

## NTIA Study Urges Multimode

by Alex Zavistovich

Washington DC ... In its long-awaited AM stereo report, the National Telecommunications and Information Administration (NTIA) has suggested that AM stereo receivers should be made compatible with both Kahn's ISB and Motorola's C-QUAM systems, as opposed to recommending a single transmission standard.

The decision was made in an NTIA study titled, "AM Stereo and the Future of AM Radio," released 10 February. In it, the NTIA determined that the "best way to achieve compatibility" would be to increase the number of radios which can receive in stereo both the ISB and C-QUAM signals.

Five years ago, the FCC opted against selection of a single transmission standard, as part of its philosophy of allow-

ing the marketplace to make such decisions. The NTIA likewise avoided such a recommendation in its recent report.

NTIA Assistant Secretary for Communications and Information Al Sikes said his organization, which sets telecommunications policy for the executive branch, did not favor a single AM stereo standard because of "unacceptable costs." To institute a standard, he said, would call for a new round of testing and a full-scale administrative procedure.

Ensuing litigation over a single standard, in addition to the procedural obstacles, could further "stalemate the market," possibly for years, he indicated.

The NTIA report said that "the most direct way to break the current market deadlock would be to ensure compatibility between AM stereo stations and AM stereo receivers."

The report went on to say that "such

compatibility can be achieved most efficiently through increased utilization of multisystem receivers."

### Testing technical viability

As part of the the NTIA's support of receiver compatibility, its Institute for Telecommunications Sciences, in Boulder, Colorado will test the "technical viability" of an automatic multisystem chip for AM receivers. Letters have been sent to Motorola, Kahn-Hazeltine and AM stereo receiver manufacturer Sanyo urging participation in the project, Sikes said.

At press time, Sanyo could not be reached for comment on whether it intended to participate in the testing. Motorola's Frank Hilbert, manager of AM stereo, said his company has decided to take part, but had not established the degree of its involvement.

Leonard Kahn, president of Kahn Communications, told RW that he intends to participate fully in the NTIA's study of multisystem capability.

Sikes noted that although the multimode systems have been said to cause degradation of the AM stereo signal, if testing proves otherwise, the NTIA will petition the FCC to protect the C-QUAM and Kahn pilot tones from interference, similar to the way the Commission protected the BTSC system's pilot frequency for TV stereo.

Hilbert disagreed with the NTIA's conclusion that a stalemate exists in the AM stereo market. He added that it was difficult to comment on the NTIA's proposed actions because to do so would be to accept the statement as true.

Still, Hilbert indicated that multisystem receivers would ultimately be a less economical solution to the dilemma than having a single system. He said that multisystem chips have been undergoing market tests "for some years," citing that National Semiconductor, NEC, Sony, and Sanyo each have experimented or are working with the chips.

These chips have been shown to be "quite a failure," Hilbert said. "The receptivity of the single system is obvious by comparison."

However, Kahn maintains that multisystem AM stereo receivers can be manufactured in a satisfactory way.

"We have built inexpensive modules that convert Motorola-only radios such as the Delco car radio to automatic switching multisystem radios that do not in any way degrade the performance of the Motorola decoder and provide excellent performance for the Kahn-Hazeltine system," Kahn said.

Sikes said he expected chip testing will take no more than ninety days. If the multisystem chip is proven not to be "a

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## Group to Examine FM Issues

by David Hughes

Washington DC ... In an effort to prevent the "AM-ization" of the FM band, the NAB has formed a subcommittee to explore improved FM transmission.

The workability of the FMX system and possibility of Class A power increases will be hot topics at the group's first meeting, slated for late February.

The FM Transmission Subcommittee will parallel the AM band improvement work being conducted by the NAB and the National Radio Systems Committee (NRSC), according to NAB engineer Mike Rau, a member of the new group.

"This will be similar to AM improvement," said Susquehanna Broadcasting VP/Engineering Charles Morgan, another member. "We'll look at it in the same manner: is there anything we can do to improve the overall state of FM?"

### FMX to be examined

High on the subcommittee's agenda is the new FMX stereo extension system, according to Rau, who is coordinating the subcommittee's activities. "We will try to supervise the implementation of FMX and determine whether it is compatible with existing receivers."

Tom Keller, VP/engineering with the NAB, co-developed FMX with Emil Torick, formerly of the CBS Technology Center and a subcommittee member.

FMX research was dealt a setback in late 1986, when CBS closed its Stamford, CT-based technology center, which was conducting research on the system.

CBS still houses the FMX project, however the NAB has been looking for another partner.

Keller told RW in early February that a new FMX partner to replace CBS could be announced by late February or early

March. He also said details of new FMX tests would be released at the NAB show in Dallas 27-31 March.

### Class A questions

The new subcommittee will also address the questions surrounding a much talked-about proposal for an across-the-board increase for Class A FM facilities.

Clear Channel Communications CE John Furr, another subcommittee member, said his firm plans to submit a rule-making proposal to the FCC in the near

future requesting a raise of the Class A power limit from 3 kW at 100 m HAAT (or the equivalent) to 6 kW at 100 m HAAT. He said no date for the petition's filing has been announced.

The subcommittee, Furr added, will discuss the blanket Class A power increase plan, along with the FCC's decision in late December to remove the 3 kW/100 m power equivalent restriction on the 20 reserved Class A channels.

Furr and other Class A proponents say

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### AM Stereo

The FCC has not yet responded to a request filed in September 1986 by Texar Inc., asking it to choose an AM stereo standard. The petition does not say which system—the Kahn-Hazeltine ISB system or Motorola's C-QUAM system, which has a greater number of stations—the FCC should select.

In the petition, Texar maintained that receiver manufacturers are experiencing slow sales due to consumer confusion about the two systems. More receiver manufacturers make C-QUAM-only radios.

However, FCC Mass Media Bureau Chief James McKinney said he doubts the Commission will abandon its "marketplace" approach on the AM stereo issue. He said broadcasters must decide which standard will survive, noting that only about 10% of all US AM stations have gone stereo.

In other news, a petition calling for the Commission to require that all AM stereo receivers be equipped with a multimode chip was filed by Press Broadcasting in November 1986.

Future FCC action on any AM stereo issue has awaited the release of a National Telecommunications and Information Administration (NTIA) report on the overall state of AM radio, particularly AM stereo, which was released 10 February. For details on the NTIA study see the article in this edition of RW.

William Hassinger, McKinney's engineering assistant, said the FCC will respond to the two petitions in the near future. But he doubted that the FCC will reopen the AM stereo docket, which he and McKinney maintain could be a time-

consuming process that might actually delay AM stereo further.

Contact William Hassinger at 202-632-6460.

### User Fees

Approved in December 1986, the FCC's new user fee policy is scheduled to go into effect 1 April, said Brent Weingardt, FCC management planning office.

Regarding broadcast services, charges will include \$2,000 and \$1,800 for major CPs by AM and FM stations, respectively. Minor CPs would carry a fee of \$500; AM licenses, \$325.

Docket number is GEN 86-285. Contact Brent Weingardt at 202-632-3906.

### Arizona Waivers

In comments filed with the FCC in December and January, broadcasters favored the FCC's October 1986 proposal to modify or eliminate its main studio and studio origination rules in response to a June petition from an ad hoc group of 14 radio licensees calling itself the Arizona Justice Committee (AJC).

The rules, now in question, were intended to ensure that a local community had access to a station's main studio. Stations can obtain an "Arizona waiver" to build studios outside their city of license if they provide at least 51% of their public affairs programming from within the city of license. Pre-recorded music programming is exempt.

The AJC, with the support of the NAB and other broadcasters, has complained that the rules are outdated. It said technological advances, such as remote facilities and satellite links, have made the term "main studio" useless and vague.

Broadcasters, the AJC added, do not need a "government mandate" to locate their studio where they can best serve their community.

The rule changes involve sections 73.1125 and 73.1130. FCC docket number is MM 86-406. FCC action is expected in late winter or spring. Contact Terry Haines at 202-632-7792.

### AM Daytimers

In December 1986, the FCC imposed a freeze on the acceptance of applications for new AM daytime-only facilities. While the action involved a "temporary freeze," the Commission said it was considering issuing a rulemaking to institute a permanent freeze.

The freeze, which was issued to help reduce AM band clutter, does not affect pending daytimer applications, the FCC added.

In other news, in January the FCC proposed a plan that would establish a 50 W minimum power pre-sunrise authority (PSA) power level to aid daytimers that will lose a key hour of morning drive time in April, when daylight savings time (DST) is extended three weeks.

According to Louis Stephens of the Mass Media Bureau's International Branch, the proposal could be approved this spring, in time for the DST start on the first weekend of April.

For information on the daytimer applications freeze contact Lenore Cunningham at 202-632-6485. For details about the 50 W PSA limit plan, which is contained in docket MM 87-3, contact Louis Stephens at 202-254-3394.

### Synchronous Transmitters

In January, the FCC said it was asking for comment on whether synchronous transmitters should be used to extend AM signal coverage, as an alternative to station power increase or antenna redesign.

Synchronous transmission, which uses two or more transmitters on the same frequency broadcasting the same material, causes "negligible or no interference to adjacent or co-channel stations," according to Bernard Gorden, Mass Media Bureau staff engineer.

The FCC said it is investigating several issues regarding synchronous transmitters, including technical standards, interference protection criteria, and possible distortion from frequency or phase synchronization. It is also studying the use of nighttime synchronous transmitters for reduction of skywave interference and treatment of transmitters under multiple ownership rules.

Several construction permits have been issued by the FCC allowing AM stations, such as KROL, Laughlin NV and KKOBB, Albuquerque NM, to begin experimental synchronous transmitter operations. Approximately a dozen stations have applied for permission to operate the equipment.

The comment deadlines has not been set at press time. Contact Bernard Gorden at the FCC: 202-632-7792.

### Spectrum Auctioning

Common carrier and private radio licenses may soon be assigned by FCC auction instead of comparative hearings or lotteries, according to the Reagan administration's 1987 budget, which was released in January.

The auctioning plan proposed in the budget will not affect licenses in mass media, public safety or amateur services. It will, however, affect unassigned spectrum in such non-mass media as cellular communications, multiple address and low power television.

Auctioning of nonbroadcast spectrum was originally suggested to Congress in October 1986 by outgoing FCC Chairman Mark Fowler, who said the practice could generate revenue for the US Treasury and expedite the licensing process.

FCC Office of Plans and Policy Chief Peter Pitsch noted that the FCC does not have authority to consider mass media license auctions.

Contact the FCC's Office of Plans and Policy: 202-653-5940.

### RF Radiation

At press time, the FCC had planned to address the categorical exclusion of certain transmitters from environmental evaluation of RF radiation at its meeting 12 February.

Services to be considered for exclusion are low power or intermittently operating systems, including land mobile, microwave domestic radio and cellular communications, said Robert Cleveland, a physical scientist at the FCC's Office of Engineering and Technology.

The topic of exclusion was first presented in an FCC notice of proposed rule making issued in March 1985, Cleveland said. For more details see the 15 March issue of RW.

In related news, results of a joint FCC-Environmental Protection Agency (EPA) survey of RF radiation in Portland, OR, show that exposure levels "compare favorably" with the protection guide established by the American National Standards Institute (ANSI).

FM broad-and narrow-band measurements made at Portland's Healy Heights antenna farm in late July 1986 indicated that the highest power density in the area was less than 700  $\mu\text{W}/\text{cm}^2$ . The ANSI guideline, used by the FCC to determine RF-based environmental impact, recommends a maximum density of 1,000  $\mu\text{W}/\text{cm}^2$  at FM frequencies.

According to the FCC results released in February, typical RF levels at homes near Healy Heights were well below 100  $\mu\text{W}/\text{cm}^2$ . Magnetic fields exceeding the ANSI guideline were found near AM antenna tuning coils, but the report pointed out that the public would not

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# AM Study Backs Multisystem

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viable solution to the AM stereo question," the NTIA said, "we would expect the market to coalesce around one of the two systems."

## Industry reaction

The FCC has been waiting for the NTIA report before ruling on two AM stereo petitions submitted late last year.

Texar, Inc. petitioned the Commission last fall, urging the selection of a single transmission standard. Glen Clark, President of Texar, declined to comment on the NTIA decision.

Clark said he submitted the petition in response to manufacturer's complaints of slow AM stereo receiver sales which he maintained was caused by the lack of a single AM stereo transmission standard.

Press Broadcasting, owners of C-QUAM station WJLK, Asbury Park, NJ, petitioned the FCC in November 1986 to issue a statement that all AM receivers be multimode. The petition maintained

that "the current stalemate over AM stereo standards has not served the public interest; neither broadcasters nor manufacturers."

Press VP/Broadcasting Robert McAllan was encouraged by the NTIA statement, saying his company supports "any proposal which would alleviate the log jam in AM, to make it competitive with FM."

The NTIA study, which considered data from 931 AM stations and 26 receiver manufacturers, showed a reluctance by AM stations to broadcast in stereo because of lack of receivers.

Second to a lack of receivers, the reason cited most often by broadcasters for not converting to stereo was a fear of choosing the wrong system.

Receiver manufacturers were likewise reluctant to produce receivers, Sikes said. The companies noted that, besides a lack of buyer demand, only 10% of AM stations broadcast in stereo.

But Motorola's AM Stereo Broadcasting Manager Chris Payne noted that

"over the past two years, C-QUAM has gone up by 200 stations." He noted that the trend in the marketplace is "clearly not in the direction of multisystem receiver, but C-QUAM, both in broadcast use and receiver manufacture."

Payne rejected the notion of a stalemate in the market. He said NTIA's decision was "like being in the eighth inning of a ball game, the score is 30 to 1, and NTIA decides to put its money on the team that has 1."

The trend toward C-QUAM is growing, although not as quickly as Motorola would like, Payne said.

Eb Tingley, VP/Engineering for the Electronic Industries Association, a group representing receiver manufacturers, pointed out that "the key is to have more (AM stereo) broadcasters on the air."

"The main problem is that there are not enough stations on the air for retailers to promote and market AM stereo receivers," Tingley said. He added that there is "no assurance in a given area that a person who purchases an AM stereo receiver will be able to use it."

Sikes stressed that government cannot assure the survival of AM radio. He added, however, that some federal actions have allowed high fidelity FM service to develop, while AM has not.

"Government should create an

environment where AM stations can compete at a state of the art level," Sikes said. "A strong competitive AM radio business is important if we want to continue substituting reliance on market forces for intrusive regulation in broadcasting."

NTIA plans to initiate talks with other countries active in AM improvement, such as Japan, Canada and Brazil, to determine how to advance US AM stereo, he said.

The agency will also petition the FCC to open an inquiry into the use of the 1605-1705 kHz of additional spectrum allocated for AM service, Sikes added. Problems of spectrum crowding in AM might be resolved through the use of the extra bandwidth, he noted.

The NTIA's decision was enthusiastically supported by Kahn, who said, "We're delighted that the NTIA has now reconfirmed the government's support of free competition."

"I hope that Motorola will graciously accept the fact that they have failed in their attempt to gain a de facto monopoly and join Sony and Sanyo in the development of multisystem integrated circuits," he said.

For additional information, contact Kahn at 516-222-2221, Motorola at 312-576-3495, the EIA at 202-457-4975 or the NTIA at 202-377-1551.

## Excerpts from NTIA Report on AM Stereo:

- After some initial success, the market has become almost paralyzed by confusion and uncertainty. ●●
- The most optimistic and encouraging news is that there appears to be a substantial possibility of a hardware solution to the AM stereo problem. ●●
- ... market share alone does not necessarily reveal the existence of a de facto standard, especially if most market participants have not yet chosen. ●●
- If, on the other hand, the multisystem chip does prove viable, we will petition the Commission to initiate a rulemaking to protect the C-Quam and Kahn stereo pilot tones ... ●●
- Use of the multisystem chips would effectively eliminate the market uncertainties resulting from the existence of two incompatible stereo transmission systems while preserving the benefits to be derived from continued competition between them. ●●

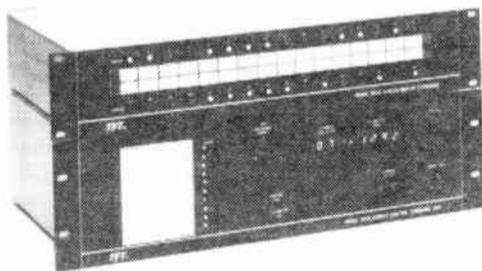


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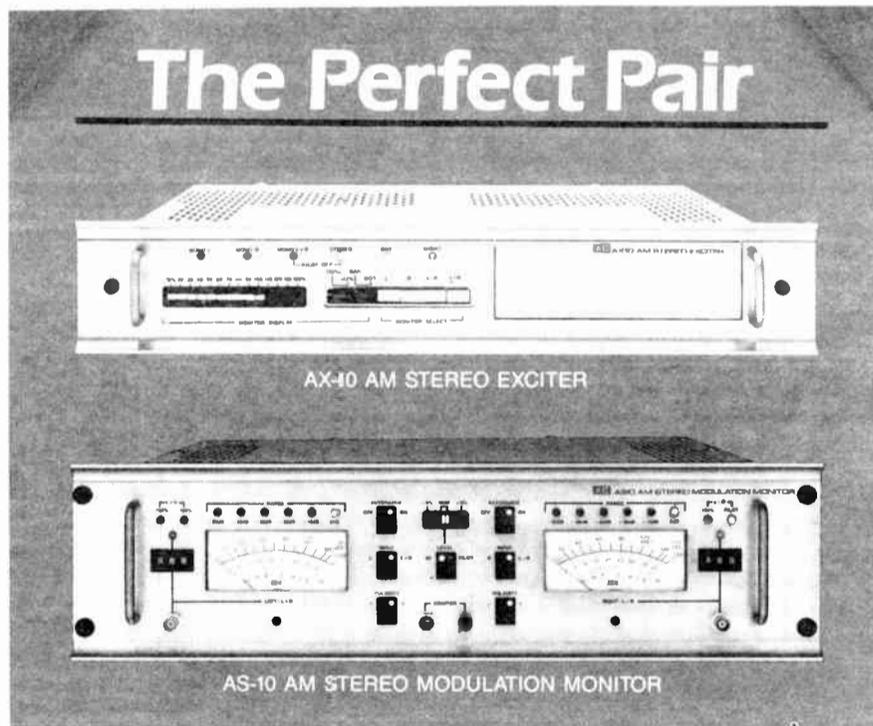
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# Antenna Site Nix Overturned

by Alex Zavistovich

Washington DC ... After an initial rejection from the county planning commission, the NAB on 17 February received a "special exception and commission" from the Loudoun County Board of Supervisors to use county land as a test site for an experimental AM broadcast antenna.

In November 1986, county planners had denied the NAB a waiver of zoning ordinances prohibiting large structures from being built on agricultural land. The association subsequently met with the board at a 9 February public hearing to appeal the decision, which was overturned by a vote of 7 to 1, according to NAB Staff Engineer Mike Rau.

## Part of antenna project

The test site is part of the NAB's project to develop AM antennas which enhance groundwave propagation while minimizing skywave interference. The antenna which NAB will test in Loudoun County is one of two designs in the project, a single monopole by Richard Biby of Communications Engineering Services, in Arlington VA.

The other entrant in the NAB's project, an array with a single horizontal and single vertical element, was designed by Ogden Prestholdt, of A. D. Ring and Associates in Washington DC.

The NAB has a letter of agreement with Howard University to use the university's land in suburban Beltsville, MD as a test site for the Prestholdt antenna.

The February hearing was attended both by property owners neighboring the proposed site, and by broadcasters, Rau said. During the proceedings, the board asked the NAB whether they had looked for alternate sites, and whether the testing was to be a temporary project.

Rau told RW that the association had examined "six or seven" sites before settling on the Loudoun county location. Technically, he said, the area was "ideal" for the test.

In overturning the county planners' decision, the board commented that having the test site would be "a good thing" for the county, according to Rau. The board, however, granted the test project "two years and no more," he added, after which time the structure would have to be removed from the county's land.

The largely rural county approximately 40 miles from Washington was selected as a testing location because it was flat and remote, with good soil moisture content and within reach of power and

telephone services. The FAA approved erection of the tower in that area, Rau noted.

## Previous problems

The latest dispute over the use of county land was not the first snarl encountered by the Biby antenna project. In mid-September 1986 at a symposium held in Washington by the IEEE, the antenna's expected performance was criticized by R. W. Adler, of the Naval Postgraduate School.

During the IEEE presentation, Adler said that numerical electromagnetic code (NEC) modeling of the antenna indicated a lower signal, different impedance and lower current than Biby had calculated.

Prestholdt's antenna, NEC tested by Jim Breakall, of Lawrence Livermore Labs, was also found to have problems. Tests showed field strengths which might cause skywave interference in a station's coverage area.

For additional information, contact Mike Rau at the NAB: 202-429-5340.

## FM Committee to Look at Transmission Issues

(continued from page 1)

that while the FCC decision is a step in the right direction, many stations in areas where the FM bands are crowded will not be able to take advantage of a non-blanket power increase. The Com-

mission said it did not address the blanket hike because it was beyond the scope of the proceeding.

## More topics

The newly-formed subcommittee will also examine other allocation issues, according to Rau, Morgan and Furr, as well as receiver related issues, antenna standards and Docket 80-90 problems.

"We will be looking at whether we should redefine the adjacent and co-channel interference rules, interference ratios and protection criteria," Furr said.

Morgan added that the group will also focus on many "nuts and bolts issues" and "short-cut pitfalls" affecting engineers at FM stations.

"We plan to take a look at AM to avoid its pitfalls—the deterioration of transmitters and receivers as well as man-made noise," he said.

## Fewer problems

Despite the need to examine FM's problems, most subcommittee members contacted said the band is in relatively good shape. Recent ratings indicate that FM listening is strong, and on the increase in many areas.

"Electrical interference is not a big problem with FM, as it is with AM," said subcommittee member Al Resnick, director of engineering/radio with Capital Cities/ABC. He also added that the overall crop of FM receivers is of better quality than those manufactured for AM.

While noting that band congestion and interference is a problem in some areas, Furr added that "there's not a lot of degradation" on FM.

At press time, the subcommittee was planning its first meeting for 24 February at the NAB headquarters in Washington DC. It plans to meet about four times per year.

John Marino, of New City Communications, is president of the FM Transmission Subcommittee. For more information about the subcommittee call him at 203-333-4800.

## Patrick To Succeed Fowler

by David Hughes

Washington DC ... As expected, the White House on 5 February selected Commissioner Dennis Patrick to be the new chairman of the FCC, to replace Mark Fowler who announced his resignation in January.

Patrick, 35, a lawyer from California, was previously a member of the White House staff, serving as associate director of presidential personnel for legal and regulatory agencies. A conservative, he joined the Commission in 1983.

Fowler will continue his duties as chairman through the spring, although no date has been announced as to when he will leave the Commission. Reportedly, Fowler has indicated he will remain at the Commission's helm through the NAB show, which will be held 27-31 March.

The Patrick nomination does not need to be approved by the Senate since he is already a commissioner. With Patrick's rise to the chairman's position, there will now be a battle to fill his previous seat on the Commission.

A list of more than two dozen names is being considered. It includes the Commission's Chief of Plans and Policy Peter Pitsch, Federal Home Loan Bank Board Counsel and former FCC General Counsel Jack Smith, and James Hughes of BDM International, a defense contractor based in Northern Virginia.

There is also talk that since Commissioner Mimi Dawson, a Republican from Senator Robert Packwood's staff, had been passed over as Fowler's successor, she may leave the FCC for another position in the federal government. Her office had no comment.

## NABER

Alexandria VA ... The National Association of Business and Educational Radio (NABER), which represents the users and manufacturers of land mobile and fixed microwave equipment, will hold its 1987 Annual Meeting 8-11 March in Arlington, VA.

Broadcast engineers often take advantage of NABER's engineering certification programs, according to Mark Huey, the organization's assistant director for communications and membership.

"Many of those who take our exams, which are geared to the land mobile industry, include engineers that are also involved in broadcasting and cellular areas," he said.

NABER's meeting is expected to attract about 200 representatives of the group, which also offers an FCC-certified frequency coordinating committee for the Business Radio Service which is geared to obtaining "an equitable portion of the radio spectrum for land mobile users."

For more information on the annual meeting or NABER's activities in general, contact Mark Huey at 703-739-0308.

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## Approach for Class IIs

Dear RW:

I am writing as a follow-up to the letter of Mr. Freitag, of WHNC in your 15 December 1986 issue.

Amen!!! The plight of the Class II daytimer on a US clear seems to have been lost in the praise heaped upon the efforts to improve the first of the Class III's, the Class IV's and those Class II's on Mexican clear channels.

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Ever try to set your clock radio to a station that's not on the air? Ever try to get a school closing from a station that can't sign on until 7 AM? Or a meeting change from a station that went off at 4:30?

When people in our area want regional news and entertainment, they have a number of choices, but when they want local news and entertainment, they have to get it at very limited hours.

Gone also is the day when the "national" station made some sense. And, if you listen to any station on a US clear, there is no major effort to program to the theoretically potential skywave audience with but minor exceptions, like WHO's rebroadcasts of Iowa football.

On the other hand, we found great local interest in Iowa football since our own Minnesota Gophers play half their

games at night. Now, ironically, the local Iowa fans want us to carry Iowa basketball which is mostly played . . . you guessed it . . . at night!

Local interference from many sources makes protection to the 0.1 mV/m contour of the skywave an academic issue at best in most populated areas.

Therefore, I suggest two approaches to the problem, a short-range one and a long-range one:

1. For the short-range, let all Class II daytimers on US clears operate with daytime facilities full-time. During this period, double-blind tests would be conducted to determine what, if any, objectionable interference would be encountered within the 0.5 mV/m groundwave contour of the US clear's current nighttime pattern.

The US clears would be prohibited from disclosing the details of the test other than to state that technical tests are being conducted and listeners are invited to forward their comments to a neutral party.

In addition, the practice of allowing eastern Class I stations to operate with their daytime facilities until sundown on the west coast should cease. This merely contributes additional interference during the critical drive-time hours to those stations "in-the-middle" without significant benefit to anyone.

2. Ultimately, the classes of stations could be established local stations and regional stations. AM stations would be defined by the actual coverage they propose to serve, rather than a specific "city of license."

The key would be the establishment of a normally protected, groundwave coverage area. Station ID's would simply identify the main studio and office location (of the public files).

Consideration could be given in the future to a "marketplace" approach to allowing stations to negotiate skywave rights with other stations.

In the meantime, it is important that we continue to the efforts to extend a fair opportunity for the existing Class II's on US clears to compete effectively in the marketplace.

Raymond Voss, VP/GM  
KSMR Radio  
Falls Church, VA 22041

## Tower shoulder-pack

Dear RW:

I have read the article in the Buyers Guide section of the January 15 issue of *RW*, in which Robert Culver describes our RF monitoring instrumentation. It is well written, straightforward and concise.

He made one comment, however, which was surprising. He stated that there is not any convenient way to carry the package when climbing towers.

We do have a shoulder pack for carrying the instrumentation while climbing towers, allowing hands-free operation. Shoulder straps are attached to the padded case with swivels for carrying

The NTLA's report on AM stereo stops short of being the positive catalyst to resolving the standards battle that the industry had hoped it would be.

Since many expected the report to declare the existence of a de-facto AM stereo transmission standard, the NTLA's decision to further evaluate the multisystem solution comes as a surprise.

In examining the feasibility of multisystem receivers, the NTIA will be delving into the performance and cost tradeoffs that such a solution will entail—tradeoffs they should quantify for all to see.

But the quantification of those tradeoffs and the possible resulting request that the FCC protect both the C-QUAM and Kahn ISB systems' pilot tones would fall short of moving AM stereo ahead.

## NTIA Not Enough

What is needed is for the factions with the most to lose or gain: AM broadcasters and receiver manufacturers, to come together and hammer out an AM stereo solution that addresses all of their mutual concerns.

The NAB and EIA should take it upon themselves to bring the broadcasters and receiver manufacturers together and either decide that stations will support a single system, or get a commitment from the receiver makers that they will actually build multisystem receivers.

Proponents of each system should also agree to participate and provide information as needed.

The fact that broadcasters and receiver makers were able to agree on one TV stereo system, plus the recent voluntary compromise NRSC preemphasis standard proves that this process can work.

The NAB's unwillingness, up until now, to represent the interests of AM broadcasters in this matter is unacceptable. If this attitude persists, then AMers should take it upon themselves to set up an ad hoc organization to negotiate, through the EIA, with receiver manufacturers to come up with a unified solution to AM stereo's plight that can be brought before the FCC.

—RW

the instrument at the waist.

A clear, soft window allows one to read and program the datalogger, and the back-pad has velcro strips for fastening the probe to extend over the head, exactly as suggested.

Burton Gran  
Hcladay Industries, Inc.  
Eden Prairie, MN

## Covered controls

Dear RW:

I've just finished reading Ty Ford's "Producer's File" column in the December 15, 1986 issue of *RW*.

In that column, Ty mentions a frequent lament of engineering personnel everywhere: adjustment controls (in this case EQ) are put on products where talent can tamper with them.

In the case of the Shure SM7, also mentioned in his column, it is interesting to note that Shure Brothers supplies a cover plate with the SM7 to cover the EQ controls on the microphone once they are set.

This gives the engineer peace-of-mind, as the talent cannot get to the controls to tamper with them.

Thoughtful and innovative product designs are what have kept Shure a leader in today's audio industry.

John Phelan, Mktg Mgr  
Shure Professional Products  
Evanston, IL

## Peak performers praised

Dear RW

Special kudos for *Radio World* November 15th issue in which you published an article by John Cummuta entitled, "Peak Performers Outline Goals."

This is perhaps one of the most impor-

tant subjects you could ever include because it is the substance of new enterprises and new job creation.

Please convey my appreciation for the article to your staff for including it, and to John Cummuta for writing it!

I am an avid reader of *Radio World*, having been a subscriber back when we paid for the privilege of getting it. Many thanks for the good work you do.

William Gerald Willis, Owner & GM  
WFLQ-FM  
French Lick, IN

## Planning for the breakables

Dear RW:

Chuck Albert wrote in the January 1st issue concerning the small broadcaster's failure to accept a major natural law: things break. It's not just the small broadcaster. We see major broadcast entities with tremendous market shares doing the same thing.

Very often we will be told by some smug functionary of these companies that they "buy only the best." They will then happily spend twice too much on some piece of equipment in honor of a 0.1 dB and a single bell. (Please forgive the play on words.)

In the meantime, their plant, the tube through which all their income flows, is not fully redundant.

Admittedly, things like antennas do not break very often, but when they do, it's a major and time consuming disaster with the green faucet turned off. Then that item that has been deferred many years in the capital budget gets serious money thrown at it unplanned and wasteful, about 6 dB of it.

Carroll Cunningham, Pres.  
DYMA Engineering  
Los Lunas, NM

## Radio World

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# FCC Files

(continued from page 2)

normally have access to these areas.

A similar survey was conducted in September 1986 at Lookout Mountain, an antenna farm near Denver.

FCC docket number for the categorical exclusion issue is GEN 79-144. For information on the docket or the results of the Portland survey, contact Robert Cleveland at 202-653-8169.

## FM Translators

No action has been reported on an FCC docket aimed at determining whether noncommercial FM translators should be allowed to be program fed by satellite or land-based microwave.

The rule change plan was released in

April 1986, in response to several previous requests from Chicago's Moody Bible Institute (MBI).

The translator feed modifications have been opposed by broadcast groups including the NAB and National Public Radio. Complaints ranged from "objectionable" interference on TV Channel 6 to the possibility of a "de facto" network of translators.

Docket number is MM 86-112. Contact Marcia Glauberman at 202-632-6302.

## RF Lighting

The FCC Office of Engineering and Technology (OET) is preparing a proposal on RF lighting device interference to AM radio, with a mid-July time frame.

Last year, comments were filed in response to the FCC's proposed radiation limits on RF lighting devices at frequencies below 30 MHz. Respondents included the NAB, which supported interim use of a  $4.5/f(\text{MHz}) \mu\text{V}/\text{m}$  limit in the frequency band 0.45 MHz to 1.705 MHz, measured at a distance of 30 m.

However, the RF lighting issue was put "on the back burner" because of more pressing matters, said Liliane Volcy, an engineer with the OET.

Docket number is GEN 83-806. Contact Liliane Volcy at 202-653-7316.

## FM Upgrades & Allocations

On 29 December, the FCC removed its rule that requires that 20 of the 80 FM channels be reserved for Class A use only, with a maximum power of 3 kW and antenna height of 100 m (HAAT).

However, some broadcasters, who had

been campaigning for an across the board power hike for all Class A's to 4 or 6 kW levels, said the FCC's action will have little effect in many areas because of existing congestion on the FM band.

Although the Class A restrictions were posed to guarantee FM service to smaller communities, the FCC said it determined that the low-power station reservations were no longer necessary. The Docket 80-90 proceeding has created approximately 700 new FM allocations; many are located in small communities, the FCC noted.

FCC docket number is MM 86-144. Contact Joel Rosenberg at the FCC: 202-634-6530.

## Duopoly Rules

The FCC has proposed allowing AM/FM radio station and UHF-TV common ownership within the same market, as well as combinations of an AM facility with either a UHF or a VHF TV station.

The multiple ownership decision is part of a rule proposal issued 15 January. The FCC also proposed a relaxation of its duopoly rule, to allow common ownership of two or more AM stations, providing their 5 mV/m groundwave contours do not overlap.

Two or more FM stations may likewise be commonly owned, as long as their 3.16 mV/m contours do not overlap, according to the FCC plan.

Existing regulations limit the ownership of commercial broadcast services in the same market to one AM/FM combination, or one TV station, or one daily newspaper per market. Common ownership of two or more AM or FM stations whose 1 mV/m contours overlapped was prohibited.

A comment deadline had not been set as of press time. Contact Andrew Rhodes at 202-632-7792.

## Cuban Interference

No progress has been reported with Cuba regarding talks on AM band interference.

Responding to the Cuban interference problem, the FCC has recommended granting eight monetary awards since 1985 in a program to compensate AM stations for transmission system improvements made to battle Cuban interference.

The requests total more than \$1.2 million. However, Congress has recommended appropriation of only \$500,000 to the US Information Agency, which distributes the funds. Most stations report that they have yet to see any of the compensation funds.

The Cuban interference contact is Louis Stephens: 202-632-7792. The compensation program contact is Leonore Cunningham: 202-632-6485.

## Minority Policy

In December, the FCC said it was asking for comment on its female/minority ownership policy and is postponing action on applications for distress sales that relate to that policy.

The policies in question deal with the application of racial, ethnic and gender preferences in comparative proceedings for broadcast licenses, the administration of its minority distress sale policy and the issuance of tax certificates for broadcast station sales to minorities.

The comment period lasts through April, with the reply comment period extending until June. Docket number is MM 86-484. Contact Bob Ratcliffe at 202-632-5414.



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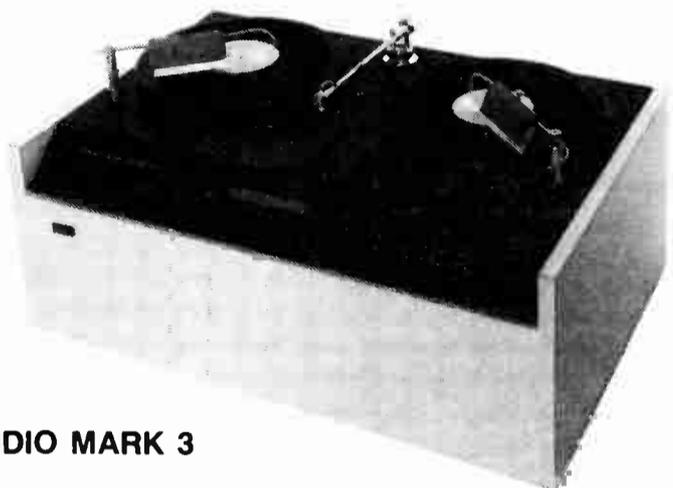
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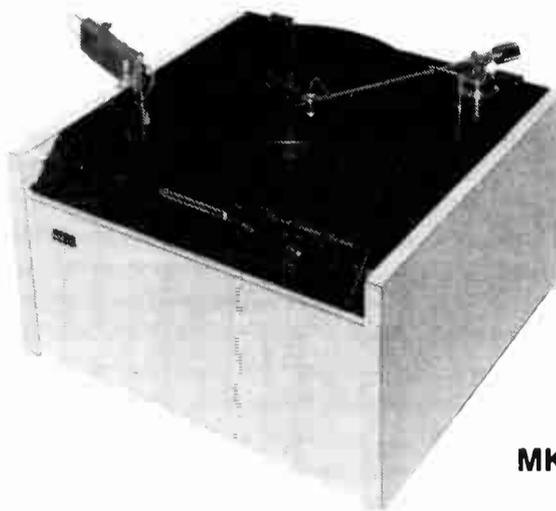
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# NRB Draws Technical Booths

by Alex Zavistovich

Washington DC ... Radio broadcast equipment companies made inroads into the National Religious Broadcasters (NRB) Convention's trade show, Media Expo '87, held 2-4 February at the Sheraton Washington Hotel.

The show floor, although dominated by religious programming displays, featured exhibits from a number of equipment manufacturers and distributors including Broadcast Electronics, Motorola, Continental, Telex, Cablewave, Broadcast Supply West and many others. Equipment ranged from microphones to transmitters.

During the convention proper, which began 31 January, several sessions and workshops covered issues in broadcast technology, station ownership and management.

According to the NRB, the Media Expo '87 equipment exhibit featured 275 companies in the 9500 square foot exhibit hall. Demand for exhibit space necessitated the addition of 18 booths to the original floor plan, an NRB spokesperson said.

Equipment company representatives seemed split in their opinions about the show and floor traffic. Several first-time exhibitors said they planned to return next year because of the promising sales leads generated by the event.

One returning NRB exhibitor, however, said he was disappointed by this year's show, though most of his complaints were about what he called slow and inept union labor.

## Floor activity

Although the exhibit hall was dominated by program-related booths, several radio broadcast equipment manufacturers were showing a range of AM and FM transmitters, AM stereo gear, consoles, and studio equipment.

Pacific Recorders' General Sales Manager John Kenyon, whose firm exhibited at the show for the first time, said he was "pleasantly surprised" by the convention, adding that booth traffic was good. The firm's display featured the AMX broadcast operations console and Micromax series cart machines.

International Tapetronics Corp., also exhibiting for the first time, showed its line of cart machines, including the Delta, Omega, Series 99, ESL-5, and DCM-1 units. The company also displayed the Scotchcart II NAB carts.

John Schaab, ITC's broadcast sales representative, said people passing through the display hall were "in a buying mood." He added that his company intends to return next year.

Continental Electronics, which exhibited at NRB for the first time last year, returned with a display including the Type 314R-1 broadcast transmitter, a 1 kW AM unit. The company also showed the Type 814B 4.3 kW FM broadcast transmitter.

Continental field service supervisor Dave Chenoweth said the show had good traffic. He noted that the attendees who come by during the show often purchase equipment some months afterward.

Broadcast Electronics, also a second-time participant in the exhibit, showed the DV2 Digitaltalk solid state digital recorder/player. The RAM chip-based system stores and plays six-and-a-half

minutes of random access digital audio and has a 6.5 kHz frequency response.

BE also featured the Sat-16 program automation system. BE representative Bill Harland commented that, although the heaviest traffic was on the first day of the show, attendees appeared interested and ready to buy.

Harris Corporation Broadcast Division District Sales Manager Ed Hawkins also noted that traffic was not as heavy as in past years, but that the show seemed to

be growing. Harris displayed its Medalist-12, a 12-channel dual audio console, the MX-15 FM exciter and the Sentinel-16 remote control.

Fidelipac Sales Director Jack Ducart added that his company decided to return after last year, noting that the NRB was a show they "couldn't afford to pass up." The religious broadcasters' convention attracts a number of customers who might skip the NAB show, he said.

Fidelipac's display featured the CTR 10

and CTR 100 cart machines, as well as the ESD 10 eraser/splice detector.

Greg Silsby, Audio-Technica's marketing manager for professional products, commented that the show was able to reach three distinct markets at once—broadcasters, fixed installation owners and musicians.

Audio-Technica used the show to introduce to this market its new AT4462 portable stereo mixer for field broadcast use. The company also showed its Uni-point series of microphones and the ATRMX64 six-channel mixer with built-in four-channel recorder.

*(continued on page 10)*

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# NABET Seeks NBC Strike Vote

by Alex Zavistovich

New York NY ... Although opening negotiations for a new master contract with NBC are not slated to begin until 3 March in San Diego, NABET negotiators have urged a secret ballot vote by the union's locals nationwide to obtain strike authorization against the network.

NABET International Representative John Krieger said the strike authorization

was requested so the network negotiating committee would have more "clout" going into the talks. At press time, the ballots had not been tallied.

The new NBC contract with NABET will replace the previous agreement, due to expire in March. The contract will affect NABET radio and television members in Washington DC, New York, Cleveland, Chicago, Burbank and San Francisco.

NABET met with NBC between 13 January and 23 January to exchange proposals and discuss terms of the master contract. NBC's proposal, Krieger said, amounted to "an all-out attack on jurisdiction and work rules."

In a late January letter to its NBC members, NABET objected to a number of the network's stipulations, including those dealing with daily hires, seniority, and "elimination of work rules and

jurisdiction."

The union also disagreed with "the philosophy that NBC can't compete or be profitable with the restrictions in the current NABET/NBC Master Agreement."

In the letter, the NABET network negotiating committee said changes suggested by NBC would have a "devastating effect" on the the network's union employees.

NABET has proposed a number of improvements for members, Krieger said, including a four-day week, "tightening" of jurisdiction, and upgrading of wages, seniority benefits, and sick leave.

NBC VP/Labor Relations Day Krolik said the network has "some problems with a number of the (union's) proposals." Many of the points are "economic settlements," he said, noting that "this is not the day and age (for NBC) to take on increased costs."

All three networks made large personnel cutbacks in 1986, and NBC sources

## Here's what broadcasters say about THE HARRIS CONNECTION:

### CAPROCK TELECASTING, VHFTV

Joseph A. Carriere, President  
Roswell, NM/Lubbock, TX:

"When a studio fire wiped us out, our Harris sales manager was on the scene in six hours and we were back on the air in 10 days!

"Our VHF equipment from Harris gives us the best quality money can buy. And Harris really stands behind its products.

"Over the years, Harris has treated us very well. Other manufacturers may make good equipment, but not all can give the kind of support we get from Harris!"

### KNOB, FM-RADIO

John R. Banoczi, General Manager  
Anaheim, CA:

"When it came time to buy a 35 kW transmitter, we found that Harris had the right product with the right features at the right price—so we went with the Harris FM-35K.

"Besides—Harris has an excellent reputation for backing and servicing the products it sells."

### KCOB, AM-RADIO

John Carl, General Manager  
Newton, IA:

"Our SX-1A, 1 kW AM transmitter performs as advertised. It gives us a stand-out presence on the dial—especially in our fringe areas.

"And Harris' SunWatch has completely solved our PSA/PSSA power scheduling problems. I don't know how a station could do it otherwise.

"When we've needed service, Harris has always come through."

### WEAT, AM-RADIO

Bert Brown, Chief Engineer  
West Palm Beach, FL:

"Most AM broadcasters who have upgraded their facilities in this part of the state have gone with Harris SX transmitters. As you are well aware, this is a lightning prone area of the country, and our SX-5A has performed well above our expectations in the area of maintenance and downtime.

"We chose Harris for its professional service and support. I have a good rapport with Harris people."

### WSTQ, FM-RADIO

Al Moll, General Manager  
Streator, IL:

"Before we switched to Harris, we were barely on the air with a poor signal. Our FM-3.5K, 3.5 kW transmitter makes us a stand-out on the dial."

### KHBS, UHFTV

Don Vest, Director of Engineering  
Sigma Broadcasting, Fort Smith, AR:

"KHBS is our first Harris installation, and I'm very glad I did it.

"What impresses me most about Harris is the service and parts support. In 19 years of broadcasting, it's the most cooperative and helpful in the industry.

"Harris knows how to treat its customers. Harris is going to win!"

### WOMA, FM-RADIO

Dale Eggert, General Manager  
Algoma, WI:

"Our FM-3.5K, 3.5 kW transmitter has operated flawlessly since our sign-on last November.

"And our Harris representative not only helped us put our equipment package together, but stayed on duty **after** the sale to see that we met our critical air date!"

### WKNO, VHFTV

Pat Lane, Chief Engineer  
Memphis, TN:

"Before I ordered our two new transmitters, I tested three service departments. Harris was the only one with an engineer on duty at 10:30 p.m. the Fourth of July. With the others I got a recording and an answering service.

"What impresses me most about Harris is the attitude and the people."

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*This is not the day and age (for NBC) to take on increased costs.*

indicate that company is undergoing a personnel efficiency drive, mandated by new President Robert Wright. Between 200 and 300 employees were scheduled to be released during November and December 1986, the sources said.

The network is trying to make some changes in jurisdiction and work rules, Krolik admitted. He added that NBC's proposed modifications were an attempt to "remain competitive in broadcasting."

Krolik said NBC was looking for "flexibility" in jurisdiction of responsibilities—ways in which an employee could perform certain technical functions in conjunction with his current duties.

The jurisdictional issue was also raised during NBC's recent negotiations with the American Federation of Television and Radio Artists (AFTRA), an agreement finalized 10 October 1986. In that case, NBC backed off from a stipulation which would have forced news personnel to assume certain technical responsibilities.

Although Krolik did not oppose the concept of a master contract, he added that the peculiarities of such an agreement can sometimes result in inflated wage rates.

In a master contract, all operations are covered under a single agreement, Krolik said. The agreement includes general articles as well as so-called "peripherals," which address specific fields, such as engineering.

The disadvantage to the network of a comprehensive agreement, Krolik suggested, is that in some markets, such as Washington DC and Cleveland, "wages are way above market rates and conditions." He stressed that "what works in one location may not be appropriate in others.

For additional information, contact John Krieger at 301-57-5420 or Day Krolik at 212-664-3291.

# Equipment on Exhibit at NRB

(continued from page 8)

At the Motorola booth, AM Stereo Broadcasting Manager Chris Payne answered questions about the C-QUAM AM stereo system, which was prominently displayed. Payne noted great interest from attendees, adding that it was a "good year" for AM stereo, in terms of broadcasters interested in acquiring systems.

Cablewave Systems displayed its line of rigid coaxial transmission cables and FM broadcast antennas. The company showed its FM antenna systems, both circularly and horizontally polarized. Marjorie Barneschi, Cablewave's administrator of broadcast sales, commented the floor seemed busier than last year, generating good sales leads.

Tim Schweiger, VP/Marketing for Broadcast Supply West, said that booth traffic was up from last year, and the number of participating companies increased. He added that the attendees at this trade show were "people who make buying decisions."

Telex representative Claude Leiman noted, however, he noticed some previous exhibitors have pulled out of the show. He attributed this to particular companies presentations being too broad for the specialized crowd at the show. Telex exhibited its ENG-4 portable wireless mic system and the AAT-1 FM sound enhancement system.

Also featured at the Telex booth were the PH-24 lightweight headsets with condenser mics and the PH-25 headset with split-feed receivers.

"The NRB is a good show for wireless mics," Kleiman noted.

## Not all positive

Although opinions about the show were generally favorable, not all exhibitors were equally positive about traffic through the booths.

At the Otari exhibit, Carey Kress of ASR, regional representative for the manufacturer, was somewhat disappointed with the company's booth location, noting that the back corner site made it difficult to gauge traffic flow.

Kress added, however, that the trade show was "not at the forefront of why people come to the convention."

Otari exhibited the MTR Series II mastering and production recorders for post production, broadcast and duplication. The company also showed its Model 5050 BQ-11 quarter-inch four-channel recorder.

CCA showed its new 500 W rack-mountable transmitter and Model 20G digitally synthesized FM exciter, as well as its G-line FM transmitters. CCA GM Ron Baker said that, although the traffic quality was higher than he expected, few people he talked to seemed ready to buy.

Of the many sessions held at the NRB convention, four were devoted solely to

engineering topics.

Since a large number of religious radio stations are on the AM band, a session on AM improvement was well attended.

AM station owners learned about possibilities for broadbanding antennas, and were brought up to date on the various subjects, including the NAB's experimental antenna project and the voluntary NRSC preemphasis-deemphasis standard.

Other AM topics covered were AM stereo, synchronous transmitters, and RF interference from electrical and lighting appliances.

A session on FM engineering topics included an update on 80-90 filings and a discussion of FM translator issues.

FM broadcasters also learned about some creative uses for SCAs and about the latest products for transmitter automation.

## Jet Crashes Into Radio Tower

by David Hughes

Dallas TX . . . Two Dallas area radio stations were knocked off the air for several hours when a Marine jet hit their tower, severely damaging the tower but not knocking it down.

KSCS and KZEW were off the air 14 January for about three hours each after a F-4S Phantom hit 1520' Hill Tower, located in Cedar Hill, while attempting a landing at a nearby military field. The

jet crashed, but not before the two crew members ejected and parachuted to safety.

The damage to the 35-year-old tower, which included severed guy wires and brace supports, was not severe enough to interrupt the service of three Dallas area VHF TV stations that also broadcast from it—KDFW, KXAS and WFAA.

"Emergency repairs" have been completed on the tower, according to John Irvin, director of broadcast operations at WFAA, which owns the tower with KDFW. However, he said much more work needs to be conducted to get the tower back in full working order.

At RW's press time in early February, the two FMs were still operating from other facilities at less than half their authorized 100 kW levels. Yet Irvin said the three TV stations were all operating normally.

Charles Staples, CE at KSCS, said his station was operating from another tower about a mile away at 34 kW. It had been operating at 14 kW upon returning to the air after the incident.

Staples reported that the plane sev-

ered one guy wire, frayed another, severely damaged the candelabra and broke a knee brace.

However, "progress on the repairs has been delayed by high winds," Irvin said, particularly in the installation of new guy cables.

Irvin maintained that several structural engineering firms are still studying the tower to determine whether it should be repaired or whether it should be torn down and rebuilt.

While Staples also acknowledged that there is talk that the tower may be torn down, he said structural engineers were looking at the possibility of replacing only the top 300' of the tower—a procedure that could take six to nine months.

In any case, Staples said he hoped to have his station operating at full power by late-February.

No tower damage estimate had been announced, Irvin added. The Navy has begun an investigation as to why the jet hit the tower.

For more information contact John Irvin at 214-748-9631, or Charles Staples at 817-429-2330.

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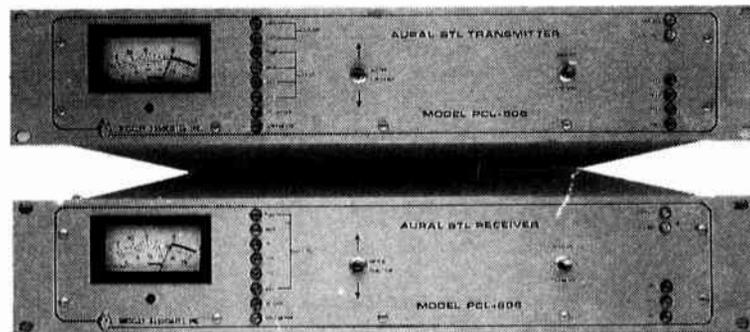
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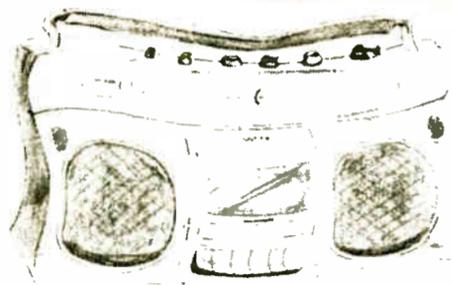
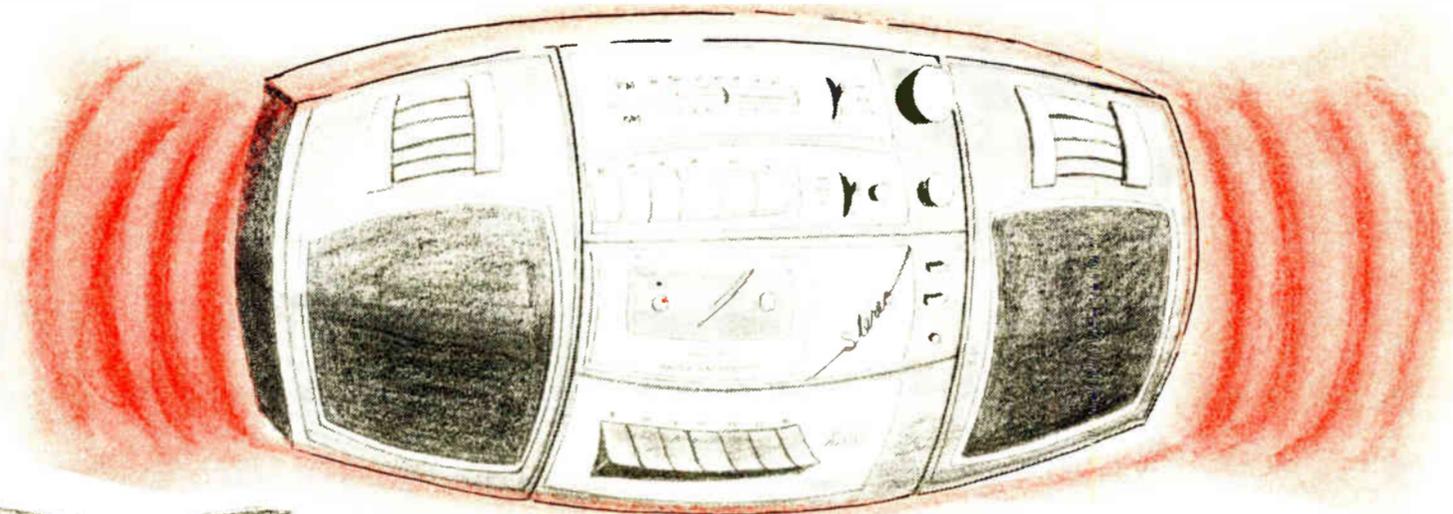


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Circle Reader Service 29 on Page 20

World Radio History

# Marantz Buy Close

by Alex Zavistovich

Chicago IL ... Dynascan Corporation, a Chicago-based electronics manufacturer, is only one stockholders' meeting away from making the California-based consumer audio and video firm Marantz Company a wholly-owned subsidiary.

During the meeting, which at press time was scheduled for 26 February, Marantz stockholders were expected to consider and approve the merger, which had been announced first in late November 1986.

On 31 December, Dynascan raised its ownership of Marantz stock to approximately 53%, by purchasing 1,500,000 shares from the company. Approval of the merger by Marantz stockholders would enable Dynascan to buy their additional stock at \$6 per share.

The company also late last year purchased 488,350 shares of Marantz common stock from the company's founders, Joseph, Fred and Nathan Tushinsky.

Kalov said Dynascan will gain some tax benefits by raising its percentage ownership of Marantz by year-end. Dynascan's

1986 year-end financial statements will also include the firm, Kalov added.

Management at Marantz has predicted a \$7836,000 loss for 1986, Dynascan said, including a loss of \$1,119,000 from "discontinued operations." Kalov, however, was confident that Dynascan could turn around the ailing company, and pointed out that "... (Marantz) offers a strong

brand name in consumer electronics markets ... "

Dynascan markets a variety of electronic products, including B&K Precision test and measurement equipment and Telemotive industrial radio remote control systems.

For more information, contact Dave Allen at Dynascan: 312-889-8870.

# BTS-USA Now Legal

Salt Lake City UT ... As of 1 January, Broadcast Television Systems (BTS), the joint company formed by the Robert Bosch Corporation and Philips Television Systems, became a legal reality in the US.

On that date, legal incorporation procedures were completed, according to Bosch officials.

BTS was formed in July 1986, when Robert Bosch GmbH of West Germany (which owns 70% of BTS) and N.V. Philips Gloeilampenfabrieken of the Netherlands (which owns 30%), agreed to form the new, international equipment firm.

BTS officials, including representatives from BTS/Europe and Bosch and Philips in the US, met in November 1986 to form

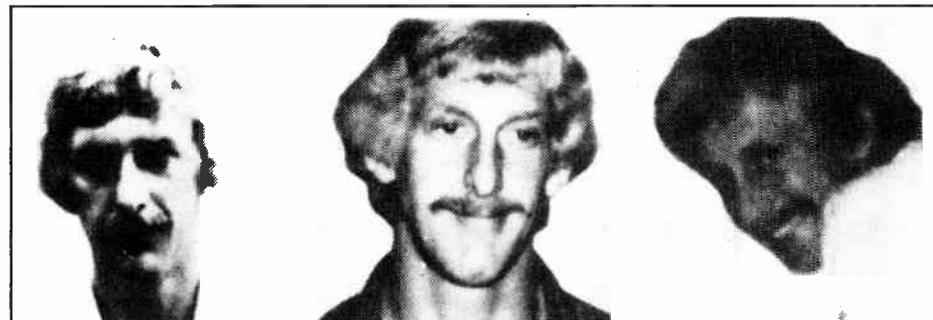
the management structure of "BTS Inc. USA."

Under the new BTS banner, Bosch's Salt Lake City facility will become corporate headquarters, with Erich Zipse as president.

The former Philips offices in Mahwah, NJ, now become BTS' sales and service headquarters, under the direction of James Wilson.

According to BTS, products manufactured in Europe and the US "will be actively marketed in the US." The firm added that all purchasers of former Bosch and Philips products will "receive the same support" from regional service centers set up by BTS.

For more information on BTS call 801-972-8000.



## FBI Seeks Radio Talent Hit Man

Washington DC ... The FBI is looking for a former radio announcer who it claims is a "hired assassin."

William Claybourne Taylor, 37, is being sought by the FBI in connection with the shotgun slaying of a former Immigration and Naturalization Service (INS) official, and wounding of a former mayor.

A Federal warrant citing unlawful interstate flight to avoid prosecution for the crimes of murder and aggravated battery was issued in August 1980 for Taylor, who the FBI adds has also worked as a radio and TV advertising salesman.

Taylor is described as white, 6' 4", 200-pounds, with blue eyes and blonde hair which has been dyed red.

In addition to his radio and TV related jobs, Taylor has also worked as a convenience store clerk, a dance instructor, a key punch operator, a painter and a trumpet player, the FBI said.

The Bureau believes that Taylor may try to seek employment at radio stations as he has in the past.

Anyone with information on Taylor is requested to take no action other than to contact the nearest FBI office. He should be considered "armed and dangerous," the FBI said.

# To Find The Best-Built Broadcast Audio Amplifier... You've Got To Look "Under The Hood."



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While the other brand is a competent performer, as a broadcast engineer you can readily appreciate the extra care in engineering we put into the model 85. And every BGW amplifier is built with the same total commitment to engineering excellence.

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# Do You Know the Way to NAB?

by Barry Mishkind

**Tucson AZ . . .** There are less than four weeks remaining before the 1987 NAB convention gets down to business in Dallas. Each year for several days, virtually the entire broadcast industry gets together to buy, sell, trade, learn, teach and not coincidentally consume mass quantities of food and liquor in the hospitality suites.

Regardless of how you feel about the NAB in general, there is no better time nor place each year for us to talk directly to the manufacturers, face to face, with their equipment right there along side.

We can ask all the questions on our minds, often seeing the equipment put through its paces as we speak. It's easy to see that that's a lot better than a theoretical discussion by telephone of a picture.

Additionally, the relationships you develop will pay off throughout the year, whenever you need assistance in dealing with a problem.

So with all those benefits available, why is it so hard to get most small-to-middle market managers to send their engineers to the show?

## The roadblock

That's not a simple question. While some stations are certain that their continued success depends on their engineering staff being on top of the State-of-the-Art, many owners and GMs feel that the NAB show is a spring junket, and feel no strong necessity to take the engineer along, or even give him time off for a free vacation.

Since they usually have little or no technical experience, their response to salesmen is "call my engineer sometime and talk to him."

Many managers feel the seminars are too much like work, keeping them from relaxing and recreating. Where and with whom they are going for dinner is the top priority. An engineer's attendance, they feel, holds little value for the station's bottom line.

If that sounds like a difficult attitude to overcome, you're right. It can be so. Over the years that I have been attending NAB shows, I've observed many individuals who spend far more time in the bars and restaurants than at NAB functions.

Even some of the station managers for whom I've worked seem to go more to be seen than for any other reason. Once seen, they can get on with their fun. However, some view NAB quite differently!

## How the other half lives

Every year I run into a number of engineers who have paid their own way to the NAB show, even driving the whole way, staying in the less expensive motels on the outskirts of the city.

They spend endless hours on the floor, talking to as many manufacturers and reps as they can, and take voluminous notes as they conduct on-the-spot comparisons of all the new, and some older, products displayed.

I was no different. The memories of

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

my first NAB show are a kaleidoscope of the 18-hour days, from the early morning technical sessions, to "the Floor," to the late evenings in the hotels when the remaining inhabitants of the hospitality suites were too far gone to provide any further useful information.

Several times, after limping back to my room, my feet felt like they would need to be replaced if I wished to go any further, but I kept at it. As a reward, by the end of the show each year, most every question was answered, and I met many engineers in similar situations, some of

“

*You can prove that  
your expenses to  
Dallas are a  
bargain.*

”

whom have become good friends.

Furthermore, and to me the most important benefit, was the ability to meet and know the technical support people of the various suppliers of the equipment in my stations.

Time and time again, these contacts have proven valuable in saving me time and effort in my job. Of course, part of my time now is taken in renewing those contacts and expressing thanks for their help over the year (I'll speak more about this in a future article).

## Getting on board

So the question returns: Will you be there to take advantage of all that the NAB can offer? For many, the question boils down to money, how much it will take to get there and exist. Am I suggesting you pay your own way? Perhaps.

The opportunity to see and learn is worth a considerable amount. And, being in Dallas, the NAB is not too far to drive from many locations. On the other hand, there are approaches that can moderate the expense of getting there.

The best and easiest on you would be getting your manager to agree that your being up-to-date on the current state-of-the-art is of great value to the station. Then he might just agree to pay your expenses.

But getting there is not always easy, since many of the benefits you'll gain are not immediately tangible to him. And saving you hours in the middle of the night is rarely high on his list of priorities!

Communicating tangible value is not that hard, if you prepare well. A list of the major expenses for the past year can be easily compiled, as well as those projected for the coming year.

By showing that savings can be effected by learning of alternative purchases, or even by simply avoiding bad decisions that can waste money, you can prove that your expenses to Dallas are a bargain.

For example, one of the hazards of being in the smaller markets is that you may not see the newer products or technologies soon enough to avoid buying outdated gear.

Maintenance costs on obsolete equipment quickly outpace initial savings.

Even if you read the trades, and have a feel for the newest gear, what about its reliability and costs of upkeep?

Any sane manager will react positively to such arguments. He would never call his car dealer in late fall to order a car without asking when the new models will come, what features they will have, and how much routine maintenance will cost.

It is exactly the same with station gear. Avoiding just one mistake can often pay for the whole trip several times over.

## Alternatives

If the manager still claims there is no budget for you to go, consider that many stations have some sort of trade or barter that might cover the motel and/or airfare to Dallas. You might be allowed to use some of that.

Check with other engineers in your area. Possibly you might share car expenses. Getting on the floor can be facilitated by contacting one of your suppliers for a floor pass.

An arrangement with another engineer locally might provide cover for you in return for your bringing back some information or catalogues. Planning ahead can get you to Dallas and back without breaking you.

Of course, getting there is only half the deal. There is a lot to do and see, and time slips by fast! So make a list of the manufacturers and products that you are interested in and the specification sheets you may want.

In the evenings, many companies have hospitality suites. Try to visit the right

ones. It is often easier to carry on extended conversations there than on the floor where the exhibitor has to deal with the traffic. Check your list, and don't give up until you've accomplished your goals.

A note about appearance: while a suit is not always necessary, a clean shirt and tie won't hurt a bit. The fact is, you have to compete with several thousand others to get the attention of the exhibitors on the floor, and they get tired too.

Presenting yourself as a professional will gain their respect and they will treat you better than if you show up in jeans and a surfing shirt!

## After the show

Be sure to take a good, large suitcase. Getting the benefits from the NAB show includes carting back about a ton of materials that will allow you to retain the knowledge you've picked up!

It will also let you prepare for next year, targeting other areas of interest. And, it will be of value in showing your manager that you weren't on a pleasure junket, but acquiring education of value to the station.

If all this doesn't impress your manager, maybe you need a new position with a station that wants you to grow with the industry. Stagnation never provided benefits to anyone.

In any event, regardless of the station and its manager, make the effort to keep yourself current. The spring NAB show is a valuable opportunity to do so. Don't miss it. You will be glad you made the trip!

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# HI-FIDELITY AM STANDARD

## APPROVED BY NAB AND EIA.

At the January 10th, Las Vegas meeting of the National Radio Systems Committee (NRSC), the membership approved a voluntary standard for AM broadcast frequency response. This standard promises to significantly improve audio fidelity on the AM band.

The NRSC is an industry technical group sponsored by the National Association of Broadcasters (representing broadcasters) and the Electronics Industries Association (representing receiver manufacturers). At a series of meetings over the last twelve months, the committee explored methods of improving fidelity in the AM band. Members of the Committee included major broadcast groups, receiver manufacturers, broadcast equipment manufacturers, and other interested parties. Attendance at the meetings included industry representatives from: NBC, Cap Cities/ABC, RKO, Group W, Viacom, Susquehanna, New City Communications, CRB Broadcasting, Motorola, Delco, Ford, Sony, Pioneer, Harris, TEXAR, Orban and CRL.

The purpose of the Committee was to find common ground between AM broadcasters and receiver manufacturers such that a frequency response standard for transmitting and receiving AM could be agreed upon.

### A DEFINITION OF THE PROBLEM

Most people are aware that the audio response of AM is generally less than that of FM, but a surprising percentage have misconceptions about the major cause of the discrepancy. On average, the largest single limitation imposed on AM fidelity is that of the receiver. With an average bandwidth of just slightly over 3 kHz, the fidelity of most AM receivers is inferior to that of the telephone. Few listeners would consider placing a high-fidelity receiver on a table next to a telephone handset, and then listening to the music on another telephone at a distant location, but that is about what present AM receiver performance amounts to.

It is true that some AM antenna systems impose transmitted bandwidth limitations, as do some plate modulated transmitters. But the number of stations where transmission bandwidth limitations cut off at a frequency lower than that of the receiver is extremely small. To verify this, one need only tune slightly off carrier on any AM music station on the band. High-frequency content, like cymbals, snare drums and castinnettes will be found. Curiously, if tuning directly on the station's frequency, these instruments will seldom be heard. Further, those limitations imposed by the AM transmitter and antenna system need not be permanent. Pulse-width-modulated, Doherty and Ampliphase transmitters can, in theory, have frequency response equal to that of FM. Modern, computer-assisted, antenna design methods can usually cure the narrow frequency response of older AM antennas.

### HOW WE GOT WHERE WE ARE

How we arrived at the present condition is a matter of some debate, but a reasonable model follows. Consider the effects of nighttime skywave propagation on wideband AM reception. A wideband receiver attempting to listen to the local signal of a Class IV station on 1230 kHz will also pass the carrier of a number of stations on 1240 kHz, producing a constant 10 kHz whistle in the speaker. Similarly, Ohio and Pennsylvania listeners attempting to receive the nighttime skywave signal of 890 kHz station WLS, Chicago, will also hear a 10 kHz beat note produced by the skywave carrier of 880 kHz, WCBS, New York. The converse is also true for listeners attempting to receive WCBS. The list of possible examples is endless.

To prevent this nighttime whistle, receiver manufacturers suppressed the response of receivers 10 kHz on either side of the frequency tuned to. While there might have been some advantage to the use of 10 kHz notch filters, for a number of design reasons, it was often simpler to employ RF bandpass filtering and audio lowpass filtering. While this may have compromised the audio fidelity more than was actually necessary, few listeners complained. Before the blossoming of television, much of AM programming was talk, including the likes of Gracie and George Burns. Listeners also had little else to judge by, as the frequency response of 78 RPM records was seldom full spectrum. Even during the AM rock heydays of the 60's, with little to compare against, few people were conscious of the missing upper octaves.

Then, as FM took hold in the 70's, listeners became aware of what wider frequency response could mean. Even where listeners and advertisers were slow to notice the difference, FM promotion and sales departments were quick to point out the technical superiority of their product. Conscious of the fact that FM's were using this technical advantage as a sales tool, AM's sought to equal FM's high-end performance. To counteract the AM receiver's high-frequency roll-off, AM broadcasters implemented pre-emphasis in their audio chains. Seldom was a sophisticated shelving or peaking equalizer used. More often, a graphic equalizer or a single-pole network was pressed into service. The result often was that the engineer who adjusted the pre-emphasis to obtain 10 dB of boost at 10 kHz unintentionally increased the 20 kHz frequency response by 16 dB. While the 20 kHz response of most studios was significantly attenuated, 16 dB was sufficient boost to bring even low-level signals up to an interfering level. The 20 kHz audio showed up as "monkey chatter" interference on stations 2 channels up and 2 channels down the band.

This led to a greater incidence on car buyer complaints that the radios in their new automobiles were being interfered with. Receiver manufacturers attempted to eliminate the interference by further narrowing the

received bandwidth. This required broadcasters to increase the amount of pre-emphasis even more, causing more interference, and a vicious circle was formed.

### BREAKING THE CIRCLE

The FCC's AM allocation standards (usually) separate daytime contours such that stations separated by 10 kHz are not able to interfere with each other, even though they may be transmitting wideband program material. Unfortunately, the same cannot be said for AM stations separated by 20 kHz. Because second adjacent stations can be much closer to each other than can be first adjacent, an AM station which transmits audio spectra wider than 10 kHz can destroy a significant portion of the listening area of another station removed by 20 kHz.

For this reason, the NRSC's voluntary standard, which will be described below, includes a "brick wall" filter at 10 kHz. There are those who will immediately point out that this does not bring AM up to technical parity with FM, and that a 15 kHz filter should have been chosen. It will serve no purpose to recount in strict detail the lengthy debate which the Committee gave this point. It was an item discussed, investigated, modeled, proposed and counter-proposed over many meetings. Suffice to say that the 10 kHz filter is the optimum which can be implemented with the existing AM band. To implement a meaningful 15 kHz filter would literally require reallocating the entire AM band, going back to 1922 and starting over again.

In defense of the 10 kHz standard, one needs to differentiate between specsmanship and actual performance. It is a documented fact that the ability to hear high frequency material decreases with age. Most adults over 30 years of age have minimal ability to hear above 10 kHz. In addition, regardless of what fancy name is attached to your mega-dollar car stereo, unless it has metallic-domed tweeters, its response above 10 kHz is almost nil. Most cardboard speaker cones are simply too compliant to accurately reproduce high-frequency signals.

All of which is a roundabout way of saying that an average listener, on an average stereo receiver, will be hard pressed to differentiate between an AM station and an FM station in a blind A/B comparison.

### WHAT'S IN THE STANDARD?

The most apparent method for achieving a standard might be to simply install the 10 kHz transmission filter and be done with it. Receivers also would be flat to 10 kHz and then implement their own brick-wall filter. Real world considerations suggest a better method. While a brick-wall filter, when designed with sufficient care, can be musically pleasing, those filters having sufficient rejection and being most suitable for the mass-produced, consumer market are usually musically undesirable. A much more musically transparent filter would have a rounded rather than square passband. To compensate for this roll-off, the committee's transmission standard includes a pre-emphasis specification.

While this may sound like re-entering the earlier described vicious circle, there are three differences: 1) the NRSC pre-emphasis specification is coupled to a brick-wall lowpass filter at 10 kHz so that efforts to boost the 9 kHz component do not inadvertently result in enhancement of 18 kHz material, 2) the receiver roll-off rate is 6 dB, compared to a typical 18 dB roll-off rate in present receivers, and 3) the corner frequency of the receiver roll-off is higher.

The committee selected a modified 75  $\mu$ S pre-emphasis. It begins its boost at the same frequency and rate as the FM pre-emphasis standard (See Figure 73.333, Figure 2, in an old copy of Part 73 of the FCC Rules). It tracks the FM curve up to approximately 6,000 Hz, where the AM curve will then begin to level off to a shelf.

This pre-emphasis, coupled with the 10 kHz low-pass filter response shown in Figure 1, constitutes the NRSC's voluntary AM frequency response standard. As before, it would serve little purpose to recount, in detail, how each breakpoint and suppression level was selected by the Committee. One can be assured; however, that the filter specification was the subject of much heated debate that lasted over several months and several meetings. It is the result of numerous revisions, changes suggested by many Committee members, and an attempt to reconcile many conflicting constraints imposed by transmitters, receivers, and filter technology.

### WHO SHOULD IMPLEMENT THE STANDARD?

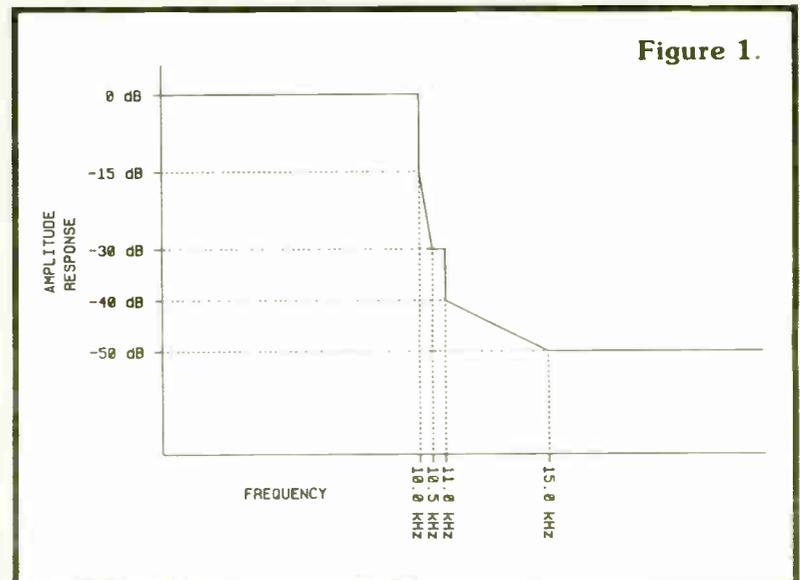
It is important to note that the standard is the work of an industry group and is therefore strictly voluntary. It is not promulgated by the FCC and does not carry the force of law. Strictly speaking, no one is legally required to adhere to the standard. So long as one continues to comply with the occupied bandwidth limitations in FCC Part

73.40(a)(12) through 73.40(a)(14), he is 100% legal.

From a practical point of view, it is in the best interest of every AM broadcaster to implement the standard within the 1987 calendar year. The ability of receiver manufacturers to produce and sell 10 kHz bandwidth receivers is dependent on AM stations uniformly restricting their bandwidth to 10 kHz. A small percentage of stations who would continue to radiate spectrum beyond 10 kHz may be all that is needed to kill public reaction to the new wideband AM receivers. In short, the future ability of AM radio to compete with FM on a more equal basis is within its own grasp; they control their own destiny.

Cost to each station to implement the standard should be minimal. All three audio processing manufacturers represented at the NRSC meetings indicated that they would make available conversion kits which would be retrofitted into their existing equipment in the field. Stations are thus able to purchase replacement circuit boards instead of an entire new system.

The NAB is anxious to know the rate of implementation of the new standard. (So are the receiver manufacturers.) To minimize the effort necessary from a station to inform the NAB of conversion, the NAB has made a pre-printed, pre-addressed postcard available to all audio processing manufacturers. One blank card will be included with each retrofit conversion kit and with each new processor shipped which complies with the standard. When the installation of the equipment is com-



plete, a station representative need only fill in the station information on the card, check the box indicated, and drop the card in the mail. An accurate tally of the number of stations who have converted will enable the NAB to best advise receiver manufacturers of when it is appropriate to introduce wideband AM receivers.

Note that the card does not contain any information about which make of equipment you have installed, in case you consider that information a competitive secret. It indicates only that you have installed one of the systems known to meet the standard.

For more information of the NRSC voluntary AM response standard, contact Mike Rau at the NAB at (202) 429-5339, or contact TEXAR at (412) 856-4276.

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# Beating Those Boredom Blues

by John "Q" Shepler

**Rockford IL . . .** This month's column opens with the tale of two engineers. Tony is Chief Engineer of a 5 kW AM/20 kW FM in Opportunity, WI, a town of 50,000 not particularly close to anything.

Tony doesn't like his job too well. It's not the hours, he gets to pick those. The pay is better than average for that size market. Besides, he only has a small apartment and the old Pinto doesn't take much gas. No, it's not the money that's a problem.

How about the work? Tony doesn't feel overworked. He is able to keep the stations on the air pretty much of the time, considering the AM transmitter is over 10 years old and makes some strange arcing sounds from time to time.

The FM is brand new, so it stays on for three or four months straight which is plenty good enough.

Tony quit wearing the beeper because he got tired of the announcers pestering him with minor problems such as jammed-up cart machines. "They can wait until morning," he figures.

A couple of months ago a real problem occurred when the FM antenna iced up and kicked off the transmitter. But the overnight guy figured out how to turn on the de-icers when he couldn't reach Tony. It worked out—they were back on in a few hours.

## Crybaby announcers

No, the work isn't too tough for Tony. Most days the job just involves setting levels, eyeballing the meter readings, and responding to panics in the studio.

The announcers always seem to panic when both reel decks are inoperative. Tony writes that off to inexperience, since some of the guys have only been in radio for five years or so. At any rate, he does generally tweak the machines without being pestered more than two or three times.

Tony's problem is that he is bored. There isn't a whole lot to do at the station between crises during the day, and he mostly drinks beer and plays pool at night.

That was OK in the beginning when he was glad to get the job after being laid off from a larger station in Pittsburg. Lately, however, the town of Opportu-

*John Shepler is a broadcast consultant, teacher, writer and former CE. He can be reached after 8 PM at 815-654-0145.*

nity is getting to be a drag.

Tony leans back to steady himself on the front of Buzzy's Bar. He is thinking that maybe he should throw his stuff in the back of the car and find another gig somewhere else. He hasn't heard from any of his radio contacts in months, but there must be a job open somewhere.

"Ahh," he muses, "I'll have a couple more beers now and do some calling around in the morning. Maybe I can find a station with some good equipment and not so many crybabies."

## Q-Tips

Tony turns to go back into Buzzy's and almost staggers into Mike, who is in a hurry to get to his 8 PM guitar lesson. Mike is also chief engineer of an AM & FM combination, the competition to Tony's employer. Mike and Tony have met but don't hang around together.

## Too few hours, too many jobs

Mike's problem is that he just doesn't have enough hours to do everything he wants to. His latest passion is improving his talents as a musician.

Mike just casually picked at a guitar until a couple of guys stopped by the station looking for someone to fix a reverb unit. Mike put a new transistor in, gratis, and got invited to hang around backstage.

It wasn't long before he was fixing amps for extra dollars and building fuzz boxes and light sequencers in the shop. Now it's getting exciting because the guys want Mike to join their band, "Opportunity Knox," and cut a demo record using some of the synthesizer effects he invented.

Does this mean the end of Mike's radio career? Probably not for a while since most new bands struggle for a long time before fame and fortune come along.

Besides, Mike still has a commitment to DJ three nights a week at Buzzy's Bar. It's fun and the extra cash will help pay for that new Fender amp he's been eyeing.

## Hard-working chief

You might think that the station manager is ready to fire Mike because of all of these outside activities interfering with his job as chief engineer.

Not a chance. The station has never sounded better and the air staff is thrilled that none of the switches or pots

in the studio have masking tape across them anymore.

You see, when Mike got laid off in Boston and took this job in Opportunity, the AM and FM were off the air as much as they were on.

Listeners complained that they were late to work because there was dead air when their clock radios came on in the morning. The operator of the Muzak service on the FM subcarrier was pulling out what little hair he had left because his SCA channel was so unreliable.

It took Mike three months to get the transmitters to stay on for a solid week. At the end of his first year, downtime was less than an hour a month.

The rusted out 30 year old backup transmitter was not only functional again, but Mike designed an automatic switcher to detect dead air on the FM and transfer to the backup within a minute.

Mike's co-workers often stop by at Buzzy's to watch his act and seem unconcerned about the station going off the air. It just doesn't anymore.

Mike still wears the beeper because he says it makes him feel more comfortable about being otherwise out of touch with the station.

Boredom is not Mike's problem. Aside from days that go too fast, his major

problem is turning down job offers from program directors and other personalities who have moved on to less well-maintained stations.

Someday he'll probably take one of those jobs for a big increase. Right now, though, he's having too much fun in Opportunity.

## Tips to beat the blues

Boredom is a problem that creeps up on people who have nothing to do and all day to do it. It also infects the rest of us who have fairly busy schedules but only routine to keep us moving.

You don't have to be a Zombie to be bored. All that is required is that the fun has gone out of your job.

What makes a job fun? It's not the job itself. Mike and Tony have basically the same job. Tony's miserable with boredom while Mike is so charged up that he can hardly sleep nights.

I guess you could say that boredom is in the mind of the beholder. For that reason, you'll have to decide for yourself if you're having fun yet. If not, here are some helpful hints that have worked for me:

*Stop taking the easy way out*—The easy way is to do just what you have to in order to keep collecting a check. A lot of people on salary figure the less they

*(continued on page 19)*



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# Moving The CE Office Up Front

by Tim McCartney

**Boise ID . . .** The importance of engineering is generally understood by station management. But, that doesn't always mean full recognition of engineers as management's peers.

Too often, CEs are seen as independent, technical wizards who exist outside

*Tim McCartney, a regular contributor to RW, is CE of KBSU, Boise State University, Boise, Idaho. He is a former GM, SBE Broadcast Engineer, and has a masters degree in human resources development. He can be reached at 208-385-3663.*

the mainstream of station life. The time has come to change this status quo.

A few minor adjustments may be all that are needed at some stations. But, in far too many, the problem is clear and visible with the CE's office no more than a dingy shop at the back of the building.

The engineer's office needs to be located with the rest of the management team; the shop's location is not so important.

The three broadcast management speakers at the 1986 Broadcast Engineering and Management Seminar in Madison, Wisconsin, addressed strategies for fully joining the management team.

Richard Hiner is Director of Navy Broadcasting, Washington, DC. John Cummata is GM of WCFL, Chicago. James Loupas is President of James Loupas Associates, Houston.

The following suggestions are gleaned from their excellent comments and from other management principles.

**1. Be a broadcaster first**

CEs must think of themselves first as broadcasters, then as engineers. This means taking the overall view of the station as would the owner and GM.

**2. Broaden your job description**

It's a mistake for CEs to describe their work in narrow terms such as, "I main-

tain the station's equipment." A broader view would be, "I provide the technical capability for this station to serve . . ."

**3. Stay current and improve**

Keep up to date on technical issues and improve on people-oriented skills

**4. Know the company**

A full understanding of the company's character, mission and objectives is needed. Then, the engineering department must operate in sync with other departments.

**5. Offer solutions**

The GM wants solutions, not problems. When a CE is confronted with impossible technical requests, the rule is to avoid saying no. Rather, suggest alternative methods of getting the job done. Managers may ask the question incorrectly, but engineers need to focus in on the problem and respond directly to it.

**6. Diversify**

More management responsibilities should be assumed. These opportunities serve to demonstrate versatile abilities in current areas of need. For example, an engineer who can organize a meeting or structure a training session needed by the station demonstrates diverse skills of significance to management.

**7. Join other departments**

Take an interest in the major concerns of the other departments, such as ratings, cash flow and program decisions.

**8. Develop a track record**

Engineers need to develop a professional track record clearly demonstrating continued commitment to technically and financially sound decisions.

**9. Know your team**

The station's team isn't only the GM, PD, CE, SM, etc.—it's also the suppliers of products and services. The objectives of each team member must be known so that mutual objectives can be identified.

**10. Dress like a manager**

Dress codes, often unstated, exist to be followed. It's very difficult for managers to perceive others as peers when barriers exist such as dirty clothing, noisy keys and pocket protectors.

Once this critical need is fully accepted, engineers will find creative solutions to dressing professionally while still taking care of necessary dirty work.

**11. Elevate your image**

The key to full recognition by management is perception. If the GM and CE both wear long sleeve shirts, ties and dark colored coats, the GM will find it difficult to ask the CE to fix the plumbing.

At the Madison conference, the issue of janitor work spurred considerable discussion. Jim Loupas urged engineers to strip away GMs' perceptions that janitorial work is a component of engineering. Those engineers objecting felt that company loyalty demands that they help where the help is needed.

Loupas agreed that engineers need to respond to station needs, but encouraged a gradual change. He suggested that, after fixing the plumbing, engineers recommend to management that the next time an appropriate specialist be contracted for such tasks.

As more engineers find themselves with management duties, it is critical that they simultaneously obtain full recognition and respect from management. While the honeymoon period on the job is the best time for this, it is rarely too late to begin the process of change.

When the CE's office is up front with the GM, PD and SM, full recognition is achieved. But, this will only happen with the efforts of engineers carefully pushing the issue.

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# Put On a New Audio Attitude

by Fred Baumgartner

## Part II of IV

**Englewood CO** ... In my last piece, I introduced the thought that there may be better ways to think about audio processing than the functions of AGC, compression and limiting, though this is what we most often do. Figure 1 shows a real world audio chain and the processes we wish to accomplish. They are not the same.

What we want to do is correct the input, color it (or not), correct for the transmitter and finally for the receiver (Figure 2).

Let's begin with the input correction. For most of us this means correcting for variations in input levels. In the early days this was done with an automatic gain control, which delivered the same average or RMS (more or less) level provided the input was inside of the "Barn Door" (Figure 3).

The better the operator "rode gain" the smaller the barn door had to be and the less the effects of the AGC. The AGC always reduces long term dynamic range and in first generation designs added "pumping" and other long term distortions.

There are of course a myriad of other input problems that could be corrected. For example:

1. Variations in short term dynamic range.
2. Variations in source to source frequency response.
3. Stereo phase errors.
4. Scratches, hiss and storage media faults.
5. Lack of acoustic or stereo information.
6. Ducking or not ducking as desired.

Unfortunately, current thought is often along the lines of, "We need an AGC" rather than, "these are problems in our input that need correcting."

With our present technology, we do have the ability to deal with many of the input problems but we may need to violate the "less is best rule."

### Processing approaches

There are basically three approaches. First is the linear "one box does all" approach. Second is preprocessing. Third is discriminate path processing.

In the linear approach, which is evident in just about all 1986 stations, the linear string of processing elements (AGC, compressor, limiter) are used to make everything at the transmitter input look about the same.

Obviously a number of input variations slip on by as everything must be treated about the same.

But with the possible exception of "elevator music" nothing could be further from the truth.

Consider the differences between a sports remote on a phone line to carts, studio microphones, CDs, LPs, 45s, RPU's, satellite feeds, etc.

Each has different long and short term dynamic variations, each has or lacks acoustic and stereo information, each

has different noise floors, frequency response, etc.

With the linear method the processing is asked to tell the difference and process as needed. It is a credit to existing devices that a credible job can be done.

The second approach is preprocessing. Here sources that are out of line with what the processors are set up for are processed before they enter the mixing board. This means more boxes again. The advantage is that it can be piecemeal and allows the use of off-the-shelf mixers.

The third approach is very rare. Discriminate audio processing is not an off-the-shelf item. Here the processing parameters are changed to reflect the nature of the input signal(s).

Routes for different audio contain different processing, and sources direct the state of downstream processors. For example, phone lines on the air kick out the super processing that would result in distorted signals being processed into greater distortion.

### Other aids to processing

Each of the above processing systems does correct some of the input signal's problems. I want to take a bit here to talk about some of the variety of devices that can be used, outside of the AGC, compressor, limiter.

Microphones are in a class by themselves as they have massive dynamic range, little inherent noise (but often studio noise), by themselves no stereo or acoustic image, and variable frequency response.

De-essers correct for a DJ's sibilance. Stereo synthesizers, reverb and the like add a spacial dimension. Noise gates cover the residual studio noise. Equalizers allow microphone and announcer correction.

With any aggressive processing a limiter to bring the peaks in line (so as not to fool the AGC into over correcting or exceeding the headroom of mixer or line

Figure 1.

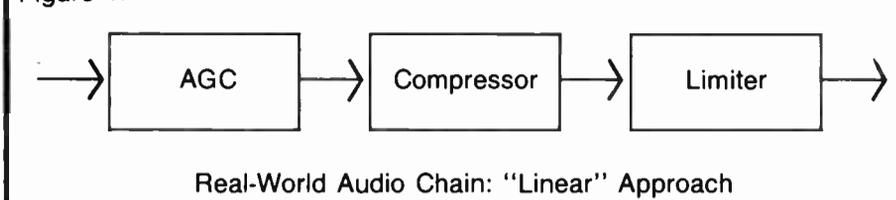
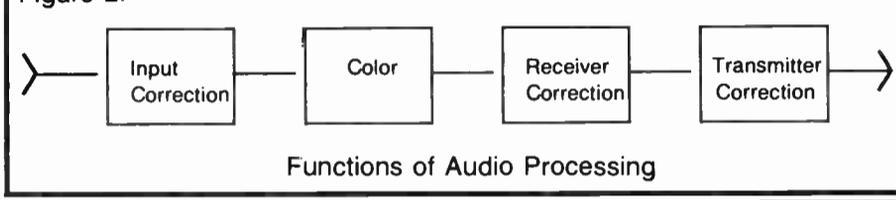


Figure 2.



amps) is a good idea.

Turntables present a number of problems. Before we get into the boxes we can use, please understand that anything with belts or pucks is trash.

A good direct drive turntable with a compromise cartridge (strong but decent) is an absolute necessity unless you are so far away from any competition that they do not exist. Also keeping acoustic coupling to a minimum is absolutely necessary.

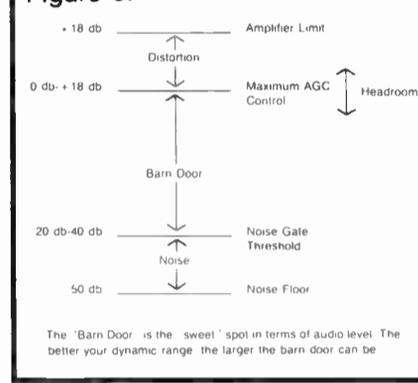
The most likely processor, meaningless elsewhere, to have on a turntable is a scratch eliminator. Ten years ago that would be a low pass filter.

Today analog scratch eliminators detect scratches and "smooth" them out. Digital scratch eliminators, based on the technology of the DOC (video drop out compensator) can just about eliminate the scratch's sound.

Scratch eliminators are all but transparent when not eliminating scratches. In rare cases an expander is appropriate for use with records. Records have their low-low end frequency rolled off as a function of the pickups and cutting process.

This can be reinserted by Sub-Bass extenders that recreate the booms below 100 Hz. Of course most transmitters, receivers and speakers don't do all that

Figure 3.



well below 50 Hz, so there needs to be some debate about the usefulness of the device in a broadcast environment.

### Cart machines and phone lines

Cart machines have long been a source of grief for engineers, what with constant tweaking of head alignment and operators dropping carts and all. Phase alignment and noise reduction seem to be the big issues.

Phase alignment boxes come in three types. One detects 180° errors and missing channels and straightens them out. It will remove wow and flutter to a large extent, but requires the recording of a

**(continued on page 23)**

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Fred Baumgartner, a frequent RW contributor, is manager of Technical Operations for KWGN-TV, Denver, and former CE of WIBA, Madison, WI. He can be reached at 303-740-2883.

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# Second Stage Modulator Fixes

by Thomas L. Vernon

**Harrisburg PA** ... When we last met here in Station Sketches, the topic was troubleshooting Class B modulators. I discussed the concept of feedback, open loop gain vs. closed loop gain, and the importance of knowing the feedback factor before troubleshooting modulator troubles.

We waltzed through the fundamentals of a conventional high level plate modulated system. Some specific suggestions were made regarding the measurement of AC and DC feedback.

We concluded with the observation that if the modulated waveform is distorted, and the output of the audio driver is OK, problems lie elsewhere. This month we will pick up there and focus on troubleshooting problems outside the audio driver.

## Outside the audio driver

Difficulties external to the audio driver are found downstream in the modulation tubes or modulator load. Tubes can easily be checked by substitution.

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

Modulation transformers are best checked by removing all leads, feeding 120 VAC into the secondary, and measuring the voltage across each side of the primary. The voltages should agree within 10%.

Some engineers try to test modulation transformers with an ohmmeter. This should be generally discouraged because

## Station Sketches

some modulation transformers are designed with an imbalance in the primary, and ohmmeter tests will give false negative results.

Once you have verified that the tubes and mod transformer are OK, the problem has to be in the modulation reactor, blocking capacitor, HV supply, or PA stage. This sounds intimidating, but the possibilities can be quickly narrowed down.

PA stage problems usually make their presence known through poor efficiency. Efficiency problems were reviewed in my 1 October 1986 RW column.

Briefly, when overall transmitter efficiency is poor, the modulator section has to work harder to produce a given level of modulation.

Efficiency figures must be good before modulator performance can be realistically evaluated.

## High voltage problems

High voltage problems typically show up in two ways, flat-topping of the modulation envelope, i.e. low positive peaks, and/or negative carrier shift.

Oil-filled capacitors are the most frequent culprit in HV supplies. Look for oil leaking around the terminals, side and bottom seams.

You will often have to remove the capacitor from its mount and check the bottom in order to be thorough. Replace all capacitors showing signs of leakage.

Poor blocking caps cause bad low frequency response and distortion. It is easiest to check this out by substituting a good capacitor.

Modulation reactors can be checked by taking them out of circuit, and reconnecting the modulation transformer for series modulation.

If performance improves, the reactor is suspect. One word of caution here: operate the transmitter at low power, and only long enough to complete the test.

Incidentally, mod reactors and transformers cannot be successfully checked with an impedance bridge. This is analogous to the ohmmeter test discussed earlier, in that it's easy to get ambiguous results.

Typically, an impedance bridge checks inductors and capacitors with a low voltage at 1 kHz.

A component that checks out OK under these conditions may become erratic when operating at high voltage due to insulation breakdown, etc.

## Larger not better

A misconception exists with some engineers that larger mod reactors and transformers somehow "sound" better than new replacements which are usually smaller. All other things being equal,

this simply is not true.

The difference in size is due to a difference in core material. Older transformers and inductors used iron cores, or iron/nickel cores.

Newer transformers use modern alloys such as hipersil, which is more efficient than iron, hence, lower losses and higher saturation density.

In many cases, it's actually possible to improve audio performance in older transmitters by substitution of newer reactors and modulation transformers.

If the modulator is basically working, but high frequency distortion and noise are not what they should be, try reversing the leads to the primary of the mod transformer. Usually one hookup gives better results than the other.

## Using a capacitor

Another trick that sometimes works on HF distortion is the installation of a capacitor (around .002 MF) between the high side of the secondary and the primary. This is usually a trial and error procedure.

Often after the modulator plate currents are statically balanced and tone is applied, it will be noted that mod currents are somewhat different from one side to the other.

If we reverse the primary leads to the mod transformer, the imbalance will be reversed. This phenomenon is quite common, and merely indicates that the loading is not perfect between halves of the primary. If distortion figures are good, this imbalance need be of no concern.

Troubleshooting modulators need not be overly frustrating, as long as a systematic plan of attack is followed. Accurate evaluation of HV capacitors, modulation transformers and reactors is best performed under operating conditions or by substitution.

Save the ohmmeter and impedance bridge for better uses. See you around the antenna farm!

# Avoiding Job Boredom

(continued from page 15)

have to do for that money the more clever they are.

Unfortunately, management isn't usually naive enough to fall for that old trick. In the end, the cheaters lose out on pay raises and promotions and seldom are satisfied.

You are better off trying to do as much as you can with each job. You may not get a nickel for the extra hours right away, but your success will pay off later several times over. In the mean time, you won't have to worry about how to fill up excess hours.

*Do it better*—Consider the requirements for your job as an absolute minimum. Get up to the expected level of competence as soon as possible. Spend your first months making all of the equipment meet specs. Be sure the station is legal.

After that, the real fun begins. If you can spend only half a day on repairs and maintenance, the rest of the day can be used to wow 'em.

Instead of just building a studio, build a showcase. Instead of just getting a recorder to run, make it run flawlessly. Instead of just wiring a rack, make it look like a factory-built job.

*Make it a contest*—When work becomes a game, it is no longer work ... it's fun! Some of the goals you could set are:

- 1. Beat all of the other stations on quality and loudness.
- 2. Reduce non-maintenance downtime to zero for a year.
- 3. Make all station equipment operative—no broken equipment sitting on any shelf.
- 4. Put together a stereo remote broadcast—something the station has never done before.
- 5. Exchange a faulty board channel within one song. Make bets with the studio staff and let them time you. If you

beat the song, they buy beers.

• 6. Design a new automation system and get it operating within a month. Make the GM buy the beers for this one.

*Try something you don't know how to do*—It's easier to get interested in a project when you're exploring and learning as you go.

Build a digital sequencer or a cue amp. Design a receiving antenna for remotes. Experiment with microphone compressor circuits. If these are too easy, try a satellite receiver or make an automation system from a personal computer.

*Invent something*—Put your creative powers to work. See if you can improve on some piece of equipment or come up with something not on the market.

Respond to the challenge: "Gee, I wish we had a gizmo that ..." If it's related to broadcasting, approach the GM and owner and see if they will help you get a patent and market the product.

*Try for a job just out of your reach*—Don't keep interviewing for jobs that you are already overqualified for and then complain about the salaries.

Instead, find something in a bigger market or a CE job if you're just a helper. If you can get paid a little more than you're worth, you'll gladly put in the extra effort to make the grade.

*Start a sideline*—Mike got interested in music and found all sorts of new adventures waiting. Maybe your interest will be computers, or something in a completely different field such as hot air ballooning or gem collecting. Try something new and see what happens.

I hope these little sparks will help ignite a fire in your mind and open up some new avenues of adventure.

If you're still having trouble getting out of a mental rut, I recommend you pick up the books: *A Whack On The Side Of The Head* and *A Kick In The Seat Of The Pants* both by Roger von Oech.

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## Satellite Times

# Satellite Audio Networks Soar

by Jeff Nordstrom  
and John Bimrose

Richmond IN . . . 1986 will go down as a record year for new audio networks thanks to satellite delivery. At last count there were approximately 70 audio networks "via satellite," with the majority intended for the radio broadcaster.

Commercial and non-commercial stations alike are seizing the opportunity to supply their communities with this programming. Today a majority of non-commercial stations have a satellite system in place. On the commercial side the average is greater than one satellite system per station, including shared downlink facilities.

I know of one station (small market) that has five different systems and is using them all on a daily basis.

### Justifying the expense

During the past few years there has been considerable controversy regarding the move to satellite distribution of network audio programs. One of the first questions raised is "Why should I purchase a downlink costing thousands of dollars?"

The answer is directly related to the break up of "Ma-Bell." Since then, relatively low cost Telco loops have been tariffed out of existence. In fact, there are no national networks left that depend totally on Telco line distribution.

Broadcasters today have the opportunity to utilize a multitude of radio networks, distributed via satellite. All it takes is an affiliate's contract and a downlink.

There are four popular audio satellite transmission techniques presently in

Jeff Nordstrom can be reached at Allied Satellite Equipment at 317-962-8596. John Bimrose can be contacted at United Video at 312-534-2400.

use, along with a couple of less common methods. Since I field calls on a daily basis regarding the differences and RW was kind enough to provide the space, we now have a chance to compare the advantages of these various techniques.

### SCPC transmission

Single-channel-per-carrier (SCPC) analog was one of the original audio network distribution methods that remains popular today. A satellite transponder is divided into 200 kHz (wide) or 40 kHz (narrow) channel segments allowing 15 kHz or 7 kHz program transmission respectively.

Each audio channel rides its own RF carrier and thus can be uplinked anywhere there is a dish aimed at the desired satellite. This is similar to the FM radio transmission technique for mono. All stations share a common FM band transmitting from their individual transmitters on a unique assigned frequency.

Since most C-Band satellite transponders are 36 MHz wide, you can see that some 50 plus carriers will fit within a single transponder. This is the case on Westar III transponder 2 and Westar IV transponder 2D, home of NPR and most baseball and football networks.

SCPC channels still have the advantages of lower cost uplink from anywhere, utilizing spectrum efficient non-complex technology.

The number one consideration on the downlink is a stable down-converter—home TVRO will not do the job! The second consideration is to match the audio conditioning that the network is employing.

Common with SCPC networks is 2:1, dbx 3:1, Wegener Panda I and II. And finally, just as with FM broadcast, the proper de-emphasis must be used if there is any hope of good frequency response.

Distributing audio by use of subcar-

riers is another popular transmission method. Subcarrier technology has been around at least as long as television has been using carriers 4.5 MHz above video to transmit audio.

Subcarriers are simply a form of frequency division multiplexing (FDM). Satellite Music Network and Moody Broadcasting are just two examples of services using this technology with much success.

Generally, the video information occupies approximately 4 of the 8 MHz of total bandwidth. The 6.2 and 6.8 MHz standard program audio subcarriers each use anywhere from 130 to 420 kHz of bandwidth (the amount of bandwidth depends on whether or not companding is used—more on this later). This still leaves some space to insert additional subcarriers.

A word of caution: If more than six or seven subcarriers are going to be inserted, the video baseband amplitude must be reduced by 1 or 2 dB (depending on the total number of subcarriers you plan to insert). Doing this compensates for the additional deviation caused by the new subcarriers.

### Uplink

The composite uplink signal is assembled in the following manner. A 600 ohm balanced audio source is fed into a modulator. Using frequency modulation (FM), it is modulated onto an analog carrier at its given baseband frequency. The outputs of each modulator are combined together to produce the subcarrier baseband signal.

When choosing subcarrier frequencies, care has to be used to keep injection levels and frequencies as low as possible. Failure to do so results in interference to the main video carrier.

At the same time the subcarrier baseband signal is produced, the video signal passes through a roofing filter with phase equalization. This eliminates any products above 4.25 MHz and compensates for any group delay in the filter.

The insertion loss of the filter is mea-

sured and subtracted from the original amount of attenuation desired. This new attenuator value is added at the output of the filter. The video signal is now coupled to the subcarrier baseband. This composite signal is fed to the exciter, up-converted, amplified by the high power amplifier (HPA) and finally sent to the antenna for transmission.

### Audio

Audio subcarriers are basically of two varieties, narrow and wide occupied bandwidth. These two terms are used to describe the amount of spectrum the subcarrier occupies.

Wideband subcarriers generally use no companding, while narrowband subcarriers do. Compressing and expanding, or companding the audio keeps the average modulation level high, thus improving the signal to noise characteristics of the system.

A 20-30 dB increase in SNR is typical as a result of companding. Companding also allows us to decrease the injection level (amplitude) of the subcarrier. This helps to reduce the intermodulation products and allows more efficient use of the spectrum.

Pre-emphasis is another common noise reduction technique. Typically, using a 75  $\mu$ sec time constant, pre-emphasis allows us to "boost" the amplitude of the higher audio frequencies more subject to noise than their lower counterparts.

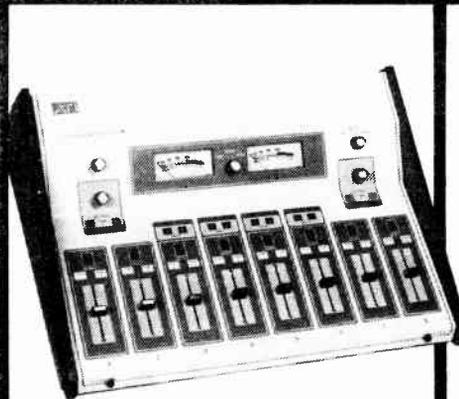
Pre-emphasis yields an additional 13 dB to the SNR. This is done prior to modulation. De-emphasis is then used at the receive end to restore the original signal.

### Monitoring

Figure 1 shows the baseband of WGN-TV (Galaxy I, TR3) uplinked by United Video (UV). UV was the first common carrier to uplink more than 20 subcarriers on a single transponder. Currently there are 23 subcarriers on this baseband.

Each subcarrier has to be monitored closely. Injection levels are kept  $\pm 0.5$  dB of tolerance. The primary thing to remember in uplinking subcarriers is to

(continued on page 22)

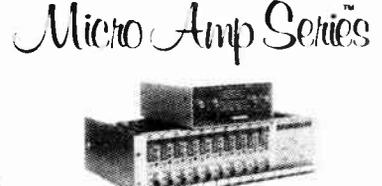


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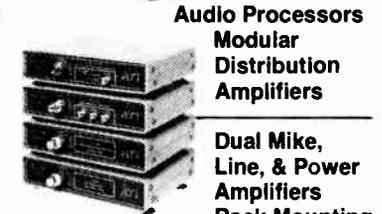


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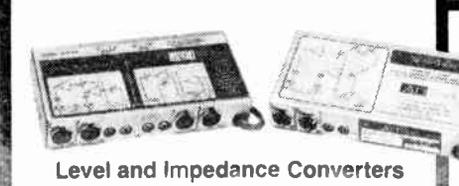
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# Reykjavik Feed a Joint Effort

by Dennis Feely

Los Angeles CA ... President Ronald Reagan and Soviet leader Mikhail Gorbachev weren't the only individuals working to solve complicated problems during October's summit at Reykjavik. Communications specialists responsible for providing the audio feed to worldwide radio networks faced an equally intriguing set of challenges.

IDB was contacted by the major radio networks two weeks prior to the event to provide audio transmission from Reykjavik.

Because we anticipated that up to eight circuits would be required, we decided to use a digital audio system. This selection was appropriate because the existing tariffs for the Intelsat system are for

*Dennis Feely is Sr. VP of IDB Communications Group. He can be reached at 213-870-9000.*

digital transmissions in standards set by Intelsat and the CCIR.

Also, we were not sure if the requirement would be for 15 kHz or 8 kHz; digital audio makes the switch easier, if it is needed. And we thought this was the best way to introduce our new Satellite Radio Program and News Transmission service (SRPNT).

Intelsat put IDB in contact with the Director General of the PTT (the Icelandic equivalent of the FCC). SRPNT would employ a transportable Ku-band uplink, 1.8 meter antenna and 300 W TWT in order to transmit to Intelsat's 341.5 East satellite.

That signal, sent via a T-1 data carrier, would be downlinked at the Comsat earth station in Roaring Creek, PA. Comsat would be supplying the equipment needed to take the signal down to the required 70 MHz.

We then proposed to demodulate the signal with their digital audio equip-

ment, channelize the data into eight separate audio channels, and then "hand-off" that feed to an IDB transportable uplink (C-band).

The signal would be boosted back up via Westar III for delivery to the networks in Washington, DC and New York. It also went to IDB headquarters in Culver City where the signal was monitored and retransmitted via the IDB data transponder on Satcom IR (for stations not receiving Westar III).

At the same time that we sought the cooperation of Intelsat to iron out bureaucratic details, we also worked with Tau-Tron, Inc., manufacturers of the chosen digital audio system. Tau-Tron assembled a package which included their equipment and the technical team needed to go to Roaring Creek in four days.

On Monday, 6 October Howard Miller and Jim Gilbert of IDB arrived in Reykjavik and began making preparations for Thursday, the first day of the summit. I arrived in Iceland on Wednesday to test the system.

After establishing telephone connectivity with Intelsat—which was a miracle since there were only 40 long distance circuits for 3000 people—we transmitted our first SRPNT signal.

Roaring Creek received us fine, but, we belatedly found out, their downlink equipment wasn't designed for data, as we had been informed, but rather for video.

The best solution turned out to be the most obvious one: we needed to locate a stable downconverter for the Intelsat frequency band (which was different from the US domestic Ku-band). Since IDB's equipment was designed for domestic use, we had to find a manufacturer who could help us—except that by this time, it was well past 7 PM Eastern time. No one was available.

So what we did was move our frequency to the uppermost portion of the international band, which in turn overlaps with the bottom portion of the domestic band. This way, we could use a domestic converter without mishap.

To protect ourselves, we also contacted two Long Island-based manufacturers, LNR, Inc. and Miteq, Inc., early Thursday morning to get downconverters made in three hours (it normally takes two to three months).

A chartered plane was on standby at MacArthur Airport to fly the equipment to Roaring Creek. Everything functioned perfectly after a speedy installation.

In fact, our system worked so well that when the White House staff was having trouble with its telephone communications (they had to share transponder time with another video customer), we had sufficient stability and power to add their signal to ours.

The success of the six-day remote serves as an excellent example of what can be achieved with cooperation among major radio customers.

## Bell Break-up Leads To Satellite Choices

by Kent Malinowski

Melbourne FL ... If necessity is the mother of invention, then deregulation must be the father of innovation.

In the wake of deregulation of telephone services, radio networks suddenly found themselves faced with soaring costs and wallowing in the confusion of whom to call for service.

One Florida-based high-tech company is riding the wave of "customer-fueled" innovation.

Technology developed by Advanced Communications Engineering Inc. (ADCOM) of Melbourne, FL, allows broadcasters and others to use satellite communication to replace expensive landline hookups.

Markets benefiting from the new technology include: regional radio-satellite networks, national music networks, sports radio networks, "for hire" satellite communication companies, and radio and TV satellite news gatherers.

As part of a continuing series of articles in RW dealing with alternatives to Telco, this article will highlight satellite communication innovation of interest to radio broadcasters.

### The market

Company officials estimate ADCOM has supplied equipment to 70% of the regional/state radio-network market in the past five years the company has existed.

With telco service, the network's programming was land-line fed, limited to 3 kHz quality, and reliability was at best marginal—subject to the phone company's own problems.

In addition, the average cost to the network of using telco services was about

*Kent Malinowski is Sales Manager for ADCOM of Melbourne, FL and was previously GM of Learfield Communications satellite division for five years. He can be reached at 305-242-0272.*

\$300 per month for each affiliate, plus a \$75 cost to affiliates.

These broadcasters now use single-channel-per-carrier (SCPC) narrowband signals to reach their affiliates. Most are on Westar III, transponder 2, with several using RCA's SATCOM IR, and Westar IV.

The satellite solution provides a minimum of 7.5 kHz (and up to 15 kHz) audio quality plus the proven reliability of satellite technology. Their average cost now is about \$150 to \$170 per month, total.

ADCOM VP of marketing, Henry Caldwell, says product quality and customer support has paid off.

"We've been able to show our customers how to replace their landline networks using our equipment. We've saved them money and provided better program audio at the same time," Caldwell says.

An added plus has been that many of ADCOM's regional and state radio network clients have found they can expand their services as a result of the new technology.

### Case histories

One example is Learfield Communications Inc. of Jefferson City, MO. In 1981, Learfield CEO Clyde Lear wanted to reduce operating expenses and increase program quality to its then 110 affiliates.

Lear selected ADCOM to design and construct a master earth station (uplink) and downlinks for each affiliate.

The satellite system uses Westar III, T-2 and provides state news distribution for Learfield's Missouri Network, agriculture programming for the Brownfield Network, and University of Missouri play-by-play for MissouriNet Sports.

Use of satellites has allowed Learfield to increase its affiliate base to more than 560—a 510% increase—in just five years.

Additionally, Learfield's transmission

*(continued on page 24)*

## ECHO

### From Telos Systems



The ECHO was designed specifically for telephone applications such as concert, weather, movie or sports listener-lines. Hardware-based digital audio storage provides up to four minutes of message time, with an internal gell cell to protect memory. The system provides a control layout similar to a cassette machine, and functions can be remoted for fully produced, and professional sounding messages. A four-digit counter displays the number of calls received in the auto-answer mode. An internal monitor amplifier and speaker allow auditioning without the need for an external telephone. Hookup is simple with a standard modular connector for telco, 1/4" TRS jack for a line-level source, and a front panel XLR mic input.

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# Audio Networks Use Satellites

(continued from page 20)

keep them from interfering with the main video baseband.

To guarantee this, the entire transmission chain must be calibrated and checked at regular intervals. Bessel nulls are used to calibrate the exciter, FM sidebands are used to set subcarrier injection levels, and HPAs are swept to assure linearity across the band.

The Bessel null test involves setting a 10.75 MHz: 1 V deviation ratio of the exciter. Once this is accomplished, a spectrum analyzer is used to set the absolute power level and deviation of each subcarrier.

With this information, the total amount of bandwidth can be controlled.

C-band has always been considered very reliable for subcarrier reception. Though not to discount the merits of Ku-band, C-band is by far the most popular medium for subcarrier transmission. It is rock solid, practically unphased by heavy rainfall, providing you have room for a 3.5 meter antenna and 4 GHz Terrestrial Interference (TI) is not a problem in your area.

With the recent boom in the home TVRO industry, inexpensive downlink hardware is available everywhere. The basic receive hardware for subcarrier reception differs little from that required for SCPC or DATS.

Once you have down-converted the signal you have several choices. You can

either use a stand alone receiver/demodulator (such as the Wegener 1601-11) or a conventional video receiver with a separate demodulator shelf. If you are planning to use a video receiver, make sure it has a composite baseband output signal.

## SCS—one step better

With the rapid growth of United Video's Galaxy I baseband and the possible scrambling of WGN's signal, it became clear additional baseband was required. This led UV's engineering group to "find a better way."

After meeting with many satellite users, UV was able to distill what seemed to be their general needs. The

result was the Satellite Communication System (SCS). Launched October, 1986, SCS is a C-band subcarrier only transmission system delivering "compact disc" quality audio and data.

## How it works

Because there is no main video carrier, 100% of the energy can be put into the subcarriers, thus allowing more subcarriers to be inserted onto the baseband.

The subcarrier frequencies start much lower, with the total baseband only occupying roughly 5 MHz. The resulting baseband is shown in Figure 2.

Since the highest modulator frequency is approximately 5 MHz, Carson's Rule of bandwidth tells us the deviation of the RF carrier is only about 17.5 MHz. That is compared to 35 MHz required for a video carrier.

Keeping in mind that TI is offset from satellite center frequencies by 10 MHz, you soon realize that any interfering carriers fall out of band. For this reason, narrowband filtering must be used at the downlink site.

SCS uses the Wegener Communication FM2 system, a type of FM frequency division multiplexing. Each analog subcarrier can be modulated using FM or a digital modulation scheme.

Some of the other benefits include the use of a downlink antenna as small as 6.2' in diameter, high reliability and the possible uplink from the user premises.

## Digital audio transmission

Early in the 1980s, the major national networks started researching ways to improve the technical quality and reliability of their distribution.

Various manufacturers of hardware and various satellite carriers were involved in the "experiments." RCA settled on a digital audio transmission service (DATS) that today is in use by ABC, CBS, NBC, United Stations (RKO) and most recently Westwood/Mutual.

One full satellite transponder is required for digital audio transmission. A time-division-multiplex modulation method is employed at a data rate of 8.7771428 megabits per second. There is only slight similarity to Marconi's spark gap transmitter.

Back to data rates. These unique data channels can be found daily on SatCom 1R, transponders 3, 19 and 23. If you enjoy home TVRO, tune in and your video receiver will display snow at the same time the signal level meter indicates signal. ("Watson, come here! You gotta see this!")

Through the use of magic, this data stream can be divided in twenty 15 kHz audio channels or forty 7.5 kHz audio channels or more 3 kHz voice and/or data channels.

For a serious, detailed overview of the system operation, I would suggest reading the operating manuals from the manufacturers of the digital receivers. From the reception standpoint, please consider that we are receiving data, not audio.

Hence at the receiver our interest is the digital bit-error rate. When the bit-error is low we will have full data recovery and excellent audio!

## Satellite use growing

No matter which system you choose, the programming currently available to the broadcaster via satellite has never been better. Add to that state-of-the-art quality, dependability and a reasonable price. It all points to a very bright future for satellite radio in the years to come.



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"And you can be sure AM stereo receivers are coming. By next year, over 30% of all new cars will have AM Stereo. And we're ready to capture those listeners right now.

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DELTA ELECTRONICS



# Changing Attitudes on Audio

(continued from page 17)  
pilot tone.

The other variety costs less, but needs no reference. It does not address wow and flutter.

The analog type looks at program and adjusts time delays to put the most time aligned signal into the middle (L+R mono mode).

Phone lines seem to be the worst thing we deal with. Frequency response is poor and varies greatly line to line, octave to octave.

Frequency extenders are actually frequency shifters as they trade some highs. These are one or two line and can almost fool you into believing that it is an average 8 kHz equalized line.

Others use compressor/expanders for noise reduction and equalizers to spruce them up a bit. A touch of reverb can wash out some of the noise on the line (so can the crowd mic). Many systems cut out the heavy-duty processors when a sporting event is aired via phone line.

CDs are a problem only because they are so perfect. Like the microphone, in an aggressive processing system, they may need to have peaks limited.

Additionally, in a broadcast environment entire passages may be below the system noise floor. An AGC with a low threshold and low gain limit may be needed if program content has extreme dynamic range that the rest of the system may find below gate level.

Reel to reels, cassettes, satellite feeds, RPU's, etc., all have limitations. I leave you with one last input error: the program itself may need to be "bleeped." This is a processing thing and yet another box in the on-air line.

### Adding color

The second processing function is colorization. Once the input correction is done and we have audio that is within bounds we can color it—or decide not to.

Colorization is anything that artificially alters the audio to an end other than clean and or exact reproduction. Frequency response tailoring is one way to color the signal.

For some, bass is something special. Some use the equalizer to match the equal loudness curve and thus color for apparent loudness (and ear fatigue?).

Reverb is an occasionally popular color tool that provides some sort of roominess as well as covering tape splices and dead air.

Additionally, "hard" limiters can be used to give rock a chainsaw edge. "Hyping" turntable, CD and cart speeds, also adds color.

In most cases color, being on the bottom of the "heirarchy of needs," is not something that should receive a great deal of attention and resources unless the previous needs have been satisfied.

### Compensating receivers

The third function is receiver correction. This is a heated topic and one that didn't receive much attention until rather recently.

The concept is that receivers have certain uniform defects that can be compensated. By and large the defects are frequency response. In the case of AM, the IF bandpass is limited on most receivers to prevent adjacent channel interference and high frequency distortion found on many AM stations.

Receiver correction became an issue with the decline of AM radio. Because the overwhelming number of AM stations sound poorly if the receiver has a wide bandwidth, receiver manufacturers did the logical thing: cut the bandwidth.

Broadcasters compensated for this reduced bandwidth (down to 3 kHz in some cases) by boosting the highs with

added preemphasis. While the solution had good short term results, the long-term cost is further damage to the AM band.

The recently approved voluntary NRSC preemphasis-deemphasis standard is a broadcaster-receiver manufacturer compromise that will hopefully match the signal AM stations transmit with improved (and wider band) AM radios.

### Correcting the transmitter

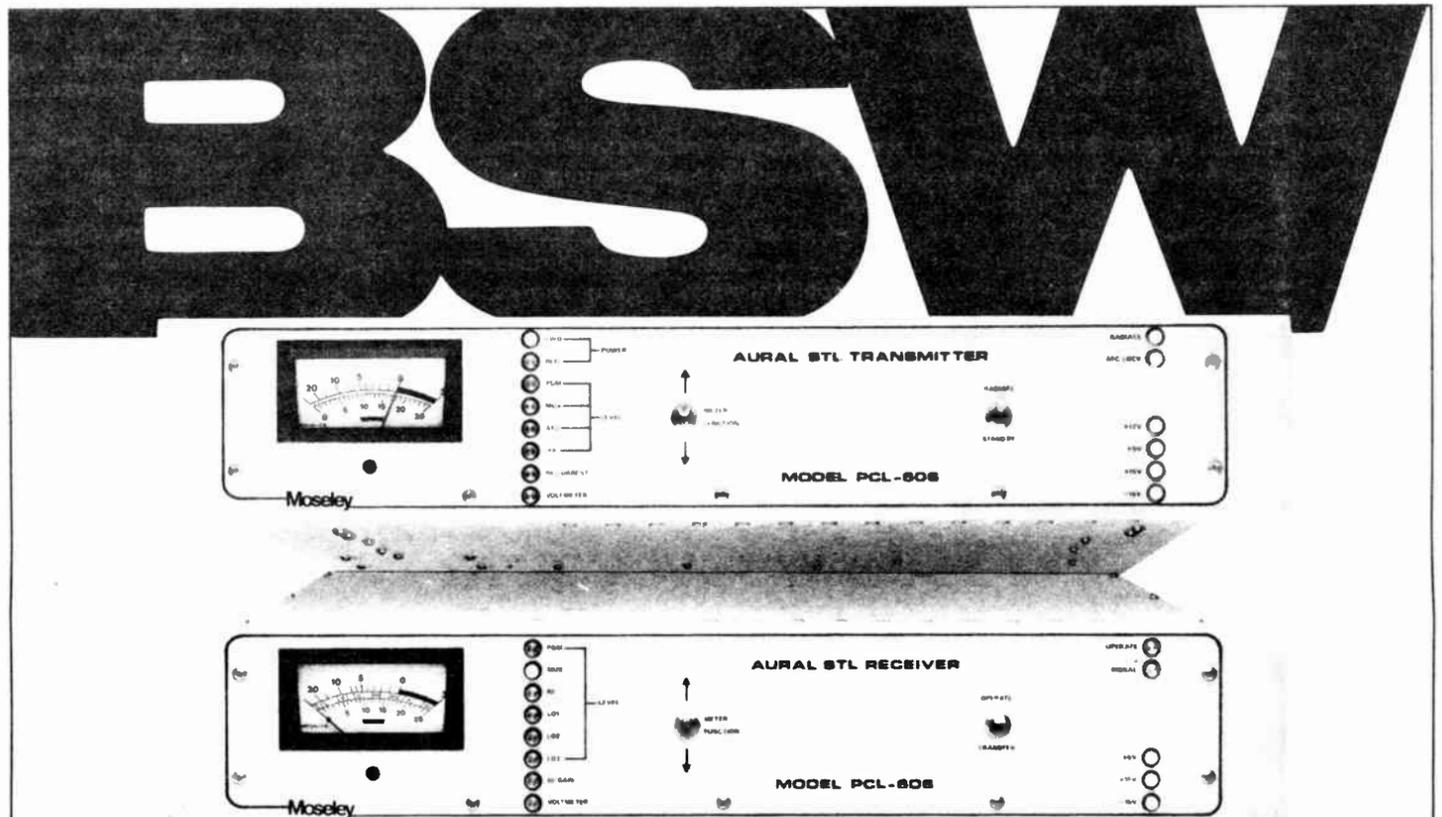
The fourth function is transmitter correction. Transmitter correction counters the shortcomings of the transmitter.

In the case of AM that can be a whole

bunch: asymmetrical modulation, square wave tilt, frequency response, narrow antennas, etc.

In FM, faults surround STL and modulator overshoots and minor frequency response problems in most cases. In most systems a limiter is the chief transmitter correction device as the biggest limit of the transmitter is that it can not (should not) over modulate.

In summary, I think it best to think of what functions the audio processors are to achieve rather than what the processor boxes themselves do. In my next installment, I will deal with some pragmatic considerations of designing audio processing chains using this analysis.

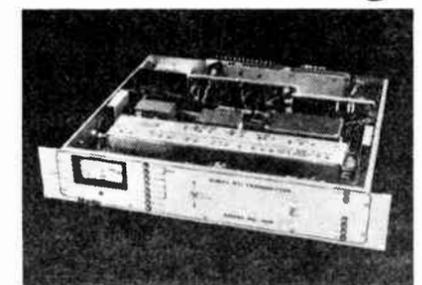


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# Choosing Satellites

(continued from page 21)

system has become a source of revenue for the company by the sale of excess capacity to other users.

Other ADCOM customers have experienced rapid growth since deploying satellite systems. In the past, landline distribution restricted many networks' growth because of limited quality and high cost. Such was the case for the Texas State Network.

At one time TSN had three audio networks time-sharing a single land line. But the use of satellite services has allowed the network to expand its program offering.

TSN now transmits six audio channels, three music channels and a data channel. Doing that on land lines would have cost them six times as much as the single line did. By satellite, the extra cost of having six channels as opposed to one shared channel was only 25% higher.

Capitol Communications, with services to North Carolina and Virginia, uses two fixed ADCOM uplinks for its sports radio broadcasts and other programming, also instead of land lines.

Capitol serves 110 affiliates in those states and has also been able to expand its programming to include Redskins football and Orioles baseball.

In addition, many local broadcasters have found satellite uplinks can be cost-effective for remote broadcasts and network distribution. (See 15 February RW "Satellite Uplinks Cost Effective.")

## Innovations in technology

The radio network marketplace for satellite-communication hardware has "grown up" since 1981. Early SCPC systems were simple, fixed-channel systems with little user flexibility. As the market began to mature, ADCOM conducted "customer conferences" to stay abreast of user needs.

ADCOM started out as a system integrator in 1981 and has evolved to become one of the leading equipment manufacturers today.

The company's original downlink con-

figuration for broadcasters consisted of ADCOM demodulator cards housed in a chassis built by Harris Corporation. The downconverter also was manufactured by Harris.

When customer needs became better defined, ADCOM replaced the Harris equipment with ADCOM manufactured chassis' and downconverters.

These new customer needs included being able to receive different channels from different networks, different channels on a single transponder, and different transponders on one satellite.

Customers were also seeking the next generation design in equipment.

Broadcasters now demand fully agile (tunable) equipment. ADCOM introduced its agile demodulator in 1984, and announced a new agile downconverter for SCPC receivers in 1986 along with a fully agile frequency-agile modulator.

This means for the first time a fully agile analog SCPC receiver and transmitter is available for both C- and Ku-Band radio distribution systems.

For radio stations, this means, also for the first time, one receiver can tune to any satellite, any transponder, and any intermediate frequency.

Multiple-network reception thus becomes an easy task. Further, components are available in configurations to match various manufacturers' chassis units. This makes equipment upgrades possible using ADCOM gear in shelf units of other manufacture.

ADCOM intends to remain an innovator in the field of satellite communications by also providing services to corporate networks (voice/data), and high-speed newspaper transmissions.

By adapting its capabilities in data communications, the company can use advances in the technology to enhance the quality of services to radio networks. No other data communications vendor has deemed the broadcast audio market important enough to merit their participation.

This technology sharing is a direct result of innovation. Innovation is the product of meeting customer needs in the marketplace. In the broadcast market, meeting needs means finding alternatives to telco.



From coast to coast, people are talking through OPTIMOD-AM Model 9100A—and dominating the lucrative adult demographics with full-service news and talk formats in mono or AM stereo. OPTIMOD-AM has literally no competition when it comes to creating crisp, intelligible, authoritative voice quality on the air.

Its six-band limiter with steep-slope crossovers pulls poor-quality actualities or phone calls "out of the mud" automatically in real time. And its adjustable, statistically-designed receiver equalizer pre-emphasizes high frequencies to assure comfortably intelligible sound from even the worst of the narrowband radios.

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**OPTIMOD-AM 9100A:  
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# Broadcast Equipment Exchange

"Broadcast Equipment Exchange" accepts no responsibility for the condition of the equipment listed or for the specifics of transactions made between buyers and sellers.

## AMPLIFIERS

### Want to Sell

**Russco mono TT preamps w/PS (2)**, \$50 ea. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

**Shure FP11 & FP12 mic to line & head phone amp**, \$99 ea. C Butler, Butler Eng, 8209 Pinon Dr, Jacksonville FL 32221. 904-286-6363.

**Phase Linear 400**, excel, \$300. B Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

**Crown PSA-Z w/balanced input module**, mint, \$1300. C Osgood, Ct Recording Sid, 1122 Main, Bridgeport CT 06604. 203-366-9168.

**Rust 150-3 FM RF amp**, \$30. M Persons, KASM, Hwy 52 W, Albany MN 56307. 218-299-1326.

**Muzak 1008 tube type amps**, 8 W ea w/4, 150, 600 & 70 V line outputs, all tested & in working cond, some w/o tubes but tested; w/tubes, \$15, w/o tubes, \$10. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

**Bogen C-100 100 W solid state PA amp**, \$60. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

**McIntosh MC30**, excel cond, \$75. J Pascale, 3 Stanley Pl, Hauppauge NY 11788. 516-265-8283.

**McMartin TBM 2500C FM RF amp**, S Wallace, WDAO, 1400 Cincinnati St, Dayton OH 45408. 513-224-1137.

**Crown D-75 stereo 35 W/chan power amp** recently factory checked, \$275 or BO plus shpg. B Defelice, CK Cable FM, 621 Bishop, Bridgeport CT 06610. 203-336-5606.

**McIntosh MC30** excel cond, \$85. J Pascale, 3 Stanley Pl, Hauppauge NY 11788. 516-265-8283.

**Kenwood KA-9X 240 W**, stereo integrated amp, excel cond, \$200. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

**Crest P2501 2 rack spaces**, 130 W/chan RMS at 8 ohms, \$525. R McMillen, 13515 SW 72nd, Tigard OR 97223. 503-684-1973.

**Haffer 220**, rack mounted, 130 W/chan, tripled pwr supply wire, \$375. R McMillen, 13515 SW 72nd, Tigard OR 97223. 503-684-1973.

**Russco 2B phono preamps (2) w/o PS**. H Konig, WAYN, 6001 Cass, Detroit MI 48202. 313-661-0896 (M&W, 11-1 PM).

**Marti TA-66 25 Hz amp**, \$100. R Miller, WRVI, 815 W Dean, Virden IL 62690. 217-965-3388.

**Altec Voice of Stars amp**, rack & case, perfect, \$35. D Olson, POB 479, Island Heights NJ 08732. 201-929-0694.

**Stanton 310**, new, flat/NAB switching plus individual gain & high-freq adjustments, \$130/BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

**Technics R&B SU-300MC** for use w/moving coil phono pickup cartridges, like new, \$60/BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

### Want to Buy

**Marantz & McIntosh tube & solid state**. C Dripps, Kurloff Entr. 818-444-7079. 800-334-8223 CA only.

**McIntosh models MC-2155, MC-2205, MC-2255** in mint cond. William Wysock, Professional Sound Systems, 2527 Treeland Ave, Monrovia CA 91016. 818-359-1373.

**McIntosh, Marantz, Dynaco Quad, Audio Research, etc. amps**; WE, Tannoy, Altec, EV, JBL, Hartsfield, Olympus, Harness, Laguna speakers; Thorens, Fairchild turntables; WE tubes & microphones. Lapine, 3920 August Dr, Lake Worth FL 33461. 305-588-8195.

**RCA BA73 program amp**, any cond. T Vernon, WHGB, 900 Market, Harrisburg PA 17101. 717-249-1230.

**Melcor 1731's**. A Berliner, Crystal Studios, 1014 Vine St, Hollywood CA 90038. 213-466-6452.

**Fisher & Heath Dynadec ST34 & Mark 6**. M Disch, Select Snd Svcs, 427 W Capital, Heartland WI 53029. 414-367-5719.

## ANTENNAS & TOWERS

### Want to Sell

**CSI VSWR alarm panel**, BO/trade. R Hahn, KDCR, Dordt College Campus, Sioux Center IA 51250. 712-722-0885.

**RCA BFC 5 bay w/heaters** tuned to 93.9 MHz. J Brown, WZZU, POB 33396, Raleigh NC 27606. 919-782-4709.

**315' 3-1/2 Heliax w/connectors**, excel cond. J Brown, WZZU, POB 33396, Raleigh NC 27606. 919-782-4709.

**50 ohm EIA 90° elbow, 1-5/8"**, \$30. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

**Cablewave 3-1/8" air hardline HCC-300-50J** w/EIA flanges, 7 spools of 200', any or all, BO. B Brown, Brown Co, POB 59204, Birmingham AL 35259. 205-879-1621.

**Scala FMO-4 4 bay omni directional antenna** tuned to 95.3, only used 4 mos, \$700 plus ship. R Phipps, KHLK, 998 A Sidney Baker So, Kerrville TX 78028. 512-257-7711.

**Transmission equip** in excel cond, BO, write for list. R Bishop, Unwest, POB 3115, Cooper Mountain CO 80443.

**HCC300-50J hard line coax 3-1/8" diameter**, 200' lengths, 1400' total, EIA fittings. B Brown, Brown Co, POB 59204, Birmingham AL 35259. 205-879-1621.

**Kintronics 7.5 kHz isocoupler**, can be retuned, never used, \$800/trade for stereo console. B Hoisington, WTCG, POB 1776, Andalusia AL 36420. 205-222-8849.

**Tower 60', 12" base, 7' sections**, \$600/BO. D Hubbard, KKRE, Box 1385, Monument CO 80132. 303-481-4700.

**CP 4 bay FM antenna**. S Lawson, KAK FM, 928 Hyland, Santa Rosa CA 95404. 707-528-4055 (eves).

**Phelps Dodge isocoupler**, 25 kW rating tuned for 94.7 MHz FM & 1260 kHz AM, is retunable, \$100; RCA BSH-8 horizontal antenna w/tuning & mounting hardware, tuned to 94.7 MHz, horizontal, BO. A Branch, Allen Audio, POB 1979, Decatur GA 30031. 404-325-7847.

**Collins (Harris) G5CPM-4 CP FM antenna** on 102.3, 1-5/8" connections & mounting hardware, \$3500; Andrews coax approx 600' & connectors, \$4000; ERI isocoupler from 1K AM, needs teflon spacers replaced, \$500; complete package, \$6000. J Atkinson, KCAB, POB 89, Dardanelle AR 72834. 501-968-4949.

**Shively 6810 6 bay**, new in '80, call for price. B Thacher, WSIP, RCA Box 591, Paintsville KY 41240. 606-789-5311.

**Cablewave 1-5/8" air, 100' on spool**, \$500. J Verkest, WFCL, POB 269, Clintsville WI 54929. 715-823-5128.

**Harris FML3E**, 106.3 MHz w/isocoupler Kintronic FMC7.5, avail 4/87. S Brown, WHBY, POB 1519, Appleton WI 54913. 414-733-6639.

**Raytheon antenna tuning unit**, will customize for 1 kW or 5 kW to buyers freq & ant impedance, 1 kW \$500, 5 kW \$700. C Stuart, C & R Stuart, POB 1236, Susanville CA 96130. 916-257-2702.

**Phelps Dodge HFMLP-2 2 bay antenna**, 91.1 MHz, 10 kW, \$300. P Russel, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

**Castle dual phaser 3**, (2) complete in 2 rack spaces, very low hrs, 4-16 stage phasing, \$325. R McMillen, 13515 SW 72nd, Tigard OR 97223. 503-684-1973.

**Andrew 1-7/8" rigid line**, 50 ohm, 3500' at 20' per section, EIA flanged, excel cond in warehouse, will sell all or part, BO. E Milián, New Continental Bldg, 180 NW 59th Ct, Miami FL 33126. 305-261-1637.

**Phelps Dodge CPFMD10 10 bay w/heaters**, 90.9 MHz on ground, mint cond, BO over \$10,000. B Bierman, Toccoa Falls College, Toccoa Falls GA. 404-886-6831.

**Cablewave HCC-300-J50 heliax 3" w/3-1/8" EIA fittings**, 350' on spool, ready to ship, \$3500; also 50' length, \$500. G Ramsey, WQSF, POB 180, Williamsburg VA 23187. 804-874-3696.

**ERI isocoupler 25 kW, 3-1/8" EIA fittings**, \$3900; non-insulated hangers & adaptors, \$300; RCA DSC-6 elements only, \$1200. G Ramsey, WQSF, POB 180, Williamsburg VA 23187. 804-874-3696.

**Delta AMC-1 Mdl D13-44-2 mod controller**. H Leupp, KFVR, Box 1738, Bismarck ND 58502. 701-223-0900.

**RCA MI-19089-2C flanges, 3-1/8"**, new (8), \$275 ea. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

### Want to Buy

**Rohn 55G or 65G tower sections**, or Tri-ex T-20 or T-26. A Emerald, Emerald Entrp, 8956 Swallow, Fountain Valley CA 92708. 714-962-5940.

**Bogner UHF TV antenna**, B4u, B8u, B16u, low & medium power input series, any chan, will consider old translator band (70-83). J Powley, WILM TV, 1536 Logan, Altoona PA 16602. 814-943-2607.

**Tower, 250-300' self-supporting**, extra heavy to support many sidearms, standing on or ground. M Cromwell, Comm Engr, 1000 27th Ave SW, Cedar Rapids IA 52404. 319-364-0271.

## AUDIO PRODUCTION (OTHER)

### Want to Sell

**UREI 565 filter set w/manual**, \$280. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

**Symetrix 108 System**, 8 line phone system, 6 mos old, used 2 mos, excel cond, w/extra control box for screening, \$1600. S Bush, KTKK, 3595 S 1300 W, Salt Lake City UT 84119. 801-264-8250.

**Shure M268** neatly modified for mic or line input, rack mt, new cond, \$179. C Butler, Buller Eng, 8209 Pinon Dr, Jacksonville FL 32221. 904-286-6363.

**Studio equip** in mint cond, little use in low demand situation, write for list. BO. R Bishop, Unwest, POB 3115, Cooper Mountain CO 80443.

**Custom built mobile studio**, newly painted, new glass, Dodge frame & engine, elec or gen operated & air conditioning, BO. B Klaus, WNIR, POB 629, Kent OH 44240. 216-673-2323.

**ADC SA-1 spectrum analyzer**, 10-band, like new, \$100. B Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

**Cetec prod room/remote console set up**, (2) TTs, 5 chan mono board, amps, speakers & cabinetry, \$2000. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

**Garron STE-100 phase enhancer**, similar to Howe Phase Chaser, 10 yrs old, works, \$250/BO. H Landsberg, Henry Engr, 503 Key Vista Dr, Sierra Madre CA 91024. 818-355-3656.

**SAE 5000A impulse NR unit**, excel cond, \$115. B Busetti, Lizard Recdg, 1124 W 2nd St, Florence CO 81226. 303-784-3540.

**dbx subharmonic synth**. S Wallace, WDAO, 1400 Cincinnati St, Dayton OH 45408. 513-224-1137.

**Eventide Monster Mat RD 780 (2)**, \$300 ea or \$500/both. R Dietterich, WLTJ, 1051 Brinton, Pgh PA 15221. 412-244-7600.

**UREI Vidigraf 970**, bargraph display gen, up to 32 chan, orig box w/manual, \$300/BO. A Tucker, Foothill Prod, 70 W 83rd, NY NY 10024. 212-877-0973.

**Shintron 346 audio dist amp**, 1 input, 6 balanced outputs w/manual, \$150; Shure M610 feedback controller, new, \$75. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

**Orban 422A studio Optimod mono w/manual**. BO. J Phillips, All-American Bldg, 414 Washington, Defiance OH 43512. 419-782-8591.

**Fairchild 659 Reverbertron II**. H Leupp, KFVR, Box 1738, Bismarck ND 58502. 701-223-0900.

**Audisar custom built 3 rack space panel w/3 high quality Audisar mic splitter transformers**, plus 1 direct box type transformer, ground lift switches, Switchcraft XLR ins & outs, great for remotes, \$150. R McMillen, 13515 SW 72nd, Tigard OR 97223. 503-684-1973.

**Lexicon 1200 audio time compressor/expander**, mint cond (2), \$5000 ea. I Kaufman, Natl Recg, 460 W 42nd, NY NY 10036. 212-279-2000.

**Eventide Harmonizer 949 w/upgrade**, 1 yr old, perf cond, \$2600. K Stephens, KTUX, 4615 Monkhouse, Shreveport LA 71109. 318-635-9999.

**Misc gear inc**: consoles, cart machines, R-R, TTs, generator, & much more, call for details. C Condon, KMGR, 5282 S 320 W, Ste D-272, Salt Lake City UT 84107.801-264-1075.

### Want to Buy

**Panasonic-Technics model SH-9020 peak level meter** display in mint cond. William Wysock, Professional Sound Systems, 2527 Treeland Ave, Monrovia CA 91016. 818-359-1373.

## AUTOMATION EQUIP.

### Want to Sell

**SMC 92A R-R cart deck**, \$500, (3) RCA 12" 3345 TTs, \$75; Collins ERI G5CPS 4 bay CP 92.5 MHz, \$2000; GE console 4BC1A1, BO; Shafer 8000 control, BO. B Harlan, WFAH/WJDQ, 393 Smith, Alliance OH 44601. 216-821-1111.

**Harris Sono-Mag Carousels**, Ampex R-R's, digital clock, tone sensor, Shafer racks, BO. R Huggler, WSUL, 250 Broadway, Monticello NY 12701. 914-794-0242.

**SEI Set-master controller**, (3) IGM Go-Carts, mono, rack mounted, wired & ready to run, \$12K/BO. E Fisher, WSDR, Box 399, Sterling IL 61081. 815-625-3400/1240/3540.

**Control Design automation controller** incl 12-source switcher, 2K-event memory, 10-event clock & power supply, all manuals & instructions, avail 2/23/87, \$4000. G Meloon, WDBA, 28 W Scribner, DuBois PA 15801. 814-371-1330.

**CD-25S tone sensors (2)**, \$200 ea w/manuals; CD-60T time-announcement controller, \$350. G Meloon, WDBA, 28 W Scribner, DuBois PA 15801. 814-371-1330.

**Control Design automation controller** incl 12-source switcher, 2K-event memory, 10-event clock & power supply, all manuals & instructions, avail 2/23/87, \$4000. G Meloon, WDBA, 28 W Scribner, DuBois PA 15801. 814-371-1330.

**CD-25S tone sensors (2)**, \$200 ea w/manuals; CD-60T time-announcement controller, \$350. G Meloon, WDBA, 28 W Scribner, DuBois PA 15801. 814-371-1330.

**IGM Carousels (4)**, (3) IGM R/R racks & extras. K O'Mally, WLRW, Box 3369, Clamagne IL 61821. 217-352-4141.

**BGM decks & Carousel (3)**, w/telco remote ctrl, sequencer, 25 Hz gen, 2 racks, \$3000. T Troit, Peppo Cable Radio, 5477 Carter Rd, Lake Mary FL 32746. 305-323-0472.

**SMC 792**, BO. L Thompson, WCLT, Box 800, Newark OH 43055. 614-345-4004.

**Cybrix automation system w/spares**, BO. D Howard, WMHE, 4665 W Barcroft, Toledo OH 43615. 419-531-1681.

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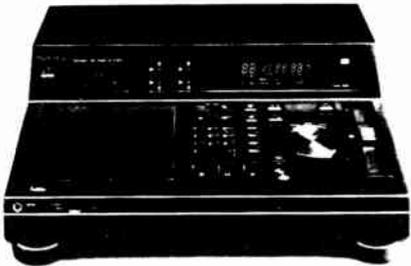
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# Broadcast Equipment Exchange

## AUTO EQUIP . . . WTS

Harris 9003 (4) IGM Go-Carts, 1 BE triple deck cart machine, (2) ARS1000 Otari's, (2) CRT control stations w/battery backup & charger, BO. T Bondurant, WMAG, POB 2208, High Pt NC 27261. 919-882-0995.

Gates SC-48 automation system, 3 racks, (2) 250RS Carousels, Criterion '55, (3) Criterion single plays, clock, printer, fader, etc, PBs were operational when removed from service, \$4000. J David, KMPL, POB 907, Sikeston MO 63801. 314-471-1520.

### Want to Buy

Carousels (3), programmer cables, used OK but must be working, D Carlisle, WTIP, 817 Suncrest Pl, Charleston WV 25330. 30-342-3136.

Cetec 7000 w/4 R-R & multicart decks. C McCarthy, KNCQ, 2551 Park Marina Dr, Redding CA 96001. 916-244-9700.

## CAMERAS (VIDEO)

### Want to Sell

Sony DXC1610 camera & mate recorder, pkg or separate, BO. F Chlebowski, Ontario Recording Svc, 45 Sobieski St, Rochester NY 14621. 716-342-5331.

JVC KY210 w/Fujinon 10:1 lens & access, excel cond, \$3195. D Brennan, Custom Video, POB 26126, Birmingham AL 35226. 205-823-0088.

Hitachi GP61 1 tube camera, \$400. C Kent, ACS Inc, 443 Elbert, Ramsey NJ 07446. 201-825-7807.

Norelco PC70 cameras w/lenses, CCU, etc. H Casteel, Technichrome, 1212 S Main, Las Vegas NV 89104. 702-386-2844.

Servo zoom lens for Hitachi FP-10 camera, 10:1, 16-160mm, f2.2 w/macro, excel cond, \$250. G Odell, The Film Group, Box 9, Wethersfield CT 06109. 203-527-2972.

Hitachi FP-20 w/10:1 zoom lens, carrying case, RCU & cable, AC power supply, shoulder pod, operating cond, BO. M Taylor, AliMar Prod, 274 County Rd, Tenafly NJ 07670. 201-569-1717.

Panasonic WV3890B (2), also have RCU's & cable to match, \$1500 ea. L Sharp, KZOK, 200 W Mercer #304, Seattle WA 98109. 206-281-5600.

Sony VO3800 w/AC300 & Sony DXC 1640 all w/battery, mint, \$1500 for pkg, K Knowles, 2827 SE 2nd St, Ocala FL 32671. 904-694-4224.

Sony DXC3000 or equiv CCD camera. M Glaser, MRG Assoc, 2 Floyd Ln, Massapequa NY 11762, 516-489-1071.

## CART MACHINES

### Want to Sell

Spotmaster PB in vgc, \$250; Spotmaster 405 R/P vgc, \$350. B Hoisington, WTCG, POB 1776, Andalusia AL 36420. 205-222-8849.

ITC Mod RP (3), two gd, 1 repairable, \$700 for all, call Mike Murphy, 11621 Valle Vista Rd, Lakeside CA 92040. 619-581-2726.

ATC mono cart machine, operating, \$400. P Wolf, Wolf Eng, 241 NE 10th Ave, Cape Coral FL 33909. 813-574-5548.

BE Spotmaster 500 (2) stereo PB, gd cond, \$300 ea. M Phillips, Phillips & Co, POB 985, Launenburg NC 28352. 919-276-1306.

ATC stereo R/P, \$350. M Phillips, Phillips & Co, POB 985, Launenburg NC 28352. 919-276-1306.

Gates Criterion stereo, R/P, needs repair, \$500. P Wolf, Wolf Eng, 241 NE 10th Ave, Cape Coral FL 33909. 813-574-5548.

ITC Delta stereo w/record unit, never used; Broadcaster Cartimer, 3 digits to 9:59 w/4 remote machine, start switches, new. M Sirkis, Peak Audio, 3107 Bedlington Pl, Holland PA 18966. 215-860-0303.

Contel 101P-B mono PB, \$150. M Gollub, WMJS, Box 547, Prince Frederick MD 20678. 301-535-2201.

Gates Criterion cart deck, \$350; (3) Scully 270 PB decks, \$200 ea. B Harlan, WFAH/WDJQ, 393 Smith, Alliance OH 44601. 216-821-1111.

Gates Criterion, 2 wirec amps, sec & tertiary tones, 1 w/all tones, 1 w/stop tone only, spare elects, \$250 ea or BO plus shpg. B Defelice, CK Cable FM, 621 Bishop, Bridgeport CT 06610. 203-336-5806.

Tapcaster 700P mono, \$100. T Trott, 5477 Carter Rd, Lake Mary FL 32746. 305-323-0472.

Sparta mono 800 R/P in working order, \$150. T Trott, 5477 Carter Rd, Lake Mary FL 32746. 305-323-0472.

BE 500 mono play, table top, \$100. T Trott, 5477 Carter Rd, Lake Mary FL 32746. 305-323-0472.

BE tape winder w/timer, carts (200) various lengths, \$200; Model 400 cart tape, new on hubs, \$75; (150) teflon wheels, \$20; 1 box of pads, \$5. R Eaton, WFHC, 158 E Main, Henderson TN 38340. 901-989-6000.

Gates Criterion mono play, \$250. P Ramsey, KOWB, POB 1290, Laramie WY 82070. 307-745-4888.

ICA stereo R/P Rapid Cue, \$450; (2) mono in one rack, \$250 for both. F McCall, Performance Srvs, 1521 W St Marys Rd, Tucson AZ 85745. 602-323-0901.

### Want to Buy

Cue cards, 150 Hz, for Collins 642 Twin Tape; also need unit for parts. B Hoisington, WTCG, POB 1776, Andalusia AL 36420. 205-222-8849.

BE 3000 & 2100 cart machines wanted. Exporter needs 90 used machines, working cond, not more than 6 yrs old, reasonable price avail. Send particulars to: RW, POB 1214, Falls Church VA 22041. Attn: Box 1-1.

ITC triple deck mono, must be in gd working cond. D Voss, KADR, RR1 Box 86, El Kadar IA 52043. 319-245-1400.

BE5300 stereo or ITC 3 deck w/record amp. S Wentzloff, WCXT, POB 448, Hart MI 49420. 616-873-7129.

## CASSETTE & REEL-TO-REEL RECORDERS

### Want to Sell

Ampex AG-350-2 in Ampex console w/manuals, used for editing, \$800 plus ship compromise or \$600 for all except console. G Meloon, WDBA, 28 W Scribner, DuBois PA 15801. 814-371-1330.

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Ampex AG-440B (2), each in Ampex roll console, one with 2 trk heads, 3.75-7.5 ips, mono electronics, one with F.T. heads, 7.5-15 ips, mono electronics, \$450 ea or \$800/pair. William Wysock, Professional Sound Systems, 2527 Treelane Ave, Monrovia CA 91016. 818-359-1373.

Revox A-200, excel w/manuals, \$850; Sony TC-650, 7" 1/4 trk, plug-in head block, vgc, \$250. B Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

Ampex recorders, 6011-2, \$250; 600, \$150; 601, \$175, tan cases. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

Ampex recorders, 8 trk w/ss; 4 trk w/ss; 3 trk/Neumann U47 mic, \$4850; 2 trk/2 trk/FT/1/2 trk/Pultec EQP1A, \$3250; Ampex remotes (2), \$100ea. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

MCI JH110C-8 working, gd cond, w/locator & rollaround. J Barcroft, KGB, 7150 Engineer Rd, San Diego CA 92111. 619-292-1360.

Sony TC7562, 10-1/2" R-R, 7.5-15 ips, gd deck, \$350, free ship; (3) Gates solid state M6629 AGC, \$150 ea or all for \$375, free ship. J Sheppard, Globe Prod, 539 W Minister Ln, Salem VA 24153. 703-389-1670.

Scully 400 logger, 4 chan record, PB, erase, constant run/VOX operation, gd cond, low hrs, BO for trade. M Glaser, C&G Ent, 679 Nassau Rd, Uniondale NY 11553. 516-489-1071.

Technics SV-P100 digital audio tape recorder. J Aulik, Chnl 26, 960 Watermullen Dr, Green Bay WI 54304. 414-494-2400.

Sony TCD5PRO stereo portable cassette deck w/built-in limiter, NR & balanced/unbalanced inputs, \$275/BO. J VonVleck, Aras Cons, 2844 Beechtree Ln, Woodbridge VA 22191. 703-221-6984.

Nagra III (4), w/sync option, 3.75:7.5:15 ips, mint cond, \$1500 ea/BO. J VonVleck, Aras Cons, 2844 Beechtree Ln, Woodbridge VA 22191. 703-221-6984.

Ampex 601, \$150. A Crain, WVEE, Box 157, Collierville TN 38017. 601-895-6483.

Pioneer RT-707 autoreverse, gd cond, (9), \$100. J Andrew, KYKY, 111 S Berniston, St Louis MO 63105. 314-725-9814.

Sony TC630 excel cond, new heads, \$300. B Michaels, Tye Bdct, POB 5105, Abilene TX 79608. 915-695-7300.

Akai GX-4000 7" R-R, 4 trk stereo, 2 speeds 7.5 & 3.75 ips, \$100. M Gollub, WMJS, Box 547, Prince Frederick MD 20678. 301-535-2201.

TEAC A-3300SX 10-1/2" R-R, 2 trk stereo, 2 speeds, 15 & 7.5 ips, \$250. M Gollub, WMJS, Box 547, Prince Frederick MD 20678. 301-535-2201.

Revox A77, excel cond, \$300. B Michaels, Tye Bdct, POB 5105, Abilene TX 79608. 915-695-7300.

3M M79, all kinds of parts, heads, motors, etc, scrapping 6 machines, 1 yr warranty on all parts. B Youger, UCA Recording, 1310 Lenox, Utica NY 13502. 315-733-7237.

Otari MKII-4 excel cond, 1/2" 4 trk, BO. R Kaufmann, Solid Gold Time Machine, PO Box 29804, Atlanta GA 30359. 404-636-2787.

Scully 280, in floor cabinet, mono, BO. G Erway, KBOW, Rt 2 Box 26B, Cordell OK 73632.

MCI JH110BX 1/4" R-R, 8/82, selling for upgrade, w/remote control, \$3000/BO. G Dalton, KKDA, POB 530860, Grand Prairie TX 75053. 214-263-2806.

Nakamichi 550, battery operated, excel cond. R Kaufman, Solid Gold Time Machine, POB 29804, Atlanta GA 30359. 404-636-9911.

Otari MKII-4 1/2" 4 trk, excel cond, BO. R Kaufman, Solid Gold Time Machine, POB 29804, Atlanta GA 30359. 404-636-9911.

Nortronics 9211 tape heads, new, reproduce 2 trk stereo, 1/4", orig equip for Scully 280B & 250, 255; Revox PR99, 2 trk stereo, 7.5-15, used less than 40 hrs. M Sirkis, Peak Audio, 3107 Bedlington Pl, Holland PA 18966. 215-860-0303.

MCI JH-10 2" 16 trk w/autolocator & varispeed, \$8500; Scully 280 1/4" mono w/Ruslang cabinet, \$1300; Teac A-2000R 1/4" stereo auto-reverse, \$325. C Osgood, Ci Recording Std, 1122 Main, Bridgeport CT 06604. 203-366-9168.

Tascam 70, \$200; Soundcraft Series II manual, \$5; TEAC 2300S stereo deck inst manual, \$5; 3M 400 inst manual, \$20; Ampex ops & maint manuals for AG-440B & AG-445B, AG-350 & AG-355, \$20 ea. D Green, Waves Snd Recrds, 1956 N Cahuenga Blvd, Hollywood CA 90068. 213-466-6141.

Ampex 440C 4-trk, 1/2" format, excel cond, \$3500 firm. E Caldwell, Production Block Stds, 906-E 5th St, Austin TX 78702. 512-836-0666.

3M M79 24 track, rebuilt, all new Saki heads, auto locator, \$16,000. B Youger, UCA Recording, 1310 Lenox, Utica NY 13502. 315-733-7237.

Ampex 440B (3), stereo 1/2 track in gd cond, working, several cabinets, \$1500-\$1800 depending on cabinet. B Youger, UCA Recording, 1310 Lenox, Utica NY 13502. 315-733-7237.

Eumig FL-1000 cassette deck, excel cond, BO. R Kaufmann, Solid Gold Time Machine, PO Box 29804, Atlanta GA 30359. 404-636-2787.

Magnacord 728 2-track stereo rack mount, working but rough, \$75 w/manual & reel knobs. G Meloon, WDBA, 28 W Scribner, DuBois PA 15801. 814-371-1330.

MCI 2 chan repro chassis for JH-110B recorder, \$600/BO. H Landsberg, Henry Engr, 503 Key Vista Dr, Sierra Madre CA 91024. 818-355-3656.

Ampex mono R-R w/Inovonics 375 elect, \$350. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

ITC 850 2 trk, some spares, \$550 or BO plus shpg. B Defelice, CK Cable FM, 621 Bishop, Bridgeport CT 06610. 203-336-5606.

Telex 230 mono FT w/record elect. S Brown, WHBY, POB 1519, Appleton WI 54913. 414-733-6639.

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ITC tape cabinets for 750/770's roll arounds. S Brown, WHBY, POB 1519, Appleton WI 54913. 414-733-6639.

Atlantis stereo cassette w/Dolby, \$150. P Ramsey, KOWB, POB 1290, Laramie WY 82070. 307-745-4888.

Revox PR99 1 yr old, excel cond, \$1500; Revox A77, perf cond in portable case, \$850. R Furby, KGAL, POB 749, Albany OR 97331. 503-926-8683.

Ampex AG-350, 2 trk stereo, 7.5-3.75 ips, gd cond in Ampex console, \$750 plus shpg. E Hevey, Successtrax, POB 1357, Winchester VA 22601. 703-877-1191.

Teac X10-R 1/4 trk stereo/reversing 3.75-7.5 ips, \$300. T Trott, 5477 Carter Rd, Lake Mary FL 32746. 305-323-0472.

Wollensak stereo cassette HS duplicator, 1 master, 5 slaves, recently rebuilt, excel cond, \$1500. W Weagant, Command Prod, 107 ICB Bldg, Sausalito CA 94965. 415-332-3161.

Telex 300 stereo reel master, 3 in shell slaves in roll around rack, vgc, \$1600/BO; Telex 300 stereo loop master w/Ampex 350 R-R slave, vgc, \$2200/BO; Electro Sound cassette winder, gc, \$500/BO. W Brassell, Brazro Recdgs, 1215 N Concord, Chattanooga TN 37421. 615-892-5995.

Ampex AG 440-B 1" 8 trk w/servo in roll around console, vgc, \$4800/BO; Teac 80-8 8 trk, vgc, \$1650/BO. W Brassell, Brazro Recdgs, 1215 N Concord, Chattanooga TN 37421. 615-892-5995.

3M Wollensak cassette dup, gd cond, \$500. R Eaton, WFHC, 158 E Main, Henderson TN 38340. 901-989-6000.

Scully 280, 2 trk stereo, 7/5-3/75 ips, gd cond, wood console avail free, plus shpg. E Hevey, Successtrax, POB 1357, Winchester VA 22601. 703-877-1191.

Nakamichi 6802X 3-hd cass deck, front panel bias for 3 types, auto azimuth adjust, \$550. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

Ampex 8 trk/4 trk/3 trk, Neumann U47/Pultec, \$3500. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

Ampex 4 trk/3 trk 7.5-15 ips, Neumann U47 w/PS & stand, \$2550. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

Ampex 4 trk 15-30 ips, Neumann U47 w/PS & stand, \$1850. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

Ampex 8 trk AG350-8 w/sel sync, Neumann U47 w/PS & stand, \$2150. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

Ampex recorders Inc: 8, 4, 3, 2, full, 1/2 trk & more, call for details. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

Pioneer RT-909 10-1/2", 3-3/4, 7-1/2 ips auto rev, excel cond, \$300. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

Ampex 440B 1/2" 4/2 trk servomotor 157.5, vgc, \$1800. D Hewitt, Remote Rcdg Services, 20 Kennedy Pkwy, Munsey NY 10952. 914-425-8569.

Otari MX7000, 1/2 trk stereo & 1/4 trk play, excel cond, \$300 w/manual. M Matthews, Rockwell Collins, 3318 Shield Ln, Galand TX 75042. 214-996-6844.

ITC 850, (2) 2 trk R/P on roll around stands, gd appearance & great working cond, \$950 ea. D Byrd, WZGC, 603 W Peachtree, Atlanta GA 30308. 404-881-0093.

Sony TCD5 field cassette recorder, Sendust & ferrite heads, w/leather case, \$350. R McMillen, 13515 SW 72nd, Tigard OR 97223. 503-684-1973.

Scully 100 24 trk w/16 trk heads, over \$3000 worth spare parts, full doc, 15 & 30 ips, w/meters, \$11,000. R Robinson, TNA, Box 57, Wallingford CT 06492. 203-269-4465.

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## CASSETTE . . . WTS

**Ampex AG350-8**, 8 trk w/Selsync, Neumann mic U47 w/PS & stand, \$2150; Ampex 4 trk 15-30 ips w/Neumann mic U47, \$1850; Ampex 4 trk, 3 trk, 7.5, 15 ips w/Neumann mic U47, \$2550. Mr Oliver, Lynn Oliver Studios, 304 W 89th, NY NY 10024. 212-874-0274.

**Ampex 8 trk, 4 trk, 3 trk**, Neumann U47, Pultec EQ, EQP1A, \$3500. Mr Oliver, Lynn Oliver Studios, 304 W 89th, NY NY 10024. 212-874-0274.

**Akai GX220 R/P**, gd cond, 1/4 trk, \$100. T Ford, WBVR, POB 298, Nassellville KY 42276. 502-726-3555.

**Teac 7030 stereo**, handles 10-1/2" reels, BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

**Ampex AG-350 w/o heads**, BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

**Scully 280-B signal chassis**, complete, gd cond, BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

**Otari MX5050 2 SHT**, 7.5 & 15 ips, new heads, belt, excel cond, \$995. Cascade Recg, 2115 N Vancouver Ave, Portland OR 97227. 503-287-1662.

**RCA RT-21 R/P**, handles 10" reels. H Leupp, KFRY, Box 1738, Bismarck ND 58502. 701-223-0900.

**Ampex 350 tube electr**, unknown cond, \$75/BO. C Larko, Audio Prods, 230 Gaskins Bldg, 124 W Washington Blvd, Ft Wayne IN 46802. 219-424-2405.

### Want to Buy

**Revox A77's**. M Persons, KGIM, 8th Ave NW, Aberdeen SD 57401. 218-829-1326.

**Ampex 350 15 ips capstan motor & mono erase head**, tech manual. D Brown, WBSN, 7929 Zimpel St, New Orleans LA 70118. 504-865-9812.

**Used 8 trk recorders & consoles** in gd working cond. K Nelson, MorningStar Stds, 1402 E 5th, Newberg OR 97132. 503-288-7431.

## CONSOLES

### Want to Sell

**Gates Stereo Statesman 6 chan stereo console** in working cond w/manual, \$200 plus ship. R Phipps, KHLC, 998 A Sidney Baker So, Kerrville TX 78028. 512-257-7711.

**Shane & Young Cherokee 300 8 pot mono console**, solid state, works good, \$600/BO. J Walters, KKJO, POB 166, St Joseph MO 64502. 816-279-6346.

**MCI 416 24 chan frame 18 in by 16 in w/producers desk**, API faders, \$10,500. C Osgood, Ct Recording Std, 1122 Main, Bridgeport CT 06604. 203-366-9168.

**McMartin 5-502 stereo**, 5 ch, gd cond, \$1000. Goodrich Ent, 11435 Manderson St, Omaha NE 68164. 402-493-1886.

**Shure M67**, \$250. B Jeffreys, WKMQ, 1901 Reedfarm Rd, Rockford IL 61111. 815-877-3075.

**McCurdy mixing console**, 12 chan stereo w/power supplies & phono preamps plus extra modules, power supplies & EQ's, BO over \$6500 plus ship if req. Bill, Vintage Country Radio Programs, 1219 Ogden, Mississauga, Ont, Canada. 416-274-7534.

**Gates 4 chan mono console**, cond unknown but board intact w/manual, \$75 plus ship. R Phipps, KHLC, 998 A Sidney Baker So, Kerrville TX 78028. 512-257-7711.

**Harris Stereo 80**, 8 chan mixing console, gd cond, BO. J Camperson, Rolling College, 1000 Holt Ave, Winterpark FL 32789. 305-646-2112.

**Teac M308 8 x 4 x 2 x 1 8 chan**, excel cond, BO. S Yates, KDEY, 121 Calder Sq, Lufkin TX 75901. 409-634-6661.

**Shure M267 (2) 2 yrs old**, mint cond w/rack mts, \$289 ea. C Butler, Butler Eng, 8209 Pinon Dr, Jacksonville FL 32221. 904-286-6363.

**Collins 212F 5 pot**, operational when taken out of service of 1 yr ago, \$250. S Vellmer, KDMN, Box 639, Buena Vista CO 81211. 303-395-2004.

**Ramsa WRT 820 w/meter bridge option**, brand new, \$3800/BO. B Covert, WMBO, Box 980, Auburn NY 13021. 315-253-7355.

**Ampex MX35 mixers (3)**, \$325 ea; SA3761 Sigma 4 chan mixers (3), \$150 ea; Presto 4 chan 50/200/500 ohm mixer, \$75; 1567A Altec portable mixers, 4 chan/master/VU meter, \$350 ea. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

**Vanco MM-7**, stereo/mono audio prod/disco mixer, 2 mic inputs w/pan, 2 TT inputs, 2 line/tape inputs, cue buss, \$125. E Helvey, Successtrax, POB 1357, Winchester VA 22601. 703-877-1191.

**Neotek Series 1**, 16 x 8 x 2, hard-wired model, excel for mobile use, w/talk-back module, tape remote, etc, \$6000. T Trott, 5477 Carter Rd, Lake Mary FL 32746. 305-323-0472.

**QRK Futura 6 slide pots**, needs mod meter, BO. G Erway, KBOG, Rt 2 Box 26B, Cordell OK 73632. 405-832-5332.

**Fairchild custom 16 x 8 x 2**, \$2000. J Maestro, FM Recg Stds, 1351 Brook Ave, Bayshore NY 11706. 516-666-4560.

**Spotmaster 4BEM50 4 mixer console**, cable, bdct/news use, vgc, \$500. Dave, 1727 Mass Ave NW #212, Wash DC 20036. 202-667-3276.

**Ramko DC8-MS 14 input stereo**, touch switches, w/manual & new pots, \$700. T Trott, 5477 Carter Rd, Lake Mary FL 32746. 305-323-0472.

**Console Sound Workshop 1280-B**, \$1875/BO. W Brassell, Brazro Recdgs, 1215 N Concord, Chattanooga TN 37421. 615-892-5995.

**McMartin B80252**, 8 chan 24 input, needs work, \$750/BO; Collins 9 chan dual output (3), \$200-600/BO; RCA BC9 mono 4 mixer 22 input \$500/BO. B Roberts, Van Pricoyen Bldg, 628 Mulford Dr SW, Grand Rapids MI 49507. 616-243-2026.

**Gates Studioette**, 5 mixer, 2 chan, operational when removed from service, \$480; Gates President M6209A, 8 mixer, 2 chan, operational when removed from service, \$960. J David, KMPL, POB 907, Sikeston MO 63801. 314-471-1520.

**Russco 505 mono console**, new, must sell, \$1100. G DuBois, Liberty Snd, 217 N Begley, Soto TX 75115. 214-223-9795.

### Want to Buy

**Stereo console**. J McPherson, WNDI, Box 545, Sullivan IN. 812-268-6322.

## DISCO & SOUND EQUIP.

### Want to Sell

**Echo Springs K10 expanders (3) w/3 elec**, \$50 ea. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

**EMT 140 tube mono w/remote**, stereo preamp & pickups, \$1750; EMT 140ST stereo transistor plate, \$2750; UREI 813, \$1250; Altec 604E speakers (5) \$475 ea; Dolby M16 A-type, excel cond, \$7950; AKG BX20 spring reverb, \$1250; Electro-Harmonix vocoder, \$100; Altec 604 silver speaker cabinet w/cross-over, \$80. C Osgood, Ct Recording Std, 1122 Main, Bridgeport CT 06604. 203-366-9168.

**Echo bleeds (3)** for passive mixer as Sigma, \$25 ea. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

**Klipsch LaScala**, excel cond, BO. R Kaufmann, Solid Gold Time Machine, PO Box 29804, Atlanta GA 30359. 404-636-2787.

**UREI 811-A Time Align studio mon w/ceiling mt brackets**, \$850/pr. T Suckling, Cozy Dog Recg, 603 SE Morrison Rd, Vancouver WA 98664. 206-694-1845.

**Orban 111B dual reverb**, \$250. D Green, Waves Snd Recdgs, 1956 N Cahuenga Blvd, Hollywood CA 90068. 213-466-6141.

**E-V Sentry III 15" woofers (2)**. J Aulik, Chnl 26, 960 Watermullen Dr, Green Bay WI 54304. 414-494-2400.

**Cerwin Vega-like speakers**, 12", \$100. D Green, Waves Snd Recdgs, 1956 N Cahuenga Blvd, Hollywood CA 90068. 213-466-6141.

**Altec-Lansing 600B**, excel cond, closest to \$90; Jensen C3781 ST 600 ohm line lead 15" duplex, closest to \$120. Good Sound, 171 Drexel, Lansdowne PA 19050. 215-626-9322.

**Allison Research Kepex 500 w/single card enclosure CM-001** in like new cond, both \$150. Good Sound, 171 Drexel, Lansdowne PA 19050. 215-626-9322.

**EV Klipsch**, 290 lb, Georgian 1954, 15" bass, 3 horns w/worlds best folded horn Klipsch bass enclosure, mahogany wood, \$290; (2) Fulton ESR-6 electrostatic tweeters, pro-modified, \$75 ea; Harbeck electrostatic tweeter, both mid's & high's, also pro-modified, \$75. J Pascale, 3 Stanley Pl, Hauppauge NY 11788. 516-265-8283.

**Blonder Tongue B9**, \$75; Pultec EQP1A, \$950. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

**EV Klipsch 290 lbs**, Georgian 1954, 15" bass, 3 horns w/worlds best folded horn Klipsch bass enclosure, real oak (2) & one mahogany wood, \$290 ea; (2) Fulton ESR-6 electrostatic tweeters, pro modified sounds much better than original, gd sound, \$75 ea; Harbeck electrostatic tweeter, both mid's & high's, also pro modified, \$75. J Pascale, 3 Stanley Pl, Hauppauge NY 11788. 516-265-8283.

**Dukan PA System**, comp w/3 100 W amps, 6 trumpet speakers, all working tube units, BO. J Phillips, All-American Bdct, 414 Washington, Defiance OH 43512. 419-782-8591.

### Want to Buy

**Older JBL**, Altec, Jensen speakers. C Dripps, Kurloff Entr. 818-444-7079. 800-334-8223 CA only.

**SEAS tweeters** to fit Dynaco A-35, new/used or blown OK, also working/blown A-35 speakers. A Tucker, Foothill Prod, 70 W 83rd, NY NY 10024. 212-877-0973.

## LIMITERS

### Want to Sell

**Orban 9000 Optimod AM**, \$1895. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

**Dorrough 310 AM audio processor**, \$900; Mari CLA40, \$200. M Persons, KGIM, 8th Ave NW, Aberdeen SD 57401. 218-829-1326.

**CRL CC300 composite controller**, \$200. R Huggler, WSUL, 250 Broadway, Monticello NY 12701. 914-794-0242.

**Delta AMC-1 mod controller**, excel cond, \$2100. T Cochran, KNOM, POB 988, Nome AK 99762. 907-443-5221.

**UREI LA-3A (2)**, excel cond, BO. R Kaufman, Solid Gold Time Machine, POB 29804, Atlanta GA 30359. 404-636-9911.

**Dorrough 310 limiter/comp**, \$550; Inonovics 230 limiter/comp, \$500. A Crain, WVEE, Box 157, Collierville TN 38017. 601-895-6483.

**Optimod-FM 8000A**, great cond, \$1900; Audimax 4450, works great, \$400. D Byrd, WZGC, 603 W Peachtree, Atlanta GA 30308. 404-881-0093.

**Inonovics MAP-II multiband processor** plus 215 limiter clipper, excel cond, \$700. T Cochran, KNOM, POB 988, Nome AK 99762. 907-443-5221.

**Fairchild Conax 600 limiter**, \$350; Gates Stay-level M5167, \$300. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

**UREI 1176 lim amp**, needs minor troubleshooting, \$280; UREI BL-40 lim amp w/manual, \$200; Harris 994-7059-001 lim amp w/manual, \$200. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

**Harris MSP 90 AM limiter**, needs work; (2) Harris Gates Solid Statesman FM limiters. S Wallace, WDAO, 1400 Cincinnati St, Dayton OH 45408. 513-224-1137.

**Gregg Labs FM Tri-band audio processor**, BO. M Hendrickson, KEEZ, Box 3345, Mankato MN 56002. 507-345-4646.

**Dorrough DAP 310 AM**, \$600; Volumax 410 FM, mono, \$300. R Dietterich, WLTJ, 1051 Brinton, Pgh PA 15221. 412-244-7600.

**Dorrough 310 processor**, BO. Joyce, KBOG, Rt 2 Box 26B, Cordell OK 73632. 405-832-5432.

**IMP 3 audio processor**, missing book, \$1000. R Furby, KGAL, POB 749, Albany OR 97331. 503-926-8623.

**Dorrough 310 DAP**. S Wallace, WDAO, 1400 Cincinnati St, Dayton OH 45408. 513-224-1137.

**UREI LA5 similar to LA4**, w/rk mtg adptr, \$300. E Helvey, Successtrax, POB 1357, Winchester VA 22601. 703-877-1191.

**CRL SC-300 composite controller**, BO. G Peterson, KGGG, Box 8205, Rapid City SD 57709. 605-348-1100.

**Dorrough 310**, gd cond, BO. B Reck, WPTL, POB 909, Canton NC 28716. 704-648-3576.

**Orban 418A OptiMod-FM circuitry** adapted for prod & rec apps, excel cond, \$450/BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

**CBS Labs 4110 & 4150A FM Volumax & Audimax**, \$700/pr. B Stuart, Radio Lassen, 3015 Johnstonville, Susanville CA 96130. 916-257-2121.

**Dorrough 310 audio processor**; Harris MSP90 & 95 systems. B Mishkind, KFXK, 3222 S Richey, Tucson AZ 85713. 602-748-1450.

### Want to Buy

**Limiter for use on Harris 1 kW AM xmt**, must be bargain. KBAK, 3933 Geneva Pl, Anchorage AK 99508. 907-835-2405.

## MICROPHONES

### Want to Sell

**EV CLS42 pro condenser mic sys**, 4 heads, 2 preamps, PS all access, \$600; Sony ECM-33F electret condensers (pr), excel, \$175. B Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

**EV C090 lavalier (5)**, \$125 ea or \$500 all. C Springer, KLMR, Box 890, Lamar CO 81052. 303-336-2206.

**AKG C60 PS**, swap for Sony C87A. E Obrien, Outhouse Recdg, 3041 Crawford St, Terre Haute IN 47803. 812-238-9312.

**EV RE-15**, vgc, \$120. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

**Sennheiser MD4210**, less than 1 yr old, \$189 ea or \$369/both. C Butler, 8709 Pinon Dr, Jacksonville FL 32221. 904-786-6363.

**Large selection mics** from Canon, RCA, Sennheiser, etc, call for details & prices. Good Sound, 171 Drexel, Lansdowne PA 19050. 215-626-9322.

**Bruel & Kjaer 4006 condenser mics**, phantom powered matched pair, new, \$1200/pr; (3) AKG C451 condenser mics w/assorted capsules, windscreens, PS & shotgun, etc, \$750/lot; (4) RCA 77DX mics, recently rebuilt by RCA, very nice, \$400/ea; (4) RCA BK5B mics also recently rebuilt, very clean, \$350/ea. P Chance, Div of Genetics, T2404 MCN, Vanderbilt Univ, Nashville TN 37332.

**Electro Voice AC24M 2 chan phantom power supply**, perfect shape, \$100. Cascade Recg, 2115 N Vancouver Ave, Portland OR 97227. 503-287-1662.

**Mics inc**: Altec, E-V's, Shure, call for details. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

**Neumann U47 PS**, stand/boom, \$950; Altec 633 saltshaker mic w/stand, \$225; EV 630, 635, 654, \$220 ea. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

**Lavalier mic**, gd for small room PA system, \$100. M Elkins, WBQM, 1312 Riverview Ave SE, Decatur AL 35601. 205-353-7951.

# Distributor Directory

The following distributors serving the broadcast industry would be glad to help you with any of your requirements.

<p><b>HY JAMES</b> The Audio Professionals</p> <p>Aphex Broadcast Electronics dbx Eventide Gentner JBL Nakamichi Pro Orban Otari Straight Wire Audio Tascam UREI</p> <p>And a whole lot more! Call Paul Grzeblak: 313/471-0027 in Michigan: 800/482-2291 24166 Haggerty Road Farmington Hills, MI 48024</p>	<p>One Source the best prices</p> <p>CALL: <b>SPENCER BROADCAST</b></p> <p>1-800-221-6941</p>	<p><b>CeCo</b> communications, inc</p> <p>"A Richardson Company"</p> <p>Contact the #1 distributor of broadcast tubes &amp; components and get the best price available on:</p> <ul style="list-style-type: none"> <li>RCA • AMPEREX • GE</li> <li>RAYTHEON • SYLVANIA</li> <li>EIMAC • NATIONAL</li> </ul> <p><b>Anthony Ianna</b> Broadcast Sales Representative 800-221-0860 718-646-6300</p>	<p><b>Diamonds Are Not Forever!</b></p> <p>We specialize in phono cartridges, factory original replacement styli and record care items only!</p> <p><b>ortofon   stanton</b> <b>SHURE</b> &amp; more!</p> <p>800-221-0906</p> <p><b>LYLE CARTRIDGES</b> 115 S. Corona Ave Valley Stream, NY 11582 516-599-1112</p>	<p>Call for Availabilities <b>800-336-3045</b></p>	<p><b>SUPERIOR LINES SUPER PRICES</b></p> <p>ADC • Andrew • Audio Technica • Audio Cable • AudioPak • Belar • Beyer • Cable-wave • Canare • Clear-Com • Crown • Electro-Voice • Farrtronics • Fidelipac • Gentner RF • JBL • Jampro • Leader • Luxo • Stantron • TFT • Tascam • Telex • UREI</p> <p>!!!! AND MORE !!!!</p> <p>CALL <b>800-531-5143</b> <b>NATIONAL</b> BROADCAST SYSTEMS 2113 Wells Branch, Bldg. 8-100 Austin, TX 78728</p>
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# Broadcast Equipment Exchange

## MICROPHONE . . . WTS

E-V 664's (6), gd-excel cond; (2) E-V 626, mint cond, BO. J Phillips, All-American Bdct, 414 Washington, Defiance OH 43512. 419-782-8591.

Parts for AKG C28A & STC 4126A mics, most outer shell parts vgc, \$500 total. R Robinson, TNA Sts, Box 57, Wallingford CT 06492. 203-269-4465.

RCA boom stands (3), \$200 ea plus ship. I Kaufman, Natl Recdng, 460 W 42nd, NY NY 10036. 212-279-2000.

## Want to Buy

Shure SM5B mic or RE-20, in gd cond, reasonably priced. J Emmel, Emke Media, POB 401, Olyphant PA 18447. 717-383-1118.

Mic shock mount assem & cable strain relief for RCA-77D; also gd used Altec 639B mics. P Dalton, PBS, 105 S Utah St, Arlington VA 22044. 703-892-6923.

E-V RE20 mic. D Brown, WBSN, 7929 Zimpel St, New Orleans LA 70118. 504-865-9812.

RCA BK5B w/windcreens (2), gd working cond. F Spinetta, KCEA, POB 2585, Atherton CA 94026. 415-321-6049.

RCA MI-4094-B boom stand. F Spinetta, KCEA, POB 2585, Atherton CA 94026. 415-321-6049.

## MISCELLANEOUS

### Want to Sell

Ribbon inductors, new, 7" dia, 16T (2), \$100 ea. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

3 Bay 24" metal rack cabinets (2), 16 ga steel w/hinged back doors & H.D. steel swivel casters, BO over \$75 ea. William Wysock, Professional Sound Systems, 2527 Treelane Ave, Monrovia CA 91016. 818-359-1373.

Spencer Microscope w/arm for mounting & light, \$100. L Oliver, 304 West 89th, Nyny 10024. 212-874-7660.

Apple II-C w/monitor, 2nd disk, mods, \$765. B Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

Alden 9271M 4 speed weather chart recorder, set up for GOES landline fax use, gd cond, recently removed from service, \$2495. LT Killion, KRNV, 104 West 8th, Lexington NE 68850. 308-324-2371.

Robot from NAB convention, he walks, talks, passes out cards, he's remarkable, great for remotes. R David, KLTG, POB 1478, Dickinson ND 58601. 701-227-1876.

Nortronics AT320B, want to trade stereo align cart, used once for 1/4 trk 7.5 ips stereo R-R align tape. R Koch, A/V Ent, POB 5195, Greensboro NC 27435. 919-273-1365.

Telephones, 6 button, Bell elect, (14), some cable, \$600/BO. D Hubbard, KKRE, Box 1385, Monument CO 80132. 303-481-4700.

Record-A-Call 560 answering units (2), not remoted, like new, \$60 ea plus ship, vgc. J Emmel, Emke Media, POB 401, Olyphant PA 18447. 717-383-1118.

ASR-33T send & receive teletype w/punch tape maker/reader, numerous rolls paper, punch tape, ribbons & stand, BO. J Emmel, Emke Media, PO Box 401, Olyphant PA 18447. 717-383-1118.

Rack mountable road case, 20" x 8" x 20" storage, ideal for cassettes/amp, \$75 plus ship. J Green, WHPC, Stewart Ave, Garden City NY 11530. 516-222-7438.

Crystal oven for RCA BTA-1R, 550 kHz, \$40. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Rank 78 rotorverter 17.5 kVA, 208 V, 3 yrs old, \$1500. J Verkest, WFCL, POB 269, Clintsville WI 54929. 715-823-5128.

Peico pedestal mount w/controls for CCTV, \$80; Ionics 200 W mercury ARC power supply, \$55; Dukane microfiche reader, \$45 plus UPS. J Baltar, Maine Reel Comm, 67 Green St, Augusta ME 04330. 207-623-1941.

Budd equip rack, tall w/rear door, like new, \$200. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Soft drawn copper wire, approx 5000' of #10 for AM ground systems, \$1800. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Stabline EMT-4106C voltage reg, 6.6 KVA, new cond. T Smith, CCI Comm, 192 Lancaster Ave, Frazier PA 19355. 215-289-1725.

UTC LS141 transformers (3), 600 ohm primary, (2) 600 ohm secs, new/excel, \$40 ea; Sylvania studio lamps, new, (9) EGK, EHK, BTL, (4) 176-018, 176-022, \$7 ea. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

Electrodyn SM-9 switch modules, (20) 1.5" wide, 7" long, 8 bus assigns & one solo button. BO. R Robinson, TNA, 10 George, Wallingford CT 06492. 203-269-4465.

Mono play tape heads for ITC-3D machine (3), \$60 ea or all for \$145; 2 trk stereo play heads (5) for ITC R-R decks, Vikron #5742, \$50 ea or all for \$200. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

ADC T-R-S 1/4" 2 x 26 (3); also T-S 1/4" 2 x 26, \$250/BO each & wire. M McCarthy, KTVI Prod, 1116 Tamarack, Mt Prospect IL 60056. 312-640-8965.

Sparta Elec tech manuals, write for product wanted. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

Misc gear including DC motor, spares for RCA 16mm film projectors; rectifiers; sound effect filter, old TV EQ instruction manuals, lens for RCA B&W camera and more, call for details & prices. Good Sound, 171 Drexel, Lansdowne PA 19050. 215-626-9322.

AEL 2201 exciter, \$250/BO; AEL 2213 stereo gen, \$200; CBX 4450A, \$450; CBS Dynamax 400 mono, BO. D Howard, WMHE, 4665 W Barcroft, Toledo OH 43615. 419-531-1681.

Elgin 19522-22, new shape, \$168; 19522-21 reconditioned, \$150. T Keegan, KSP, Box 137, Maple Glen PA 19002. 215-646-5142.

Budd 77" equip rack, \$150. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Weston 2031 power meter for Continental Power Rock & FM, \$45. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

Bud 16 space front face rails open frame rack, grey w/casters, \$75. Cascade Recg, 2115 N Vancouver Ave, Portland OR 97227. 503-287-1662.

Teletype 33 (2), ASR, w/punch & reader, w/ or w/o stands, take one or both, \$250 ea or BO & you pick-up; many 16mm projectors to sell; Fairchild Galaxy (rear screen) salesman's projector. DMT A/V, Box 9064-RW, Newark NJ 07014. 201-484-5291.

Plate transformer, 200-250 V primary, nominally 1160 V sec at 1 A, w/taps for 3600 & 4400 V, \$500. J David, KMPL, POB 907, Sikeston MO 63801. 314-471-1520.

Cart racks, (3) 250 capacity wall-mounts, \$125 ea; 15-25 capacity wire units, \$15 ea, all in excel cond. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

Powerstat T5007 variable auto xfrm, 230 V 2 phase primary, sec 115/0/115, 49 A. L Nixon, WTKV, 601 N Lee St, Valdosta GA 31601. 912-247-3333.

DEC Writer II, like new cond, \$200. P Russel, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Calzone custom travel case for Otari MX5050B, never used, \$150. S Kirsch, 2590 Hillside Ct, Baldwin NY 11510. 516-223-8878.

H/P rack clock, \$25. D Olson, POB 479, Island Heights NJ 08732. 201-929-0694.

Sparta tech manuals for audio & RF products, write for product. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

Nortronics heads (50) premium, 2050 1/2 trk mono R/P cue head, rear mount w/stand & nut, \$10 ea. M Jones, WIVK, 6711 Kingston Pike, Knoxville TN 37919. 615-588-6511.

Nortronics heads (50), new, 3250 1/2 trk stereo/play cue, rear mount w/stand & nut, \$10. M Jones, WIVK, 6711 Kingston Pike, Knoxville TN 37919. 615-588-6511.

## Want to Buy

Service manual for Akai GX635D, will pay for xerox & ship. Chris, Y107, 101 E Harris, Caddillac MI 43601. 616-775-1071.

Radio & Electronic Engineering by F. Terman, prefer edition from 50's. S Bauder, WLEF, E 1825 Hwy 182, Park Falls WI 54552. 715-762-2611.

Book or copy for HB400D-HB410B. Simonsen, KHAT, Box 6066, Lincoln NE 68506. 402-423-1530.

Rack mount(s) for Panasonic TN-63 video monitors; rack mount(s) for Conrac ENA-12 video monitors. F Vobbe, WLIO, POB 1689, Lima OH 45802. 419-228-8835.

Vacuum crystal, 1490 kHz, for CCA AM100D or Harris BC1T xmr. B Siltzman, IBC Engr, RD1 Box 312, Trumansburg NY 14886. 607-273-2970.

Sansui QS quadrasonic bdct equip, QSD-4, QSD-1, QSE-5B, etc, working or non-working. R Longseth, Sound Effects Plus, Box 349, Sioux Falls SD 57101. 605-339-1632.

Service manual for RCA 76B-2 console; any transcriptions including AFRS. L Scott Jr, POD 1729, Bartow FL 33830. 813-533-4654 eves.

## MONITORS

### Want to Sell

McMartin TBM 3500 FM mod monitor, just taken out of service, in working cond, \$100/BO plus ship. R Phipps, KHLC, 998 A Sidney Baker So, Kerrville TX 78028. 512-257-7711.

Compeite stereo or SCA package, McMartin TBM-3700, TBM-2200A, TBM2000B, factory tuned & tested. Goodrich Ent, 11435 Manderson St, Omaha NE 68164. 402-493-1886.

McMartin TBM-4500A stereo modulation monitor, factory tuned & tested to your frequency. Goodrich Ent, 11435 Manderson St, Omaha NE 68164. 402-493-1886.

McMartin TBM 3000 FM monitor in working cond, just taken out of service, \$100/BO plus ship. R Phipps, KHLC, 998 A Sidney Baker So, Kerrville TX 78028. 512-257-7711.

Gates GTM-88F FM freq monitor, need crystal, \$150; Gates GTA-88F freq comparator for pilot & SCA freq. have manual, \$100. D Gander, KDUZ, Box 10, Hutchinson MN 55350. 612-587-2140.

McMartin TBM2200A, TBM3700, BO. L Thompson, WCLT, Box 880, Newark OH 43055. 614-345-4004.

Harris M6659 mod mon; McMartin TBM 3700 FM mono; McMartin TBM 2200A FM stereo; McMartin TBM 2000B SCA monitor. S Wallace, WDAO, 1400 Cincinnati St, Dayton OH 45408. 513-224-1137.

Belar FMM-1, \$625/BO; Belar FMS-1, \$625/BO, gd cond. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

McMartin TBM 3500/TBM 3000 working, \$500; working tubes, many new receiving in new cond, SASE for prices. B Greenough, WNTA, Box 84, Mansfield PA 16933. 717-662-4600.

## Want to Buy

Type accepted AM mod monitors in working cond. J Coursole, WCKK, 689 W Sunnyside, Oshkosh WI 54901. 414-324-4441.

EBS monitor, decoder/encoder, Gorman-Redlich CED or similar. J Powley, WILM TV, 1536 Logan, Altoona PA 16602. 814-943-2607.

Aural TV mod monitor, mono, Belar TVM-1 or similar. J Powley, WILM TV, 1536 Logan, Altoona PA 16602. 814-943-2607.

## MOVIE PRODUCTION EQUIP.

### Want to Sell

Kodak Ektagraphics Arc 35mm slide projector, uses Marc-300 pwr supply (not inc), \$650. G Ormrod, GFO Productions, 122 E 19th, Olympia WA 98501. 206-352-8028.

Large selection of movie/video prod gear, call for details & prices. Good Sound, 171 Drexel, Lansdowne PA 19050. 215-626-9322.

Auricon Pro 1200 16mm, comp w/zoom, op & mag amp, tripod, new cond, BO; 35mm cam varible shutter, 3 motor, 6000' mag, 400' mag, zoom lens, new cond, BO or swap. L Meister, L Meister Prod, 312 River Rd, Nutley NJ 07110. 201-667-2323.

## Want to Buy

High-speed 16mm film camera, pref inexpensive. G Ormrod, GFO Productions, 122 E 19th, Olympia WA 98501. 206-352-8028.

## RECEIVERS & TRANSCEIVERS

### Want to Sell

Gonset G50, last used in 1971, free, you pay ship. R Koch, A/V Ent, POB 5195, Greensboro NC 27435. 919-273-1365.

Motorola MX340 4 chan w/PL, \$400. G Dalton, KKDA, POB 530960, Grand Prairie TX 75053. 214-263-2806.

Motorola MX330 walkie talkie, portable, 2 chan w/PL, \$300. G Dalton, KKDA, POB 530860, Grand Prairie TX 75053. 214-263-2806.

GE MVP 20 W 2-way radios on 468.625, 2 mobile & one base w/antennas, manuals & access, \$1800. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Marti RPT40 & BR10 on 161.64 MHz, 3-5 element yagi & phasing harness, trade for UHF gear or sell, 1 yr old. D Fertenberry, KVON, 1124 Foster, Napa CA 94558. 707-252-1440.

Marti RPT 1 W portable RPT xmr on 455.70 & 455.80 MHz, AC or battery operation, \$350. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

WWV rcvr, rack, perfect, \$40. D Olson, POB 479, Island Heights NJ 08732. 201-929-0694.

REL FM tuner, original & pristine w/manual, \$400. D Olson, POB 479, Island Heights NJ 08732. 201-929-0694.

Microwave Assoc VR-3X tunable receiver, \$500. G Ramsey, WQSF, POB 180, Williamsburg VA 23187. 804-874-3696.

Technics ST-G5 quartz digital tuner, 16 presets, scan & memory, \$120. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

JRC NRD-515, comm grade general coverage receiver, 96 ch memory unit, matching sprk & CW filter, mint cond, \$900. G Finerman, Advanced Media, 17 Hillcrest, Sulfertown NY 10901. 914-368-1143.

## Want to Buy

HF380 0-30 MHz transceiver. N Chavigny, Radio Ranch, 1309 Elton Ln, Austin TX 78703. 512-472-5379.

Collins 5157 0-30 MHz receiver, incl 55G preselector. N Chavigny, Radio Ranch, 1309 Elton Ln, Austin TX 78703. 512-472-5379.

Sansui QRX Series quadrasonic receivers, working or non-working. R Longseth, Sound Effects Plus, Box 349, Sioux Falls SD 57101. 605-339-1632.

Drake R-7 or R-7A or Hammarlund HQ-150 or any Hallicrafter. B Securo, WCHL, 1721 E Franklin, Chapel Hill NC 27514. 919-942-8765 X102.

Sequerra FM1 & Scott 4410 non-working OK; Wayne Kerr R161 detector bndge 4-100 MHz. M Disch, Select Snd Svcs, 427 W Capital, Heartland WI 53029. 414-367-5719.

## REMOTE & MICROWAVE EQUIP.

### Want to Sell

Moseley TRC-15 parts, subaudible metering gen & demod plus analog front panel meter & brand new front panel, \$100/BO. D Mussell, Bdct Tech Serv, POB 13475, New Orleans LA 70165. 504-866-3846.

Motorola MR96 wideband audio microwave link, duplex, \$2000. B Ferguson, RJF Bdctg, Box 132, Salem NJ 08079. 609-935-1510.

Moseley TRC15 w/manuals, excel cond. J Brown, WZZU, POB 33396, Raleigh NC 27606. 919-782-4709.

Moseley TRC15, gd working cond, BO. D Bergstrom, KCSJ, 1st & Main, Pueblo CO 81003. 303-543-5900.

Microwave Assoc VR-3X sat receiver w/IF & demod card, \$1000. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Modulation Assoc analog satellite mono audio receiver, \$350. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

RCA BTR-30A remote control, 30 chan, Hallikainen & Friends TEL-172 digital telemetry kit, vgc, \$1200. B Surratt, WINA, 501 E Main, Charlottesville VA 22901. 804-977-3030.

Moseley TAU-3 tolerance alarm unit, \$250; Moseley DRS-1 selector unit, \$250; Moseley DRS-1 status control terminal panel, \$125. S Keating, Keating Tech Svcs, 18653 Ventura Blvd, Tarzana CA 91356. 818-708-7768.

Tek 485 scope 350 MHz, w/manual, \$3500; Sencore SG165 stereo analyzer w/manual, \$600. J Pancraty, Satellite Network Corp, POB 4080, McAllen TX 78502. 512-787-7855.

Marti RMC20 digital remote control, \$600. J Verkest, WFCL, POB 269, Clintsville WI 54929. 715-823-5128.

Moseley TRC15 studio end, BO. Joyce, KBOG, Rt 2 Box 26B, Cordell OK 73632. 405-832-5432.

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# Employment

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## POSITIONS WANTED

Exp announcer seeks new position w/VA station, 5 yrs on-air, great prod, former MD.

## 1. BROADCAST 2. EQUIPMENT 3. PROFESSIONAL 4. SALESPERSON

Do you fit this description? We must have a power hitter... a street fighter to handle our NE U.S. accounts. Can you make it in NYC? If you can sell in the presence of the top people in the #1 market, we need each other. If you have the track record, we'll give you the keys to the city and the NE territory. Call me in complete confidence. Dave Burns 317-962-8596

G Hale, POB 52, Pratts VA 22731. 703-786-3423 or 703-948-6459.

Seeking tech position, radio,



# Broadcast Equipment Exchange

**REMOTE . . . WTS**

**Modulation Assoc SCTC XP-1** down converter, \$500. G Ramsey, WQSF, POB 180, Williamsburg VA 23187. 804-874-3696.

**Isocoupler**, 900 MHz, for use w/STL on AM tower, 2 mos old, \$250. E Swicegood, WKXR, 919-625-2187.

**Wegener MA** satellite music network receiver, SMN Star Station format plus card to receive country format, also have satellite video system, \$2000/BO. K Harnack, WPAD, 1700 N 8th, Paducah KY 42001. 502-442-8231.

**Want to Buy**

**Video STL** for LPTV, inexpensive. B Gray, K26BH/K38AT, POB 1838, Yucca Valley CA 92286. 619-228-1133.

**Digital Sat System** for ABC, from dish to demod or separate equip. R Beaty, WBRB, POB 288, Mt Clemens MI 48046. 313-797-1400.

**Moseley AW-15** or similar, phone line control, 8 sources min. F Vobbe, WLIO, POB 1689, Lima OH 45802. 419-228-8835.

**STATIONS**

**Want to Sell**

**AM station**, 1 kW day, near major market, good dial position, good price, terms. A Crain, WWEE, Box 157, Collierville TN 38017. 601-895-6483.

**Class A FM** all new equip, bldg, great terms, only station in market, w/w real estate, \$149K. Joyce, KBOG, Rt 2 Box 26B, Cordell OK 73632. 405-832-5432.

**Class A FM** in Iowa for sale, will finance to right couple, \$200,000. A Penfold, KOSG, 202 N 7th, Osage IA 50461. 515-732-5591.

**AM 10,000 W**, 1 MHz. D Hastings, WKYB, Box 1000, Hemmingway SC 29554. 803-558-2556.

**Distress Sale**, 1 kW AM, W Penn, great potential, great equip, incl real estate, \$66,000. P Lenz, WEBG, POB 1580, Evansburg PA 15931. 412-898-3166.

**Want to Buy**

**AM construction permit**. P Hunn, Hunn Radio, RD1 Box 1067, Westpark NY 12993. 518-546-7985.

**Small market AM or FM**, will owner operate, all replies confidential. D Stebbins, KELK, POB 2574, Elko NV 89801. 702-738-7118.

**STEREO GENERATORS**

**Want to Sell**

**Gates stereo gen** for TEI exciter, can be adapted to other exciters, w/manual, \$180. D Gander, KDUZ, Box 10, Hutchinson MN 55350. 612-587-2140.

**Moseley SCG-4T** subcarrier gen. K O'Malley, WLRW, POB 3369, Champaign IL 61821. 217-352-4141.

**Harris MS-15**, great cond, \$800. D Byrd, WZGC, 603 W Peachtree, Atlanta GA 30308. 404-881-0093.

**SWITCHERS (VIDEO)**

**Want to Sell**

**Visual Elec 24-10 24** input, 7 buss prod switcher, just removed from service, \$1000/BO. B Ellis, KOZK, MPO Box 21, Springfield MO 65801. 417-865-2100.

**TAPES, CARTS REELS**

**Want to Sell**

**MCI JH110B (6)** w/cab's in gd cond, \$2500 ea. M Drayton, WPFW, 700 H St NW, Wash DC 20001. 202-783-3100

**Ampex 671**, three groups to choose from: 7" x 2400' hand picked bulk taped down ends, 70 per ctn 60' ea or \$42 per ctn plus UPS; or hand picked taped down ends in printed box, 50 per ctn, 80' ea, \$40 per ctn plus UPS; or as is bulk, 60 per ctn, 35' ea, \$21 per ctn plus UPS. Call Burlington Audio Tapes, 106 Mott St, Oceanside, NY 11572. 1-800-331-3191 or in NYS 516-678-4414.

**Spotmaster 500 Series**, R/P, rack mounted, solid-state, accepts A, AA, B or C carts, \$325 plus ship. J Emmel, Emke Media, POB 401, Olyphant PA 18447. 717-383-1118.

**Spotmaster 500 Series** older tube table top R/P, needs some work, \$225 plus ship, fair/good cond. J Emmel, Emke Media, POB 401, Olyphant PA 18447. 717-383-1118.

**Fidelipac**, numerous sizes & Aristocrat in 8.5 min length, BO. J Emmel, Emke Media, POB 401, Olyphant PA 18447. 717-383-1118.

**Aristocart carts**, (200) brand new, must sell, w/stereo Hot Tape, \$3 ea or all for \$600. B Prenevost, WQFL, 5500 E Riverside, Rockford IL 61111. 815-654-1200.

**Various carts**, (154) 10 min Aristocarts, (186) Fidelipac 300 or various lengths, (19) other carts, total 359, \$250. K Harnack, KOSE, 509 S Walnut SE, Osceola AR 72370. 501-563-2641.

**Fidelipac 300**, various lengths, used cond, 50' ea plus 10% ship, min order 25; new Fidelipac 300 shells, \$2 ea plus 10% ship, min order 10. S Tuzeneu, WIHS, POB 117, Middletown CT 06457. 203-346-3846.

**Fidelipac 300 carts**, 14 ea long lengths, \$1 ea; (19) Mastercarts, \$1.50 ea/BO. M Saady, First City Rec, 141-60 84th Rd 3E, Bnarrowood NY 11435. 718-846-2062.

**Scotch 208**, 226 pancakes & reels, new, BO, Scotch 5" & 7" new empty reels in boxes, BO. B Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

**Mono country cart library**, excel audio quality, good tape & pads, Fid's 300's, one or all, \$2.50 ea. B Taylor, KWSS, Box 292, Miami AZ 85539. 602-425-4378.

**Fidelipac 300** gray carts, used, loaded, 75' ea, unloaded 50' ea. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

**Fidelipac 300**, (85) various lengths, \$1 ea. C Shelonberger, WFTW, POB 10, Ft Walton Bch FL 32549. 904-243-7676.

**Sesac 16"** transcription library, like new cond, collectors items, BO; RCA transcription player, 16", works, fair cond, BO. R Bellavia, WSBC, 4949 W Belmont, Chicago IL 60641. 312-777-1700.

**Metal reels**, 8-10" of 1/2" Ampex tape, BO. C Larko, Audio Prods, 230 Gaskins Bldg, 124 W Washington Blvd, Ft Wayne IN 46802. 219-424-2405.

**Want to Buy**

**Dr. Dimento** shows wanted for non bdct use in any format. S Fink, Clackboard Prod, 2289 S Green Rd, Beachwood OH 44122. 216-382-4886.

**Scotch 1/2 mil tape** in bulk. H Simons, WAEB, POB 2727, Lehigh Valley PA 18001. 215-434-4424.

**Good used 1"** video tape in quantity. H Casteel, Technichrome, 1212 S Main, Las Vegas NV 89104. 702-386-2844.

**TAX DEDUCTION EQUIP.**

**Cart machines**, stereo or mono, prefer R/P. J Scott, KBU, POB 6423, Malibu CA 90264. 213-457-3887.

**IRS qualified, non-profit org** needs multitrack tape recorder or other equip, any cond. B Goldes, Balalaika Orchestra of Detroit, 1937 Byrd, Dearborn MI 48124. 313-271-3261.

**Non-profit college** needs prod & test equip for bdct & cinema depts. K Wolfe, Columbia College, 925 N La Brea, Hollywood CA 90038. 213-851-0550.

**Non profit college station** needs all kinds of bdct gear & test equip. S Walter, WMMR, 328 Kaufman Union, Mpls MN 55455. 612-625-5926.

**Need mixer board**, cart machine, stereo or mono & carts. B Murphree, Water Valley JC's, 120 Simmons, Water Valley MS 38965. 601-473-2501.

**Non-profit religious org** needs complete FM facilities for foreign & domestic bdct, STL, FM xmtr 10 kW or less, antenna rings, TTs, audio console, R-R, cassette, etc. B Diefenderfer, Morning Star Ministries, 590 Main, Slatington PA 18080. 215-767-5985.

**Mic mixer**, 6-8 chan & other PA equip for church. P Johnson, Pilgrim Baptist Church, Hebron Ave, Glastonbury CT 06044. 203-633-7190.

**Permittee of chan 35** soliciting tax deduct donations of video equip, esp 3/4" recorders, editors, & tapes. K Sleeman, Ind Public Media of Phila, 2714 Quarry Rd NW, Wash DC 20009. 202-332-6130.

**MW school needs prod gear** to support news & prod program: R-R, carts & cass machines, entire studio, tax deductible. D Siccot, Creighton Univ, 25 & Calif Sts, Omaha NE 68178. 402-280-3014.

**Need mod monitors**, Orban 8000A, 10 W exciter, xmtr 300-1000 W, 3 bay CP antenna, etc. J Carlson, Redwood Comm Radio, POB 135, Redway CA 95560. 707-923-2911.

**Bdct equip** needed by small college building new department. R Toomey, McCook Comm College, McCook NE 68001. 308-345-6303.

**Radio & RF bdct equip** wanted as donation, receive full market value. SFC, POB 3382, LaVale MD 21502. 301-729-8876 (5-10PM).

**TEST EQUIPMENT**

**Want to Sell**

**GE TM-17** test set w/2 cables & metal carrying case, \$150; Fluke 8000A digital multimeter, \$75; Heathkit AV-3 AC-VTVM, \$20. W Arnett, WBAT, 723 Horton St, Marion IN 46952. 317-664-2411 (eves).

**Potomac FIM41** field strength meter, near new, calibrated 3/8/85, 0.54 to 5.0 MHz, prefer accept trade-in of older type field meter. A Crane, Crane Eng, POB 157, Collierville TN 38017. 901-853-4735.

**Sprague TO-3** condenser checker in gd cond, \$35. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

**B&K 1022** beep freq osc. BO. P Bear, KXCI, 145 E Congress, Tucson AZ 85701. 602-623-1000.

**GR-1191** freq counter, BO. P Bear, KXCI, 145 E Congress, Tucson AZ 85701. 602-623-1000.

**GR-1926** multi-chan RMS detector, BO. P Bear, KXCI, 145 E Congress, Tucson AZ 85701. 602-623-1000.

**Multitester 480**; Presto dummy load w/meter; Heath scope 012; Lafayette audio gen TE22; Fisher K10 expanders (3) w/echo springs; VU meter w/input control; pwr transformer PC8411; Hot Stylus w/meters. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

**Nems Clark 120 AM** field strength meter, \$600. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

**Sencore Cricket** transistor checker, vgc, \$60. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

**Audio/video test equip**, jigs, fixtures, Sound Tech 1000A FM gen; Tek NTSC waveform mon & vectorscope, JVC color camera, etc; library of AV manuals w/file cabinets; spare parts of Sony, Hitachi, JVC, Panasonic, Pioneer, etc, AV svcs dept close out, call for more info, sell by price or BO for all. Karl, 603-352-8400.

**Itek up/down counter**, \$40; Lear Siegler 7650 digital multimeter, 19" rack mount w/3 printer connectors, \$125; Tek 547 scope, \$85; Matec 1204 master sync & exponential gen, \$150; Tapaz 250 GW static inverter, \$125; Weston Roter 840 RMS/DC converter, \$150; HP 3420B DC diff voltmeter ratiometer, \$150; Macrodyne Erdac 1100A transient recorder, \$175; Tek RM 564 scope, \$85, plus UPS charges. J Baltar, Maine Reel Comm, 67 Green St, Augusta ME 04330. 207-623-1941.

**McMartin BFM 1521R** audio gen, gd cond, w/manual, \$75. R Eaton, WFHC, 158 E Main, Henderson TN 38340. 901-989-6000.

**Sound Tech 1710A** w/ind, dist analyzer, excel cond, \$3000. D Denton, Denton Engr, 16142 Via Harriet, San Lorenzo CA 94580. 415-278-6463.

**B&K 1403**, \$125; Telegquipment D61A dual trace, \$325; LSI ADM-3 CRT terminal, \$100. B Urz, NCS, 2620 S 36th, Omaha NE 68105. 402-553-4591.

**Jasoni Elec audio tape analyzer** prototype, \$260. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

**Loftech TS1** trade for Orban 245 stereo synthesizer. E O'Brien, Outhouse Recdgs, 3041 Crainford St, Terre Haute IN 47803. 812-238-9312.

**IVIE 30** spectrum analyzer w/IVIE 17A analyzer & 20B noise source. M Brenner, Cal State Univ, 213-498-4796.

**Nems Clark 120 AM** field strength meter, recently calibrated, \$600. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

**Sound Technology 1500A** tape recorder test system, \$5500. B Mishkind, KFXX, 3222 S Richey, Tucson AZ 85713. 602-748-1450.

**Potomac FIM21** field intensity meter, 7 yrs old, excel cond. B Securo, WCHL, 1721 E Franklin, Chapel Hill NC 27514. 919-942-8765 X102.

**Tek 527** waveform monitor, one in gd working order, one for parts, \$500/BO for both. S Kafka, K61CU-TV, 902-941 O St, Lincoln NE 68508. 402-476-6115.

**Fluke 8050A** digital multimeter w/DB measurement, excel, \$275. R McMillen, 13515 SW 72nd, Tigard OR 97223. 503-684-1973.

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**EMPLOYMENT SECTION:**

**Help Wanted**

Any company or station can run "Help Wanted" ads at the flat rate of \$18 per listing per month (25 words max). Payment must accompany insert; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$2. Responses will be forwarded to listee unopened, upon receipt. Call 800-336-3045 for display rates.

**Positions Wanted**

Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 3 issues of Radio World. Contact information will be provided, but if a box number is required, there is a \$2 fee which must be paid with the listing (there will be NO invoicing). Responses will be forwarded to the listee, unopened.

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 Positions Wanted  Without Box Number

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Name \_\_\_\_\_ Title \_\_\_\_\_

Company/Station \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone \_\_\_\_\_

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# RW

# Broadcast Equipment Exchange

## TEST . . . WTS

HP 606B signal gen, 50 kHz to 65 MHz, excel cond, \$250 w/manual. M Matthews, Rockwell Collins, 3318 Shield Ln, Galand TX 75042. 214-996-6844.

### Want to Buy

Quadraphonic scope, 4 chan & quad R-R music. R Longseth, Sound Effects Plus, Box 349, Sioux Falls SD 57101. 605-339-1632.

Potomac AT51 test system. J Meeker, Family Radio, 4609 78th Pl SW, Mukilteo WA 98275. 206-348-3322.

## TRANSMITTERS

### Want to Sell

Collins 550A, 500-250 W AM, \$1500. S Vellmer, KDMN, Box 639 Buena Vista CO 81211. 303-395-2004.

RCA BTF10D 104.1 MHz, \$7500. J Eves, WPAY, 1009 Gallia St, Portsmouth OH 45662. 614-353-5176.

RCA BTA-1R, 550 kHz, \$3000. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Plate xformer TMC, 18 KVA, 3 phase, 210-250 V primary, sec yields 6000 VDC, 3 A, \$300. A Emerald, Emerald Ent, 8956 Swallow Ave, Fountain Valley CA 92708. 714-962-5940.

Gates BC1T 1 kW AM w/100' tower tuned to 1450 kHz, BO. J Chidester, KGLN, 162 W 6th, Glenwood Springs CO 81602. 303-945-6501.



Reliability, unsurpassed easy handling, outstanding performance, unbeatable prices. 15, 30 and 80 W exciters, 100, 200, 250, 400, 500 and 1000 W amplifiers. All front panel programmable, broadband. 2, 10 and 20 W STLs.

**BEXT Inc.**  
739 Fifth Ave.  
San Diego, CA 92101  
619-239-8462  
Telex 229882LJMR

Collins 20V2 500-1000 W, mint cond, 1140 kHz, BO. S Vellmer, KDMN, Box 639, Buena Vista CO 81211. 303-395-2004.

Continental 814R-1 2.5 kW FM, 802A new type exciter, 3 yrs old, new final tube, \$17,000. B Michaels, Tye Bldg Co, POB 5705, Abilene TX 79608. 915-695-7300.

RCA BTA10F, all or any parts, plenty of gd parts avail. B Emanuel, KASH, 1300 E 68th Ave #208, Anchorage AK 99518. 807-522-1515.

Continental 317-B 50 kW AM, 710 kHz, R Benson, KEEL, POB 20007, Shreveport LA 71120. 318-425-8692.

Gates Vanguard 1 1 kW, as is, BO. D Bergstrom, KCSJ, 1st & Main, Pueblo CO 81003. 303-543-5900.

Weston 2031 power meter for Continental Power Rock & FM xmtrs, \$45. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

Plate xfmr, 25 kW for Continental/Collins FM xmt, we crate, you ship, \$1300. J Banks, WLTT, 5912 Hubbard Dr, Rockville MD 20852. 301-984-6000.

RCA BTA250M 1340 kHz solid state supply, clean w/manual, \$1500 FOB Phila. B Hoy, WHAT, 3930 Conshohocken Ave, Phila PA 19131. 215-878-1500 X31.

## OVER 110 AM AND FM TRANSMITTERS

AMs: 50kw, 10kw, 5kw, 2.5kw, 1kw. FMs: 40kw, 25kw, 20kw, 10kw, 5kw, 1kw. All Manufacturers, All powers, All working, All spares, All inst. books.

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5946 Club Oaks Drive  
Dallas, TX 75248

R.E. (Dick) Witkovski  
Owner. 214-630-3600

TEPCO 10 W FM translators (3), BO. K Brown, KWOR, 1340 Radio Dr, Worland WY 82401. 307-347-3232.

Collins 21E 5 kW AM, w/some spare parts & tube, avail around 12/15/86, \$8000 plus pkg & ship. D Aydelotte, WCB, POB 1290, Cumberland MD 21502. 301-724-5000.

Gates TE-3 working when removed, \$900. B Greenough, WNT, Box 84, Mansfield PA 16933. 717-662-4600.

Collins 21E 5 kW AM xmt, call for details. J Meeker, Family Radio, 4609 78th Pl SW, Mukilteo WA 98275. 206-348-3322.

RCA BTA-5T, 5 kW AM, excel cond, manuals & spare tubes, 550 kHz. H Leupp, KFVR, Box 1738, Bismarck ND 58502. 701-223-0900.

Harris BC1H1 1 kW AM, excel cond, present main 1240 kHz, some spares, \$7000. L Robinson, WPAX, Box 129, Thomasville GA 31799. 912-226-1240.

### Want to Buy

Lower power TV UHF & VHF xmt, call collect. N Davis, Davis Comm, 25 Tall Pines, Defuniak Sp FL 32433. 904-892-4038.

McMartin B-910 FM exciter or transmitter, any cond, also buying used monitors Goodrich Ent, 11435 Manderson St, Omaha NE 68164. 402-493-1886.

AM, 1kW or less for wide area carrier current system. B Diefenderfer, Morning Star Ministries, 590 Main, Slatington PA 18080. 215-767-5985.

5 kW AM, gd cond, decent care, reasonable price. B Ell, WTNX, Rt 2 Box 96, Lynchburg TN 37352. 615-759-7111.

Gates BC5B 5 kW AM xmt, 570 kHz, parts avail for retune to 1310 kHz, w/book & tubes. BO. Bob Dobbs, KBBX, POB 388, Salt Lake City UT 84110. 801-292-5229.

Harris MW10 or similar unit. H MacDonald, KUMT, POB 710, Ennis MT 59729. 406-682-7598.

LPB carrier current xmt, pwr line coupler & instruction manuals, prefer solid state, paying \$100. D Sites, AmConGen, MRS. APO NY NY 09108.

Non-commercial station needs your xmtrs, 1-10 kW, need in any cond, will pay cash & pick-up. R Van Zandt, WGNV, POB 500, Petersburg IL 62675. 217-632-3115.

FM 1 kW xmt needed, near \$4000. Doug Booth, WLTS, 504-943-9019.

FM 1-3.5 kW, non-profit station. B Shiver, KBJ, Box 193, Jacksonville TX 75766. 214-586-8724.

AM xmt, 5 or 10 kW. B Sadler, WFSI, 918 Chesapeake Ave, Annapolis MD. 301-269-6500.

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**MONITOR SERVICE AND CALIBRATION**  
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**GOODRICH ENT. INC.**  
11435 Manderson St.  
Omaha, Nebr. 68164  
402-493-1886

Gates BC500GY or 250, working or not. K Kimsey, KSLQ, 102 Elm St Ste 203, Washington MO 63090. 314-239-6800.

Continental 1970's 315 or Collins 820E AM xmt, 5000 W w/solid state drivers. J Meeker, Family Radio, 4609 78th Pl SW, Mukilteo WA 98275. 206-348-3322.

## TUBES

### Want to Sell

10 3" #5820A early TV pick-up tube, collectors item, \$300; Vidicon 8480-4810 for RCA TK-27 film chain, gd cond, \$90; many receiving tubes. WE & industrial numbered tubes, gd selection, single or lot. Good Sound, 171 Drexel, Lansdowne PA 19050. 215-626-9322.

6166A/7007 (3), new, boxed, \$1500 ea. Call Mike Murphy, 11621 Valle Vista Rd, Lakeside CA 92040. 619-581-2726.

EIMAC 4CX1000A, used, \$125. C Shelonberger, WFTW, POB 10, Ft Walton Bch FL 32549. 904-243-7676.

Small audio & RF tubes, from \$1-5, write for list. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

EIMAC 4CX1000D, never used. R Benson, KEEL, Box 20007, Shreveport LA 71120. 318-425-8692.

EIMAC 4CX5000A, factory sealed box, late date code, \$1025. A Emerald, Emerald Ent, 8956 Swallow, Fountain Valley CA 92708. 714-962-5940.

Tubes, 813 at \$20; 845 at \$20; 6252 at \$50; 829 at \$30. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Eimac 4CX1000 tube & SK-890B socket, fits Collins 830 1 kW xmt, both new & in box, BO. K Buckley, WCLD, POB 780, Cleveland MS 38732. 601-843-4091.

Misc audio & small RF tubes, from \$1 to \$5, write for list. D Peluso, DGP Consultants, 2900 E Charleston #197, Las Vegas NV 89104. 702-384-0081.

### Want to Buy

Tubes, 242C or 211 for WE-451A xmt. H Parrish, WOZK, POB 910, Ozark AL 36361. 205-774-5600.

Tube socket for 6076 tube, needed immed. L Smith, Foster Comm's, 115 W 1st, San Angelo TX 76903. 915-653-3387.

## TURNTABLES

### Want to Sell

GA CB77 drilled for Micro-Trak tone arms. BO/trade. R Hahn, KDCR, Dordt College Campus, Sioux Center IA 51250. 712-722-0885.

Presto 6N lead screws/disc cutting 224/104/106 lines, \$65 ea. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

Sparta GT w/pedestal cabinet, \$150 plus ship, vgc. J Emmel, Emke Media, POB 401, Olyphant PA 18447. 717-383-1118.

Russco MK-V variable TT's w/Micro-Trak 303's & 2 Harris preamps, excel cond, \$750 plus ship. R Kerbawy, WTNJ, Box 1127, Beckley WV 25801. 304-877-5592.

Rek-O-Kut, 3 speed, gd cond, \$125, free ship. J Sheppard, Globe Prod, 539 W Minister Ln, Salem VA 24153. 703-389-1670.

12" TTs w/tonerms (2), direct drive, excel cond, \$175 ea. S Vellmer, KDMN, Box 639, Buena Vista CO 81211. 303-395-2004.

Rek-O-Kut CVS 12 TT speed variance, \$150; Harmon-Kardon mixers (2) DPR7, \$100 ea. L Oliver, 304 W 89th, NY NY 10024. 212-874-7660.

Russco Cue Master, like new. w/Micro-Trak tonearm, \$150. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Micro-Trak 303 tonearm (3), \$225, free ship. J Sheppard, Globe Prod, 539 W Minister Ln, Salem VA 24153. 703-389-1670.

QRK Studio Pro TT w/Micro-Trak arm (2), \$250 ea. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Gray 108B viscous damped tone arm, 16", new cond, extra slides, silicone fluid, \$100, phono preamp, PS audio, stereo, like new cond, \$60. Good Sound, 171 Drexel, Lansdowne PA 19050. 215-626-9322.

Russco Studio Pro, vgc, \$275/BO; Russco Studio Pro (2) fair, \$85/BO ea. RCA 16" in RCA cabinet antique, \$150/BO. W Brassell, Brazro Rec, 1215 N Concord, Chattanooga TN 37421. 615-892-5995.

QRK 12-8, no tonearm. BO. M Saady, First City Recdg, 141-60 84th Rd #3E, Brainwood NY 11435. 718-846-2062.

Gates CB1200 w/Grey 303 tonearm. BO. M Saady, First City Recdg, 141-60 84th Rd #3E, Brainwood NY 11435. 718-846-2062.

BE QRK 3 spd, Micro-Trak tonearms & Stanton cartridges, fair to gd cond, \$500/pr. M Elkins, WBQM, 1312 Riverview Ave SE, Decatur AL 35601. 205-353-7951.

Disc cutting head stack, 1/2" for Studer A80. M Brenner, Cal State Univ, 213-498-4796.

Sansui P-L50 linear programmable table, \$95. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

RCA 70D w/arm, etc, gd cond, \$75. D Olson, POB 479, Island Heights NJ 08732. 201-929-0694.

Grampan cutter heads type 1D feedback (2), one \$300 & other \$275. L Oliver, Oliver Sids, 304 W 89th, NY NY 10024. 212-874-7660 alt 1PM.

Gates CD77 as is, BO. B Greenough, WNT, Box 84, Mansfield PA 16933. 717-662-4600.

Rek-O-Kut B-12H w/120 arm & Empire 980 arm, also B-12H usable or for parts, \$125 for all. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

QRK w/base & Russco, \$50/both. M Matthews, Rockwell Collins, 3318 Shield Ln, Galand TX 75042. 214-996-6844.

### Want to Buy

2.5-3 mil styli for GE RPX040 & VR11 mono cartridges, also need RCA pickup for Mod 70 transcription TT or diamond reliping if avail. RL McDonald, Mission Recdg, 5231 Horton SE, Mission KS 66202. 913-722-2677.

Blank recording discs, Audiodisc, Soundcraft, Presto, Transco, Allied, etc, any sizes, any amounts. B Leslie, Pro Recdg Service, 13709 Mapleleaf Dr, Cleveland OH 44125. 216-662-1435 (eves).

EMT 927's, 930's, Thorens TD124, Gerard 301 & 401. C Dripps, Kurloff Entr, 188-444-7079. 800-334-8223 CA only.

RCA 16" in RCA floor cabinets, also parts for 70D & BQ2 TTs. L Scott Jr, POD 1729, Bartow FL 33830. 813-533-4654 eves.

## VIDEO PRODUCTION EQUIP.

### Want to Sell

Crosspoint 6006B sync gen, dist system w/4 phase adjustable black burst outputs, gd cond, \$995. D Brennan, Custom Video, POB 26126, Birmingham AL 35226. 205-823-0088.

Shintron 336 video dist amp, 1 input, 6 outputs w/manual, \$100. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

Rack of video prod equip, desk-style rack, Shintron 370 switcher, sync gen, Panasonic triple B&W monitors, Microtime T-120 & Edutron TBC's, Shure M267 audio mixer, all wired, operating order, \$5000. M Taylor, AliMar Prod, 274 County Rd, Tenafly NJ 07670. 201-569-1717.

Panasonic CT1010M, \$295; Panasonic WV 5203, \$400. L Sharp, KZOK, 200 W Mercer #304, Seattle WA 98109. 206-281-5600.

For-A 4200 color corrector, \$2500; Panasonic 8500 VHS editing deck, \$1850; Hitachi FP10UD video camera, \$1500. S Dubin, 30-15 Seven Dr, Fair Lawn NJ 07410. 201-797-4019.

JVC 3/4" CR-6650U, \$2995; Bogen 3040 (2), \$100 ea; Panasonic WV3806B (2), \$300 ea; 150' of 19 pin camera cable, \$150 per 50'; Sony DR10A (3) camera to switcher headsets, \$50 ea. L Sharp, KZOK, 200 W Mercer #304, Seattle WA 98109. 206-281-5600.

### Want to Buy

TBC, any make, any model, must be working w/manuals. Grossman Assoc, 1555 Astor St, Chicago IL 60610. 312-944-6248.

Ward TA-903 & TA-901 video DA's, modules, racks & schematics. M Hill, KOZY TV, 990 Garfield, Eugene OR 97402. 503-484-3044.

BVU 110 or 150 or entire remote portable video package, priced reasonable for a school. M Glaser, C&G Ent, 679 Nassau Rd, Uniondale NY 11553. 516-489-1071.

Panasonic TN-63 video monitor. F Vobbe, WLIO, POB 1689, Lima OH 45802. 419-228-8835.

Shintron 383 color bar/black/bkdg signal gen, any cond. G Odell, The Film Group, Box 9, Wethersfield CT 06109. 203-527-2972.

## VIDEO TAPE RECORDERS

### Want to Sell

JVC CR6600 U-matic VCR w/remote control, new heads, excel cond, \$1795. D Brennan, Custom Video, POB 26126, Birmingham AL 35226. 205-823-0088.

Ampex Mark X video tape head, newley refurbished, \$800. G Stewart, WPCB TV, Chan 40 Dr, Wall PA 15148. 412-824-3930.

Ampex helical 2" & 1", working cond, BO. F Chlebowski, Ontario Recording Svcs, 45 Sobieski St, Rochester NY 14621. 261-342-5331.

Sony VO2610 3/4" R/P, \$600; JVC 6000U, 3/4" R/P, \$600. C Kent, ACS Inc, 443 Elbert, Ramsey NJ 07446. 201-825-7807.

Sony VO-4800 3/4" portable VCR w/Portabrace carry case, \$1200/BO. B Ellis, KOZK, MPO Box 21, Springfield MO 65801. 417-865-2100.

Sony VO-4800 portable 3/4" VCR w/2 batteries, charger, Kangaroo pack, \$995; Sony VP-1000 3/4" player only, fair cond, \$115; Sony VO-1800 3/4" VCR, fair cond, \$165. G Ommrod, GFO Productions, 122 E 19th, Olympia WA 98501. 206-352-8028.

RCA TR800 spare parts & assemblies. T Smith, 192 Lancaster, Frazier PA 19355. 215-289-1725.

RCA TR600 spare parts & assemblies; Sony BVH spare heads & scanners; Sony, NTSC, & PAL align tape, new stock BR5-2. T Smith, CCI Comm, 192 Lancaster Ave, Frazier PA 19355. 215-289-1725.

Sony VP2000 3/4" U-matic videocassette player, vgc, \$200. A Ross, 8022 27th NE, Seattle WA 98115. 206-525-4624.

JVC 5000 3/4" U-matic player, recently overhauled, \$300. M Taylor, AliMar Prod, 274 County Rd, Tenafly NJ 07670. 201-569-1717.

### Want to Buy

Carts 1" for IVC VC100 or VC200 VTR, threading leaders only OK, also open reel adapter kit. M Cassiere, NTV Prod, 4 Minoru St, Esmond RI 02917. 401-231-0425.

**Buy from manufacturers and distributors who advertise in Radio World, they support radio.**

Sony BVU-110 or 150 3/4" portable VCR or equiv. M Glaser, MRG Assoc, 2 Floyd Ln, Massapequa NY 11762. 516-489-1071.

RCA TR800 & access, need not be working. H Henson, Henson Prod, 4569 Haven Crest Rd, Winston Salem NC 27106. 919-924-8717.

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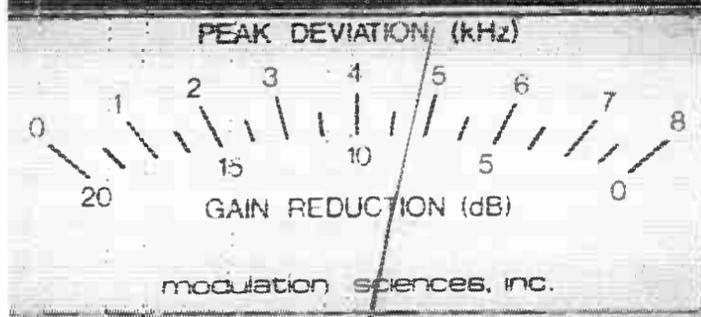
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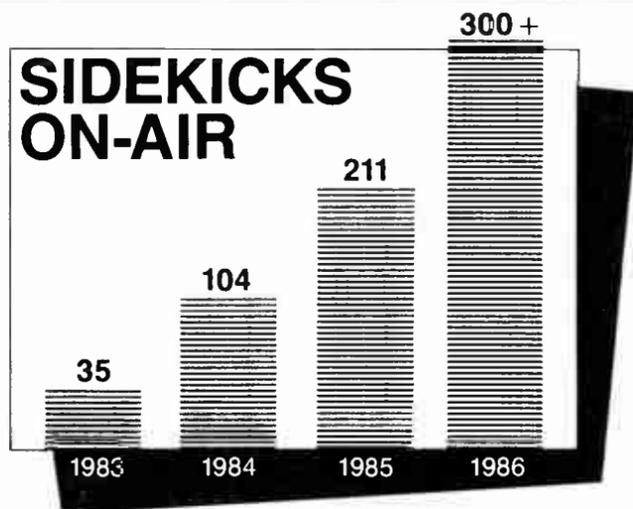
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## A SUCCESS STORY

**THE OBJECTIVE** was no small task: design a radio console that would become the new standard.

**THE METHOD** involved listening to veteran broadcast engineers and installers. After all, they're the people who have seen and experienced all the ideas that came before. From this research we learned of the problems that had to be solved and the features that broadcasters required. We then added ten years of console building experience and innovation, and created the A-500a console.

**THE RESULT:** An unsurpassed console that exceeds prior broadcast standards. Its module/mainframe interface borrows from the computer industry, utilizing all-gold contact insulation displacement technology. The logic system is based on programming the module slot, allowing full module interchangeability. It also provides for separate programming of the module's "B" input selection, thus avoiding embarrassing false starts and mutes. Full console-to-machine control is supported without extensive use of interface boxes and cables. Three audio busses are provided to enhance talkshows and remote functions. There are separate processing loops for the speech and music paths, as well as individual channel insert points. A complete line of microphone and line inputs, remote selectors, and machine control modules is offered in virtually any combination, configuration or mainframe size you desire. The A-500a also features a full family of studio turret and turret components to ease facility design.

**THE PERFORMANCE:** Needless to say, it's a new age for audio, and the A-500a is a step ahead. While specifications don't say it all, ruler flat frequency response, 0.03% distortion, crisp square wave response, and a noise spec that's unheard of deserve merit. Couple such performance, reliability, and innovation together, and a new broadcast standard is set.

**THE SUCCESS:** WHEATSTONE broadcast consoles are installed in major markets all over the country, from frontline independents to national networks. They are in use right now at some of the world's largest institutions.

**THE POSSIBILITIES:** The possibilities are up to you.

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