, Box 550369-101, Dallas TX 75355. 214-348-2618.

AM, 2.5 kW in gd cond, will consider 5 kW. A Terry, WODY, Box 545, Bassett VA 24055. 703-629-5900.

Any 40-200 W VHF or 1-2 kW UHF xmtrs, top prices, finders fees. J Worrall, 4618 Gabriel Dr, New Orleans LA 70127. 504-241-6634.

Harris/Collins 5 kW AM, must be in gd cond. R Merrill, WZKY, POB 2639, Gulfport MS 39505. 601-832-5111.

FM 3-5 kW, grounded grid, McMartin or CCA preferred. E Sutton, WOKI, 1900 Winston, Knoxville TN 37919. 615-531-2000.

Wanted late model 1 kW UHF LPTV xmtr, close to VHS channel 43. J Bahr, 154 Guajataca St Crown Hills, Rio Piedaas PR 00924.

FM 500-1000 W w/wo exciter, stereo solid state preferred. L Maierhofer, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Spare parts for Gates BC-1T xmtr & parts for Rust model OC and IC remote control units. Jim or Dale, WXEE, 304-436-4191.

3K or 6K xmtr for Class A station, STL link, remote control, other related equipment. A Stevenson, 312-975-9682.

RCA BTA-1R or equiv AM 1 kW xmtr. L Afflerbach, CTC Media, 5550 Sterrett Pl, Columbia MD 21044. 301-621-5045.

McMartin AM/FM xmtr, any model, exciter or stereo modules. Goodrich Ent., 11435 Manderson, Omaha NE 68164. 402-493-1886.

McMartin older B-910 FM exciter. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

TUBES

Want to Sell

Tubes, 1000's have receiving & amp number your looking for, some transmitter tubes too, $2most. A Branch, Box 1979, Decatur GA 30031. 404-325-7847.

Eimac 4CX1000A, new in box, $500/BO. K Kushnir, Empire Comm, 2120 Bluebell Dr, Santa Rosa CA 95403. 707-545-8300.

Eimac 4-500 A's for AM McMartin xmtr, 1000 hrs, $150 per tube; tube transformer for 4-500 A tubes in McMartin 1 kW AM, new. T Noordyk, WSHN, POB 190, Fremont MI 49412. 616-924-4700.

Various inventory of electron tubes including (2) 813; 845; OD3; (2) IR5; (4) IT4; 885; (3) 6J7; 5R4; (5) 5AR4; (2) 5V4; (2) 6J5 & many more, $2/ea. M Johnson, KGAL, POB 749, Albany OR 47321. 503-451-5425.

Penta Labs Super Premium output tubes w/increased plate dissipation, new w/warr, individually tested, KT88, $18; EL34, $9, quantity discounts avail. R Katz, Allegro Snd, 15015 Ventura, Cherman Oaks CA 91403. 818-377-5264.

3CX1500A7, 4CX5000A, 6146B, 4CX2508, 4CX3000A & more. We carry large inventory all major brands, Eimac, Amperex, RCA, etc. Call Stew 1-800-842-1489.

Want to Buy

Information on a 5736 power tube, maximum ratings, pin out, etc. D Kerl, WHHI, 3319 W Beltline Hwy, Madison WI 53713. 608-273-6919.

Tubes wanted, 6072/6072A, no RCA, need 1000 pieces. R Katz, Allegro Snd, 15015 Ventura, Sherman Oaks CA 91403. 818-377-5264.

TURNTABLES

Want to Sell

Technics SL1200 MK2 (2) less than 2 yrs old, gd cond, incl Audio-Technics cartridges, $250/ea, $400/both. G Elliot, POB 2288, Huntington WV 25701. 304-525-7788.

QRK 12" TT's (2) w/new motors, Rec-O-Kut arms, Ramko preamps, $100ea; complete, (2) Technics SP-10 Mk II TT's w/EPA-500 tonearms & Ramko preamps, w/walnut finished double insulated sandboxes, $700/ea. J Swett, 4025 Lugano Way, Flagstaff AZ 86004. 602-526-1975.

Stanton 310B stereo phono preamp, brand new, BO. R Sundell, POB 734, Upland CA 91786. 714-985-0701.

Russco Studio Pro Model 1B (2) both w/Micro-Trak tone arms, $200/ea. plus shpng. M Hagens, 1705 N Queensbury, Mesa AZ 85201. 602-962-7130.

Record recording amp for Presto cutter. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

Sharp DX-100, Philips 212 & CCA CCA12-72. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Stanton 681EE calibration standard cartridge/stylus & (3) new D6800EE replacement stylus assemblies, new cond, $75. D Zimmer, 3055 N Tyndall Ave, Tucson AZ 85719. 602-623-2933.

Technics SL-1200MK2 (2) stereo TTs w/needles/carts, perfect cond, $600/both. B Coleman, POB 460, Lobelville TN 37097. 615-593-2978.

Gates 16" TT w/16" Micro-Track tone-arm, BO. J Sidote, POB 949, Welch WV 24801. 304-436-2131.

Want to Buy

RCA, Presto, etc. 16" disc recorders, & recording blanks any size, recording needles any type, pre-recorded discs. W Davies, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

WE, RCA, others, arm pickups, TT's, recorders, amps, blank recording discs, literature, 16" transcriptions. R Van Dyke, Caffrey House, Squires Ave, E Quogue NY 11942. 516-728-9835.

Presto 6N cutter. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

TV FILM EQUIP

Want to Sell

Spindler-Sauppe S-32B used on multiplexer, w/lens, mounting plate & manual, $500/BO. P Wagenschein, Baylor University Division Telecom, 1218 S Third BU Box 7368, Waco TX 76798. 817-755-1511.

16mm interlock system, B&H mag/optical projector, (2) 16mm mag R/P, Selsyn drive system & racks, $1500/BO. R Barwig, Barwig Recording, 5254 W Agatite, Chicago IL 60630. 312-283-2820.

B&H JAN 614 EVMS lightweight pedestal mount 16mm magnetic & optical sound telecine projector, complete w/manuals, vgc, $425. G Ormrod, GFO Prod, 432 East X St, Tumwater WA 98801. 206-352-8028.

Want to Buy

35mm telecine projector east coast area. A Weiner, 14 Prospect, Yonkers NY 10705. 914-423-6638.

VIDEO PROD EQUIP

Want to Sell

Sony DR-10 intercom headsets, excel cond, TRS Connector, $60/ea. D Haggadone, 1039 Jenne St, Grand Ledge MI 48837. 517-627-4537.

JVC CP-5000U 3/4" video player with RF output, $595. B Hines, RD 1 Box 413A, Export PA 15632.

Otari EC-201 hand held time code reader, $250. P Cibley, 138 E 38th, New York NY 10016. 212-986-2219.

VIDEO PROD EQUIP . . . WTS

Quanta Microgen MG-100B SIO, 256 colors, 50 page memory, 9 speed rolls & crawls, RS-232 I/O port, character edging & much more, $1595. B Hines, IPS, RD 1 Box 413A, Export PA 15632. 412-468-4115.

Quanta Microgen MG-100B title generator, 256 colors, 9 speed rolls/crawls, 50 page memory, auto page sequencing, character editing, line by line color, RS-232 I/O port for computer hook-up, excel cond, $995. B Hines, RD 1 Box 413A, Export PA 15632. 412-468-4115.

Sony VCR-4 telecine adapter, high resolution uniplexer for film to video transfer, gd cond, $50; Froehlich 190-300 stereo video control center-interconnect, (3) VCR's & (4) audio sources, lighted passive switches, audio volume control, $75. W Watrous, 739 S Orange, Sarasota FL 34236. 813-366-3316.

Sony VO5850, VO5800, ECS 90, BVU-800, BVW15. M Mehalko, 201-361-1917.

Sony SL-HF300, Panasonic BT-S1300 & MIT 2000. E Boucher, EAB Recdg, POB 958, Lewiston ME 04243. 207-786-3476.

Sony AVC-3260DX B&W w/monitor viewfinder, $100; JVC RM86U control trk editor/controller, $850; Videotek KV1365 12" color video monitor, w/blue gun, $250, plus shipping for each. M Holwin, Anamnesia Studios, 49 S Oxford, Brooklyn NY 11217. 718-852-7630.

3M 5110 & 5120 downstream keyer w/borders, outlines & matte generators for matte fills, BO. G Spiller, BES Teleproductions, 6829 E Atmore, Richmond VA 23225. 804-276-5110.

Sony FCG-700 frame code generator, new in box, $1000; JVC LP-101 digital audio proc, $1000. R Lawrence, Moonshadow Video, 4280 Reston, Roseburg OR 97470. 503-679-8966.

Sony PVM-8221, new 8" super fine pitch high resolution monitor, $400. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Laird/ICM VC 2000P video processor, $800. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Sony EVS-700V 8mm video/audio cassette recorders, gd cond. B Weiss, KJLA, 3435 Broadway, Kansas City MO 64111. 816-753-7707.

Custom Design remote studio. w/(2) JVC 110 cameras, control units, multi-core cable, Panasonic switcher, (3) B&W monitors, Shure mixer & much, $10,000. M Bacon, 216-467-3037.

Quanta Microgen-100B-SIO video titler w/258 colors, 50 pg memory, 9 speed rolls, crawls, RS-232 I/O port, character edging & more, like new, $1195/BO. B Hines, Rd 1 Box 413A, Export PA 15632.

VTA Wiz color correction computer for Bosch FDL-60 B2 telecine, BO; Nagra/Ampex VPR-5 1" portable VTR, new $13,000; Stuart 8" floppy drive for Boxx/Alpha audio system, never used, $2000. D Schlegel, SSI, 7155 Santa Monica, Los Angeles CA 90046. 213-874-9344.

Panasonic AG-A750 editing controller w/cables & instructions, mint cond, used 5 hrs, $575. Chief Engr, Vidcom Consultants. 412-327-1333.

CBS 5500A color corrector, chroma keyer 7000, image enhancer 8000 MK III, plus 5500 sensor, BO. J Phillips, WZOM, 408 1/2 Clinton St, Defiance OH 43512. 419-784-1059.

Convergence Model CI-90 time code reader & burn in unit, excel cond, $382. Chief Engr, Vidcom Consultants. 412-327-1333.

Zenith video projector w/10' motorized screen, Panasonic WV-F2 remote camera, $5500. B Hull, WDIX, POB 741, Mt Airy NC 27030. 919-786-4675.

Panasonic Model WJ-810 time/date generator plus stop watch function, excel conc, $250. Chief Engr, Vidcom Consultants. 412-327-1333.

Chyron IIIB w/all avail fonts, many discs, gd cond, in service, $2000/BO. T Turk, Travis Turk Prod, 518 Macfie Ct, Madison TN 37115. 615-255-7787.

VIDEO TAPE RECORDERS

Want to Sell

JVC CR4400U 3/4 port recorders (4) w/access, $800 ea/BO; (3) Sony RM-430 edit controllers, $500/BO; JVC BR-6400U VHS recorder, $1500/BO. T Quinn, Monte Vista Std, 208 Cherry, Capitola CA 95010. 408-475-0423.

Ampex 1" VPR-20 w/AC power supply, battery charger, case, $16000. N Lindquist, POB 14920, Columbus OH 43214. 614-888-4788.

JVC CR-4700U 3/4" portable recorder w/AAP47U AC pwr supply/charger, (3) NiCads, custom case, (20) KCS-20 tapes, excel cond, $1895. B Hines, IPS, RD 1 Box 413A, Export PA 15632. 412-468-4115.

Sony VO-2610 U-matic gd cond, $600. A Allegra, 1380 Valley Forge, Lansdale PA 19446. 215-368-4444.

JVC 3/4" CR-6060U w/remote control, $600. N Lindquist, POB 14920, Columbus OH 43214. 614-888-4788.

JVC editing system excel cond, low hrs, w/665OU player, 8650 recorder & RM 86U edit controller, cables & (2) NEC 12" color monitors, $4250/BO. D Haggadone, 1039 Jenne St, Grand Ledge MI 48837. 517-627-4537.

RCA HR-Z, Panasonic AU-200, M-Format, bdct quality, portable & editor, both excel cond, w/TBC, $3500. D Lahey, 17094 McGuffie, Salinas CA 93907. 408-663-5192.

JVC CR6600 3/4" R/P, BC plus shipping. M Holwin, Anamnesia Studios, 49 S Oxford, Brooklyn NY 11217. 718-852-7630.

Sony AV 3600 1/2 " B/W R/R (2), $200. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

Panasonic AG-6400 hi-fi VHS portable deck, (3) new batteries, charger, hard case, $1600; Panasonic AG-1950 stereo hi-fi VHS edit system w/AG-95 edit controller, $1600 or all for $3000. R Lawrence, Moonshadow Video, 4280 Reston, Roseburg OR 97470. 503-679-8966.

Sony EV-S700U 8mm, PCM digital audio, low hrs, $500. M Maciejewski, WMUS, 3565 Green St, Muskegon MI 49441. 616-744-1671.

Sony VO-2610 3/4" R/P, audio dub, excel cond. $550; Sony VO-2600 3/4" R/P, audio dub, $550. R Jensen, Racine Telecable Corp, 5812 21st, Racine WI 53406. 414-632-3131.

Sony VO6800 remote 3/4" w/Porta Brace case, excel cond, $1800. M Bacon, 216-467-3037.

Panasonic NV 3020 1/2" R/R (3). $300. D Hurd, Box 853 Station A, Searcy AR 72143. 501-279-4658.

JVC 4400-LU 3/4" portable deck, like new; (2) Sony 2860 3/4" decks w/RM-400 edit controller; (2) Sony SLO-323 Beta I industrial decks; RCA TR-22HB quad w/headwheel panel, BO. G Spiller, BES Teleproductions, 6829 E Atmore, Richmond VA 23225. 804-276-5110.

JVC CR-850U (3) 3/4" broadcast recorders w/address trk time code, have time-code readers for machines but not in machines, $6000/ea. A Baker, 804 E 38th St, Indianapolis IN 46205. 317-925-7371.

Sony VO-2610 3/4" R/P, audio dub, excel cond. BNC I/O, still adj, $550. R Jensen, 5812 21st St, Racine WI 53406. 414-632-3131.

Sony BVU-110, gd cond, $1000 ea: BVJ-50, gd cond, $600/ea; BK-112 time code generators, $400/ea; blank tapes, all formats; Beta breakaway cables. Ugly George Satellite TV, 314 W 52nd St, NYNY 10019. 212-677-2200.

JVC CR6600U 3/4" recorder. feeder deck for JVC edit system, low hrs, nice shape, new drum, $950. J Kreines, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Sony VO-2600 3/4" R/P, audio dub, excel cond, $550. R Jensen, 5812 21st St, Racine WI 53406. 414-632-3131.

Sony VO-2610 3/4" R/P, w/RF pack $500; Panasonic NV9100A 3/4" player, $350; (2) Sony VO-2600 3/4" R/P, $450/ea, plus $25 shipping for ea item. N Mishaan, POB 335 Lynbrook NY 11563. 516-582-1338.

Want to Buy

Panasonic NV-9600 edit source deck. J Andrist, Box 273, Omak WA 98841. 509-826-3340.

RCA TR-4, Ampex VR-2000 to pick-up. East Coast area please. A Weiner, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

Panasonic AG-7400A S-VHS portable; JVC BRS-410U dockable S-VHS recorder; S-VHS A Series editing system; 16:1 lens for JVC BY-110 camera w/rear controls. R Lawrence, Moonshadow Video, 4280 Reston, Roseburg OR 97470. 503-679-8966

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
A. Commercial AM station
B. Commercial FM station
C. Educational FM station
E. Network/group owner
F. Recording studio
G. TV station/teleprod facility
H. Consultant/ind engineer
I. Mfg, distributor or dealer
J. Other _____

II. Job Function

A. Ownership
B. General management
C. Engineering
D. Programming/production
E. News operations
F. Other _____

WTS: ☐ WTB: ☐ Category: _____

Make: _____ Model #: _____

Brief Description: _____

_____

_____

_____

Price: _____

WTS: ☐ WTB: ☐ Category: _____

Make: _____ Model #: _____

Brief Description: _____

_____

_____

_____

Price: _____

WTS: ☐ WTB: ☐ Category: _____

Make: _____ Model #: _____

Brief Description: _____

_____

_____

_____

Price: _____

Broadcast Equipment Exchange

703-998-7600 **PO Box 1214 • Falls Church VA • 22041** **FAX: 703-998-2966**

WE SURPRISED OURSELVES!

AUDIOARTS® A-50 RADIO CONSOLE!

We wanted to know if it really was possible to build a high quality low-cost radio console. We found the answer to be quite exciting! We've come out with the A-50 console and even given it its own trade name: AUDIOARTS. This console comes complete with machine control functions; individually programmable channel logic; program, audition and telephone outputs; control room and studio monitors; as well as headphone and cue power amplifiers. It's also designed so you can expand or add accessory modules as your needs grow.

The A-50 is cost effective through clever engineering and the latest advances in electronic assembly procedures. It was developed by the same design team that creates our other high end equipment. Its performance is light years beyond the competition.

Imagine the benefit that our major market experience can bring to your station. Take advantage of Wheatstone's expertise and reputation. Call us today for immediate action!

Wheatstone® Corporation

6720 V.I.P. Parkway, Syracuse, NY. 13211 (TEL 315-455-7740 /FAX 315-454-8104)

Circle 80 On Reader Service Card

Many of the headaches associated with building a new studio were eliminated with the WHEATSTONE pre-wire package. Set up and wiring of WAZU was a breeze. The furniture is solid and good looking, quick and easy to assemble—many hours were saved. Our jocks love the easy straight-forward layout of the new A-500 air console... and, after a quick and easy production room installation, little time was needed teaching the staff how to use the new multi-track studio; operators familiar with an on-air console adapt themselves easily to the SP-6 stereo console and the easy ways to insert special effects and audio processing—operation is so simple!"

John Soller, chief engineer at WAZU

Radio is Starting to Experience a Shortage:

Technical Experts

Let our experts supply your prewired studio, consoles, studio furniture and audio system engineering. We'll help with your design, then build, wire, test and document your whole studio furniture installation—all at our factory. This takes a *major* load off your technical people and ensures project completion on time.

When Osborn Communications decided to upgrade member station WAZU in Dayton, Ohio, they chose WHEATSTONE for the job. With 12 rooms of Wheatstone consoles already installed, the Osborn people are well qualified to vouch for our commitment to client satisfaction.

Draw on our experience and reputation. Get a great looking studio with cutting edge performance. Contact WHEATSTONE—the experts!

Wheatstone® Corporation

6720 V.I.P. Parkway, Syracuse, NY. 13211 (TEL 315-455-7740 /FAX 315-454-8104)

Circle 101 On Reader Service Card