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See pages 25 to 30

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Upgrade Date Unchanged

by David Hughes

Washington DC ... The FCC has rejected a request by the NAB to allow the FM facilities upgrade deadline to extend beyond 2 March 1987.

In 1984, in conjunction with the Docket 80-90 procedure, which created 689 FM allotments, the Commission said existing Class B and C FM stations that were not operating at maximum facilities by early 1987 would be downgraded to the classification corresponding to their actual facilities.

However, in a petition for rule making and emergency relief filed in August 1986—less than seven months before the deadline—the NAB asked the FCC to "begin an expedited review of the matter" and issue "temporary waivers" to stations that had shown a "good faith effort" to upgrade, but had not actually done so before the end of the three-year grace period that was implemented in 1984.

The NAB argued that a plan to issue temporary waivers would give the Commission time to further assess the need for the reclassification plan, or to extend the upgrade deadline.

Pockets of interference

The association maintained that the FCC's plan to reclassify FM stations would create "unprotected pockets of interference" that could "destroy service currently enjoyed by many listeners."

Many stations face significant obstacles in their attempts to upgrade, such as FAA regulations, local zoning restrictions, land shortages and cost, the NAB said.

According to a survey it conducted, the average Class C facility would have to spend $567,339 to upgrade, while a Class B would have to spend an average of $126,912.

The survey also indicated that 63% of the more than 400 responding Class C FM stations were not planning to upgrade, with 9 out of 10 of those indicating that there are obstacles preventing the upgrade, such as "expense."

Argument "unconvincing"

However, in its 20 November ruling on the matter, the Commission maintained that the NAB's argument for the delay was "unconvincing." The FCC said it had considered all the issues that had been addressed by the NAB.

"The primary and overriding public interest goal remained allowing service in areas being encumbered by stations not built up to their full potential," the FCC said.

While acknowledging that there were "obstacles" individual stations had to overcome, "many already have upgraded," the Commission said, adding that many are still waiting for their upgrade applications to be processed.

"Those not upgraded continue to underserve, or not serve, areas in which they are receiving protection from interference," the FCC added.

The three-year upgrade period was sufficient, the Commission responded. Stations that fail to upgrade by the deadline "will continue to serve the primary audiences they had chosen to serve up to the point of the downgrade."

The FCC's action is detailed in Report MM-206. For more information, contact Mark Lipp at the FCC, 202-634-6530, or Margaret Davitt at the NAB, 202-429-5350.

FM Applications Backlogged

by Alex Zavistovich

Washington DC ... Staff shortages at the FCC have compounded the number of radio filings that await processing, now a backlog of approximately 1,700 applications for new FM stations.

According to Larry Eads, chief of Audio Services for the FCC Mass Media Bureau, the slowdown in processing can be attributed in part to a recent hiring freeze at the FCC, in which 17 vacancies were not refilled.

Eads divided the application backlog into "complex cases" involving educational FMs which raise the issue of interference to TV6, with the majority of the remaining cases stemming from the July 1985 opening of a universal window and the Docket 80-90 windows.

A number of mutually exclusive applications have also been held up by the return of some applications rejected by the FCC's so-called "hard look" processing, Eads said.

The "hard look" approach was recently adopted by the FCC to expedite the processing of FM applications, said Bob Greenberg, supervisory engineer in the FCC FM branch. The policy enumerates several critical points the FCC considers to be essential in determining whether an application is "substantially complete."

Any application not deemed substantially complete is returned by the FCC.

Eads maintained, however, that despite the holdup of some applications, the hard look approach is aiding the processing of filings.

"There has already been a reduction in the number of applications returned," he said.

AM applications normal

"(AM) cases are moving along at a normal rate," Eads said. At the end of November, 298 applications for new stations or major modifications were pending, which Eads claimed was "normal, or down a few" from past levels.

Eads stressed that there was no need to impose a freeze on further applications to alleviate the backlog.

"The FCC already has a mechanism to control the flow of applications; applicants cannot file until a window is opened," Eads said.

The FCC has a different view of "backlog" than does the public at large, Eads added.

Applications which have entered the processing system are said to be "in the pipeline," he noted. A "normal" AM processing—an uncontested filing without mutually exclusive applications—may be acted on within five months of its receipt.

Any application which has been in the system for a year or more is considered backlog, Eads said.

Engineers' opinions

A number of consulting engineers who were contacted said they were concerned about the current status of radio station applications awaiting processing.

Serge Bergen, a consulting engineer from Fairfax, VA, suggested that application backlogs were due to nonregistered engineers submitting applications. He felt that, in the future, the load could be eased by ensuring that applicants filed in good faith.

Bergen also said he was opposed to "hard look" processing. "The Commission, overwhelmed by spurious applications, went to the other extreme," he said.

Bergen suggested that the FCC establish registration of engineers in the state in which they practice as a possible way to improve filings.

Ralph Dippell, of the Washington, DC firm Cohen and Dippell, also said that registration would ease the backlog resulting from improper filings. He suggested that requirements be set for engineers practicing before the Commission.

Charles Gallagher, an engineer based in Lanham, MD, disagreed with the idea

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Regulatory News

Minor Xmtr Mod CP Eliminated

by David Hughes

Washington DC ... In an order issued 29 October, the FCC approved a plan that will allow AM and FM stations to make certain "minor" electrical or mechanical modifications to their transmitters without filing for a construction permit.

According to the plan, unveiled last June, broadcasters will no longer have to file FCC Form 301 and wait for Commission approval in order to make minor modifications to their transmission equipment.

However, the plan only affects changes that do not create harmful interference.

The new rules require a broadcaster to prepare only a "brief statement or diagram" that must be retained at the transmitter site and retained for the life of the affected equipment.

Equipment performance measurements must be made before modifications, the Commission said.

Unlike the original FCC proposal of this rule change, which exempted modifications to AM stereo exciters and generators, the Commission said it will permit the changes to be made to AM stereo and monaural gear, as well as to FM and TV equipment.

The FCC, concerned about the frequency stability of AM stereo exciters and generators, originally stated that it would not extend the rule relaxation to permit modifications of AM transmitters to interconnect an AM stereo generator to a type-accepted AM transmitter.

However, in the final text, the FCC decided to extend the rule change provisions to cover AM stereo gear. After studying comments from Motorola, NBC and the NAB, the FCC said it saw "no reason to exclude from the scope of this proceeding the interconnection of type-accepted AM stereophonic exciters to an AM transmitter."

The original plan to exclude AM stereo changes, the FCC said, would have made the new rules "more restrictive" than the old rules. The FCC added that "any electrical or mechanical modification to broadcast transmission equipment, including AM stereo exciters, will be permitted without prior Commission approval."

It said that modifications to any piece of transmission equipment, not just AM stereo generators, have the potential to create harmful interference. Therefore, the FCC said it would not be logical to prohibit AM stereo modifications that create no interference.

In related news, on 24 October the FCC said it will reinstate certain returned applications that failed to comply with requirements contained in an April 1985 public notice dealing with transmitter site maps filed with FM construction permit applications.

The Commission's 1985 public notice detailed map requirements that would "expedite the processing of FM applications" by allowing the FCC to independently verify geographic coordinates and topographic features of proposed sites.

FM broadcasters are required to submit a series of 7.5 minute US Geological Survey (USGS) topographical quadrangle maps specifying the proposed antenna and transmitter site.

The 1985 public notice required FM applicants to submit either the entire full-scale 7.5" map, or a legible photocopy, containing at least two USGS coordinate markings. The notice also said that an applicant, in place of the full-scale map, could submit a reduced topographic map "so long as it was accompanied by a full-scale copy of the section of the map containing the site."

In the notice, the FCC told applicants that failure to comply with the new requirements would "automatically result in a return of their applications."

Although the order was published in the *Federal Register*, the specific requirements contained in the public notice were not included, the FCC said in its October update. The Commission also said that the new requirements in this "substantive change in policy" should have been included in the *Federal Register* "so that the public would have been adequately informed."

In deciding to allow the resubmission of some applications, the FCC indicated that it would only reaccept those applicants who have "preserved their rights at various levels of appeal." These will be permitted to amend their applications and to correct the transmitter site map deficiency only, the Commission maintained.

For more information on the transmitter site map issue, contact Roxanne McElvane at the FCC: 202-632-3954. For more information on the minor modifications rule for FM and AM stations, contained in docket MM 86-264, contact Michael Lewis at 202-632-9660.

Featured this issue

FCC Clips

Haller Joins Private Radio

Ralph Haller, who had been deputy chief of the FCC's Policy and Rules Division, was named deputy chief of the Private Radio Bureau in early December.

Haller, who joined the Policy and Rules Division in February of 1985, previously was chief of the division's Technical and International Branch.

Before that, he was in charge of research at the FCC Office of Science and Technology laboratory in Columbia, MD, in addition to his many previous duties with the Commission.

According to the FCC, Haller has published more than 20 technical papers and reports, delivered presentations to many conventions, and represented the US in international CCIR forums during his career with the FCC.

For more information, contact the Commission's news media information office at 202-632-5050.

"Reports" Becomes "Record"

The FCC said it has discontinued its "FCC Reports" service, replacing it with the "FCC Record."

"Whereas FCC Reports contained only unique and precedential items, the FCC Record will be a comprehensive, timely and inexpensive research tool," the FCC announced in November.

It will contain all texts that are released by the Commission's Office of Congressional and Public Affairs, along with public notices, speeches and staff reports. It will also feature a table of contents and a biweekly and cumulative index.

The FCC Record will be available every two weeks through the Government Printing Office at a yearly cost of $173.

For more information, contact Brent Weingardt at 202-632-3906.

International Bulletin

The FCC's Office of Engineering and Technology (OET) has released "OET Bulletin 66," which covers "treaties and other international agreements for telecommunication."

The document lists treaties, agreements and arrangements that relate to telecommunications, including frequency coordination and notification procedures, according to the Commission.

It also lists "agreements and arrangements relating to radio communications between amateur stations on behalf of third parties and agreements relating to reciprocal licensing of amateur stations and operators."

While supplies lasts, copies of the bulletin can be obtained by sending a self-addressed mailing label to Technical Information Officer, FCC, Office of Engineering and Technology, Washington DC 20554. For more information on the availability of the document, contact International Transcription Services at 202-857-3800.

Regulatory News

Plan for Second FM Band Filed

by David Hughes

Hackettstown NJ . . . Radio New Jersey (RNJ), owner of an AM daytimer about 50 miles west of New York City, has asked the FCC to create a new FM broadcasting band between 225 and 230 MHz.

The new "FM2" band, as RNJ calls it, would be available primarily for "stand-alone" daytimers, according to Larry Tighe, president of RNJ, which owns WRNJ, Hackettstown, NJ, a 2.5 kW daytimer, with postsunset power levels ranging from 21 to 22.3 W.

He said the plan, which was filed with the Commission 18 November, would permit many daytimers to move to the FM2 band with fulltime operations, thereby reducing clutter on the existing AM band. That, Tighe added, would allow the remaining AM stations—other daytimers, fulltimers with poor nighttime signals and even 50 kW operations—to upgrade.

The proposal would permit AM daytimers to operate an FM2 facility, along with their current AM facility, for a five-year period, "during which the new FM service will have become viable."

After the initial period, one of the two—presumably the AM daytimer, in most cases—would go dark, according to the plan.

AM daytime channels that go dark could not be reapplied for, according to Tighe. That, RNJ contends, would result in a 30% to 50% reduction in the number of AM stations on the present band, thereby "permitting power increases and vastly improved audio quality for the remaining AM stations."

Fewer stations on the AM band would result in less skywave interference, splatter and adjacent channel interference, while increasing opportunities for power increases, antenna pattern changes and improved audio quality, thereby making AM stations more competitive with FM, the petition indicated.

If there were not enough daytimers to fill the FM2 band in some areas, the plan calls for the new FM frequencies to be opened eventually to AM stations that share time, fulltimers with inferior night facilities (such as Class IVs with night power levels of 250 W or less) and to noncommercial applicants.

Yet, Tighe and his Washington DC-based attorney Larry Roberts indicate that the new band would probably not be enough to satisify the needs of all daytimers in some areas.

Even if the new 5 MHz-wide band cannot accommodate all interested daytimers, those that remain on the less cluttered AM band would be able to change frequency and/or increase their power, Tighe said. He added that he would like to see the Commission classify an application for an AM frequency change as a "minor" action.

Apart from allowing more daytimers to operate at night, RNJ said its plan would also reverse the trend in which "urban centers" dominate the broadcasting band.

"The FM2 frequencies would be developed by operators of daytime and low-power AM stations that are generally located in expansive and often developing rural areas, but are operating with inferior technical facilities due to early assignments in urban areas," the petition said.

Stations operating on the FM2 band would be technically compatible with those on the standard 88-108 MHz FM band, and would use the same interference standards. The RNJ petition recommended that FM2 operations be limited to 20 kW ERP, which would provide a coverage area of about 30 miles from the transmitter.

The new band would allow 25 200-kHz-wide channels, beginning at 225.1 MHz (channel 301), and ending at 229.9 MHz (channel 325). RNJ said that propagation characteristics in the FM2 band would be similar to TV Channel 13, which operates between 210 and 216 MHz.

"The propagation characteristics of the proposed FM2 band give essentially equal coverage (at 20 kW power and 500' HAAT) as the existing FM band with a significant reduction in distance to co-channel and adjacent channel interfering contours," the petition stated.

It added that the shorter FM2 band wavelengths, as compared with the standard FM band, would allow better signal penetration into buildings, and allow transmission with "lighter, less-expensive and more-efficient transmitting antennas."

RNJ said the band could also accommodate secondary uses, such as for RPUs and STLs, on a non-interference basis.

The 225-230 MHz band is currently allocated to fixed and mobile services. RNJ maintained that there are fewer than one dozen nongovernmental users in the band.

Tighe, a helicopter pilot, said that the radios in various crafts he flies feature radios that cover the 225-230 MHz region. After checking FCC files, he said he learned that there are only seven licensed nongovernmental stations in the band—all with low powers and all in the Detroit area.

Both Tighe and Roberts, who say they have had informal discussions with representatives in the receiver manufacturing industry, maintain that the dual FM band would encourage consumers to purchase new receivers, thereby benefitting manufacturers.

Roberts said he has received numerous comments from broadcasters in support of the plan, including from owners of clear-channel AMs.

RNJ said it also plans to ask the Commission to allow it construct a fulltime FM2 station in Hackettstown (227.5 MHz) on an experimental basis, and work with a receiver manufacturer to develop an experimental receiver.

At RW's press time, the FCC had taken no action on the RNJ proposal.

For more information, contact Larry Tighe at 201-850-1000 or Lawrence Roberts at 202-659-4700.

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SBE, NARTE Hold Discussions

by David Hughes

Los Angeles CA ... The SBE and the National Association of Radio and Telecommunications Engineers (NARTE) are working to remedy a dispute over a NARTE ad that claimed the FCC "authorized" NARTE's engineer certification program.

At the same time, both organizations say they generally support an FCC plan to turn over additional engineering certification programs to the private sector.

Richard Rudman, president of the SBE, told RW in November that he had "extensive" talks with NARTE President Ray Thrower about the advertisement, which appeared in an SBE bulletin for its Baltimore chapter in mid-1986.

The ad, in part, states that "The Federal Communications Commission has authorized organizations such as NARTE to institute testing and certification programs."

During the summer, Rudman, joined by some NAB officials, criticized the ad, saying it inferred that the Commission specially authorized NARTE to perform engineering certifications. The SBE also offers a certification program.

The FCC, which decided in May 1984 to turn over a portion of its engineer certification program to industry organizations on a voluntary basis, has maintained that it does not endorse any specific industry-based certification program, including NARTE's.

While the Commission "endorses" the concept of industry-backed engineer certification programs, it does not "endorse" specific programs or "authorize" any of them, according to FCC Engineering Policy Branch Assistant Chief John Reiser.

Rudman said his discussions with Thrower were aimed at "bringing this (dispute) to a peaceful conclusion. We both agreed that it would be wasteful for both organizations to be antagonistic."

SBE informed NARTE of its problems with the ad in a letter, which Thrower said he received after articles on the problem appeared in the 15 August 1986 issue of RW.

Rudman said Thrower agreed to raise the wording issue during a November meeting of NARTE's board of directors.

After the board meeting, however, Thrower maintained that, despite talks with SBE, NARTE stood behind the wording in the ad. He pointed out that FCC staff members were not critical of the wording when they saw copies of the ad in 1984, when NARTE unveiled its current certification program.

He acknowledged that while the dispute with SBE over the ad has not been entirely settled, talks with Rudman did "a lot of good." Thrower said the two groups have a "commonality of interests."

In related news, both the SBE and NARTE filed comments with the FCC in November on a plan to ask Congress to permit the Commission to allow a private organization to administer FCC Commercial Radio Operator Examinations.

According to NARTE, six types of commercial radio licenses and two types of endorsements are currently issued by the Commission. Congress previously allowed the FCC to delegate examinations in the amateur radio service to private organizations.

"While the private examiner will be responsible for the drafting, administering and grading of the examination, the Commission will continue to make the ultimate determination of an applicant's qualifications," NARTE said in the November/December edition of its *NARTE News* publication.

Both SBE and NARTE said they approved of the plan. However, both organizations said the FCC should allow multiple organizations to perform the exams, not just one organization, as the Commission proposed.

The SBE said it has "strong reservations about the proposal ... to delegate examination responsibilities to only one organization or entity."

It added that "any one organization with the Commission's imprimatur which administers all commercial license examinations and which later decides to offer broadcast technical certification examinations would obviously enjoy an unfair advantage over existing voluntary technical certification programs such as that offered by SBE."

NARTE maintained that "the authorization of multiple organizations to administer these examinations will ensure the greatest access by the public to the examination/licensing marketplace."

The FCC docket number on the plan is GEN 86-367. For more information, contact Ray Thrower at NARTE, 503-581-3336, or SBE President Richard Rudman at KFWB radio in Los Angeles, 213-462-5392.

Local RFR Preemption Unlikely

by Alex Zavistovich

Las Vegas NV ... Despite strong support from broadcasters indicating that they would favor an Environmental Protection Agency (EPA) recommendation of a radio frequency radiation (RFR) standard, EPA officials do not predict federal preemption of local RFR guidelines.

Richard Tell, chief of the Electromagnetics Branch of the EPA Office of Radiation Programs said "all but one comment" at a public hearing in Washington, DC in September urged the agency to select a standard. He added, however, that he saw "no chance of an EPA standard preempting local regulations."

Tell said that the NAB had also voiced its support of an EPA guideline at the hearing, saying that the cost of selecting any standard would pale in comparison to not selecting any at all. He said that the NAB endorsed an EPA standard because it might stop the proliferation of regulatory laws on a local level.

The EPA has been receiving written comments on four alternatives for national RFR exposure standards, Tell said. The alternatives range from roughly 1/10th the American National Standards Institute (ANSI) exposure limit to having no standard at all.

The ANSI standard recommends a maximum power density exposure limit of 1 mW/cm² on a 6-minute time-averaged basis.

Revising ANSI

During 1-2 December in Las Vegas, the chairmen of the working groups of ANSI standard C95.1 subcommittee 4 met. The subcommittee is responsible for the revision of current ANSI guidelines, Tell added.

"Active discussion" was held on the issue of a two-tiered ANSI standard, said Tell, who is also chairman of the ANSI dosimetry group. The revision would provide two different exposure values—one for the general population, and a second for workers, he added.

The discussions were held in preparation for a June 1987 meeting in Portland, OR, at which a "strawman" draft of the proposed ANSI standards will be submitted for ratification, according to Dr. Kristian Storm, chairman of ANSI subcommittee 4.

The Portland event, scheduled prior to a meeting of the Bioelectromagnetic Society, was characterized by Tell as a "major meeting."

Significant changes

Tell suggested that the new standard would have "significant changes," due largely to new concerns about RF burns and shocks, especially at low frequencies.

Previously, ANSI had focused its attention on specific absorption rates (SAR) for an entire body, Tell said. Current ANSI guidelines limit SARs to 0.4 W/kg for frequencies above 3 MHz.

The new guidelines, while maintaining the SAR criterion for frequencies above 30 MHz, would specify new limitations in current to avoid burns and shocks, Tell commented.

He indicated that field strength would not be a major consideration in the standard, because "if you limit field strength to avoid every possible occurrence of burns or shocks, it would mean dropping the strength value so low you would have to shut down every station in operation today." Body current limitations, Tell maintained, would be a more practical approach to the problem.

In other news, the EPA is not seeking comments on the exemption of AM from future RF radiation standards, as was reported in the 1 November issue of RW. Comments were sought for the selection of an RF exposure standard, Tell said, and AM frequencies are to be included in any such standard.

For more information, contact the EPA at 202-382-3324. Contact Richard Tell at 702-798-2440.

Opinion

Readers' Forum

Got something to say about *Radio World*? Any comments on articles? Call us at 800-336-3045 or send a letter to Readers' Forum (*Radio World*, Box 1214, Falls Church VA 22041 or MCI Mailbox #302-7776).

More on heat problems

Dear RW:

I read Floyd Hall's article "Heat is Xmtr's Worst Enemy" in the 15 October 1986 issue of RW, and found it quite informative and entertaining. My experience has born out the truth of several things he said.

There are a couple of things I could add in regard to cooling buildings and transmitters. First, I have one 25 kW FM transmitter that is known for being hard on finals. Tube life has been greatly increased by venting the transmitter air outlet straight up through the roof, and using a squirrel-cage-type blower with a ¼ horsepower motor to aid the air flow and help overcome restriction.

Secondly, I have a site with two fans, one blowing out and the second one blowing in, but at a higher CFM rate, to pressurize the building. I've found that in our area there is a concentration of bugs and airborne dust and dirt near the ground, so rather than have the air intake down low, I moved it up. This cut down on the dirt that found its way into the building and, as an added benefit, improved air circulation.

With the air inlet low and air outlet high, it seemed the cold air was going directly from inlet to outlet. There was a large amount of hot air that stayed trapped up near the ceiling. In the winter the cold air stayed on the floor, making feet uncomfortable. (That can be quite a factor in Minnesota when it's 30° below zero!)

When I reversed the blowers so the inlet was high and outlet low, the cold air mixed with the hot air near the ceiling, and was forced down before it left the building. This removed the chill from the floor and reduced the floor-to-ceiling temperature gradient, resulting in better equipment stability from summer to winter and a much more comfortable building.

Al Martin
Segue Services
Merrifield, MN

RW *replies: Columnist Floyd Hall responded, "Thanks for your comments on 'The Old Timer' column re: transmitter cooling.*

But, you missed the bus in several ways, as you have described the changes you have made.

First, in hot weather, the air on the ground, in the shade on the north side of the building, is cooler.

Second, if you are getting bugs and dust into the building, you either didn't filter the air intake or the intake blower didn't have enough capacity. You want a couple of inches of air pressure inside the building to keep dust from filtering in through the cracks and to aid the flow of air out the exhaust blower.

If, as you say, hot air stayed up near the ceiling, then your exhaust blower is too small, or is restricted. (Don't tell me you used fans!)

If you want to warm the place up in the winter—it's simple. Put a thermostat on the exhaust blower!"

Resounding themes

Dear RW:

I write this as I finish reading your 15 October 1986 issue of RW. I have enjoyed RW for several years now, having been directly involved with satellite-delivered radio for some time.

In this issue, two themes seem to have been struck, both of which are routinely ignored by small radio general management (as opposed to the big four networks: CBS, ABC, Mutual and NPR). In his letter, Charles Burke says, " . . . it is as if the industry runs on a hand-to-mouth basis with little reward for future planning."

Also, the resounding theme throughout your articles dealing with engineering is the seeming inability of radio management to make quality decisions regarding engineering needs. I have yet to pick up any copy of RW that wasn't critical of management's attitude toward engineering. Management needs to be criticized!

I spent nearly five years full time with one of the premium young companies in satellite-delivered radio equipment as both service manager and systems engineering manager. As soon as we became involved with radio, the problems compounded.

It was appalling to me, in trying to service the technical needs of radio clients utilizing our equipment, of the abject ignorance on the part of affiliates in their attempts to become familiar with the equipment or the technology involved to deliver top-quality sound via satellite.

It almost seemed that the only thing the GM of any affiliate wanted was top-quality equipment for the lowest price, and to be totally irresponsible toward the maintenance of the equipment.

I can spend hours talking about different affiliates, and the total absence of any knowledge of technology, or their rejection of any of our attempts to teach them about the technology.

Part of the problem is that all the GM sees is dollar signs from selling commercial time, while at the same time refraining from any expenses that do not directly increase that particular revenue.

Those small satellite-delivered networks must be involved with the technical perfection of their affiliates, as well as just collecting affiliate fees. If the affiliate is going to go full time with the satellite, then he should not only be encouraged to buy spares, but be required to install redundancy. This not only covers his butt if something goes down, but enhances the reputation of the network in having taken care of his affiliate.

Costs? Well, how much are you going to spend on salaries, benefits and overhead for a fulltime talent staff, as opposed to a complete satellite system that is backed up with spares?

However, be that as it may, this engineer finally got frustrated with the never-ending battle and left the industry. When it becomes immediately obvious that you aren't going to be listened to, it comes time to make a change.

You GMs out there are going to have to face up to some tough (and immediately) expensive decisions which, over the long haul, will pay off in better service, happier affiliates, and lots of advertising and listeners. Back up both your equipment and, most of all, your engineers.

Granted that you don't have the same big bucks as the Big Four, but with prudent attention you can still have high-quality, satellite-delivered sound without breaking your bank. Listen to your engineer or equipment manufacturer when they encourage excellence, even if it means a few more bucks for engineering.

And finally, an observance about AM stereo. You all can make it work; force a standard! Without a standard, your effort will go the same road as did quadraphonic sound. Whether it be C-QUAM or the Kahn system, make a decision.

If the problem is that some manufacturer will become upset or not isn't and shouldn't be the problem. Because, whichever system you choose to standardize on, that manufacturer would probably be more than happy to license it out.

Chuck Albert
Smyrna, GA 30080

Lip service

Dear RW:

I read with interest the many articles in your publication and others about the improvements in AM broadcasting. We talk about AM stereo, preemphasis, widebanding arrays and all the other new electronic black boxes that will rush in

(continued on page 6)

Policy On Upgrades Is Fair

Despite the NAB's efforts to convince the FCC to extend the deadline for Class B and C FMs to upgrade to their maximum facilities, the FCC declined to extend the upgrade period beyond the three-year deadline of 2 March 1987.

The FCC's rationale was to allow those Class Bs and Cs a chance to upgrade to the full capacity allowed under their license—and to gain a few years' financial benefit—before the Docket 80-90 stations come on the air in the early 1990s.

The FCC measure was, in a sense, protectionist, warning FMs involved to "use it or lose it." The three-year grace period was generous to begin with, and certainly offered those FMs interested in upgrading plenty of opportunity and support in which to do so.

Of stations responding to the NAB's survey of the 896 licensed Class Cs and 92 Class Bs operating below minimum power or height criteria at the beginning of the three-year upgrade program, about 39% indicated that they had already upgraded. Of remaining stations, 75% of the Class Cs and 63% of the Class Bs indicated cost as the sole factor inhibiting an upgrade.

While the NAB's efforts were well placed, the FCC's decision to stick to its 2 March deadline has its merits. The Commission's primary duty is to ensure the proper allocation of channels within each band.

Of course the costs to upgrade may be high, but the public in those areas of a station's total service area (TSA) are not being served when that station chooses to operate below minimum power or height criteria.

Unused allocations shouldn't sit idle; the public should be served. If, in three years, a station is unable to commit to serving its TSA, then other stations should be given the opportunity to do so.

But now cost and time factors are not valid arguments, since it is not the FCC's role to protect indefinitely a station's right to upgrade when that station either doesn't have the funds or isn't interested in fully serving its community.

If a station feels upgrading will ensure future growth, and it wants to protect its investment in the future, it should act now. Three years has been enough time to make this decision.

—RW

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Best Approach to ATIS Debated

by Alex Zavistovich

Washington DC ... Although broadcasters and equipment manufacturers support the FCC's goal of establishing an automatic transmitter identification system (ATIS), opinions vary as to whether a single system will be effective and whether a system is necessary for audio transmitting devices.

In August, the Commission proposed an ATIS system for satellite video uplinks, and asked for comments on a similar system for all broadcast services and radio transmissions.

Interest in an identification system was rekindled in April, after the "Captain Midnight" incident, in which an uplink operator jammed an HBO satellite feed, according to Jim Beckham, of the FCC's enforcement division.

The ATIS plan would assign a unique number to every transmitter upon manufacture. The number, modulated onto the unit's transmission, would correlate to a licensee's database and act as a signature of the radiated signal.

The FCC proposal would have all radiated video satellite uplinks include ATIS on their signal after 31 December 1987.

Many groups expressed the opinion that the need for an audio identification system is less significant that a similar system for video.

National Public Radio (NPR) manages "a decentralized network of 19 transmit and more than 275 receive terminals." The Commission's notice, NPR said, should be addressed to the issue of interference from video carriers into lower powered channels.

NPR maintained that audio identification is "far less imperative" than satellite video uplink identification because of "the absence of serious audio interference problems." NPR also pointed out that there are no adequate designs for audio identification.

"The Commission should continue to study audio interference and identification system design," NPR said, "but resolution of video interference problems should not be delayed pending the outcome of such study."

CBS indicated that some services may not require the identification system. The company cited AM, FM and TV as broadcast services in which identification of a signal "has rarely been a problem." Mobile stations, however, would benefit from ATIS as an aid in frequency coordination, the company said.

Rockwell International Corporation, a transmitter manufacturer, said that although radio frequency management is "highly desirable," the FCC's ATIS proposal "is unlikely to be viable."

The corporation noted that the cost of the equipment would amount to a 10% increase in transmitter cost.

Even a marginally beneficial ATIS system would take "many years ... at enormous costs" to put into effect, Rockwell said. The corporation suggested that alternatives to the ATIS system should be pursued.

The NAB supported the FCC's goal of "creating mechanisms to identify and solve interference problems."

However, the group held that "the expectation that a universal identification system can be implemented in the time frame proposed ... is overly optimistic."

According to the NAB, informal telephone surveys with satellite users indicated that "additional study is needed, along with the cooperation of the industry, to solve the problem" of signal identification.

The survey reportedly generated a number of alternatives to the ATIS system proposed by the FCC, including using a "plain language" code on multiple lines, or a single coding technique "with a robust binary or ASCII format signal."

An advisory committee of industry representatives should be established to discuss issues relevant to the ATIS system, Dow Jones suggested. The company added that the FCC ought to have the signal "incorporated within the transmitter at some reasonable time in the future."

A frequent concern voiced in the comments was that the system should include safeguards to ensure that the identification code would not be tampered with by operators purposely interfering with satellite operations.

Docket number is 86-337. For additional information, contact John Hudak at the FCC: 202-632-6977.

'Dear RW' Continued

(continued from page 5)

to save the day, but I feel we are all just paying lip service to the real problem in AM broadcasting.

What will the public listen to on a consistent basis? If the guy trying to shave at 6:30 AM in the morning has to turn his radio dial in a die-hard attempt to hear your station, he will push the button marked "FM" and the "marketplace approach" takes over. Chances are you will never get him back.

The same thing happens in the pre-(and post-) sunset hours. If this same listener is trying to hear you, and the class I, II, III dominant station on your channel has you protecting a skywave 750 miles from your hometown, the same thing happens.

We wonder why FM has dominated in the past 15 years. It is very simple. Joe Listener can *hear* the FM stations consistently. And with the advent of the 80-90 channels and the deregulation of channel spacing, this will make as many as 2,500 different channels and upgrades possible.

Let's not kid ourselves. Until we come up with a system of engineering that will give us equal, interference-free signals that will compete with the FM signals in each market, we will start to see a lot more AMs just going dark.

As one of my colleagues said in a recent reply comment before the Commission's AM committee, "Let's save the Whales." I say if we do not do something to save the AM band now, it will not be the whales that will be extinct, but all the other little fish in the AM sea. We have the engineering know-how to cure the problem. Now if we can just use it ....

W. Lee Simmons
Broadcast Telecommunications Consultant
Hilton Head Island, SC

January 1, 1987

Japan Testing Five AM Stereo Systems

Tokyo Japan ... Japanese broadcasters and receiver manufacturers have started a two-year program to test all five of the AM stereo transmission systems originally proposed for use in the US, with plans to eventually recommend one as a national standard.

Tests of the five systems began in October 1986 at an experimental station north of Tokyo, according to M. Ebisawa, CE of radio station JOQR. An elaborate display describing the tests was featured at the International Broadcast Equipment Exhibition held in Tokyo 19-21 November.

The tests are being performed at the direction of the Broadcast Technology Association (BTA), a group consisting of 15 receiver manufacturers and 17 stations expressly formed for this purpose.

A 1 kW transmitter operating on 855 kHz, set up specifically for the testing period, is used.

The BTA test program could last up to two years, according to Ebisawa.

The testing will result in a final report recommending a single system to be presented to the Japanese Post and Telecommunications Ministry (Japan's version of the FCC), Ebisawa explained.

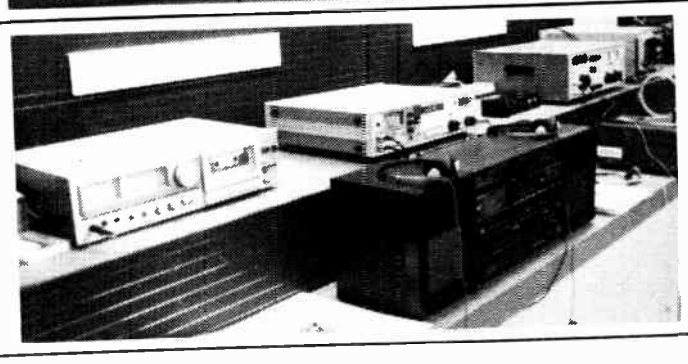
If adopted, the recommended system would become the only AM stereo system used in Japan.

The October tests utilized Kahn Communications Inc. and Motorola manufactured exciters.

Future tests of the Magnavox, Harris and Belar systems will be performed, Ebisawa said, using test exciters assembled in Japan.

Voice, tones and music were broadcast and 19 different types of receivers were used to generate tapes for subjective evaluation as well as to gather test data.

Ebisawa did not know if the results of the tests would be made public.



M. Ebisawa, CE of JOQR (top); Equipment to be used in Japan's AM stereo tests (left).

Metric Curve Date Set

Washington DC ... The NAB has made available metric AM groundwave and field strength curves in time for the 1 January 1987 FCC metric curve deadline.

Both the curves and blank graph paper use original FCC material, the NAB said. Nineteen sets of frequency-dependent propagation curves encompassing frequencies from 540 to 1610 kHz are available. Curves for each frequency group are drawn on regular and expanded graphs.

A complete set of the 19 graphs, with graph paper and an instruction sheet, is available to NAB members for $45, and to nonmembers for $60. Twenty-five supplemental sheets of the regular and expanded versions of the graph paper are available to NAB members for $25, and to nonmembers for $40.

A special introductory package containing a set of curves and one set of supplemental graph paper sheets is available through 28 February to NAB members for $59.95, and to nonmembers for $89.95.

To order the material, call NAB Station Services at 800-368-5644, 9 AM to 5 PM EST. For more information on the program, contact Bob Hallahan at 202-429-5350.

At RW's press time, the FCC extended the metric curves deadline to 1 February. See the 15 January issue for details.

FM Filings Backlogged

(continued from page 1)

of registration of engineers, pointing out that "the existence of a license may not solve the problems" of improperly filed forms.

Gallagher also said he supported the hard look processing approach. "If (the FCC) hadn't imposed the hard look, they'd have many more backlogged applications than they have now."

Robert Culver, of the Washington, DC-based firm Lohnes and Culver, maintained that another factor contributing to the backlog might be petitions for reconsideration submitted by applicants whose submissions were rejected by hard look processing.

For additional information, contact Larry Eads at the FCC's Mass Media Bureau: 202-632-6485.

Seattle SBE Battles RFI Sources

by Alex Zavistovich

Seattle WA ... An industry committee is being assembled by the local Seattle chapter of the SBE to investigate faulty transformers in the city's lighting system which have caused RF interference to broadcast facilities in the area.

The group was invited to present a draft of its proposed activities to the NAB, said Marty Hadfield, director of engineering for SRO Broadcasting and chairman of the local SBE chapter.

Hadfield said he sees RF interference to radio broadcasting as an industry-wide problem, citing numerous examples in Seattle alone.

In one instance, Hadfield said, a radio station in the city was experiencing interference due to a number of faulty supply transformers on a utility pole outside its broadcast facility. The transformers produced a "60 Hz to 120 Hz AC buzz, which could be heard on any broadcast radio," Hadfield said.

In another instance, complaints of poor reception of AM radio and TV broadcasts were traced to a sewage treatment plant running at reduced capacity, Hadfield said. The plant's "SCR" controller, which because of poor ground conductivity was poorly grounded, was the root of the problem, he added.

Hadfield maintained that extensive interference to broadcast signals was caused by the electrical systems of the trackless trolley mass transit system of the Municipality of Metropolitan Seattle.

The trolley system caused three distinct types of interference, Hadfield said. In one case, power substations of the system were rectifying, remixing and retransmitting radio noise; the other two types of interference came from trolley noise and from the system's overhead power distribution system.

The trolley system has 26 substations spaced approximately every 6000' to power the buses, Hadfield said. Noise from the substations was being generated by a diode in a 6-phase power supply which converted the city's electrical power to 600 VDC current for the trolley.

The system produced a 360 Hz buzz, audible on broadcast radios, Hadfield noted. He said the problem was corrected by using bypass capacitors.

Trolley noise

The problems of trolley noise and the overhead distribution system were not as easy to correct, Hadfield said.

The Seattle trolley buses used "chopper-type control circuitry" that emitted a continuous whine which was modulated when bus electrical systems were in use, he said. As early as 1980, noise peaks could be heard in the standard broadcast band at 100 KHz, 450 kHz, and 700 kHz, he said, becoming part of the background noise floor at 7 MHz.

In May 1982, in response to numerous interference complaints, a joint meeting was held in Seattle with the FCC and the Western Washington Cooperative Interference Committee, an independent public interest group. The meeting was attended by representatives from Seattle's transit company and local radio stations, Hadfield said.

The FCC concluded that the problem was "incidental interference from unauthorized broadcast equipment," Hadfield said, and as such was covered under part 15 of the FCC Rules and Regulations. The problem was determined to be the responsibility of the metro transit group to correct, he added.

Correcting the problem

Trolley system officials were "very helpful" in correcting the problem, Hadfield said.

The group removed all but one bus from service for testing, during which chart recording and spectrum analysis of background noise and contributed noise for an unmodified bus was conducted. These findings were compared to those of a bus modified to increase common-mode rejection.

The transit group proposed a correction program in December 1982, Hadfield said, which included a provision for retrofitting approximately 109 trolleys with new SCR-type controllers.

The buses were also outfitted with an RF capacitor for the top of the bus, where the voltage is introduced, and a choke arrangement inside the bus to increase common-mode rejection, he added.

AM radios are now being used to test buses at a checkpoint in the transit company's storage facility, Hadfield said. If the radio's broadcast signal is interfered with, he said, the noisy bus is "red-tagged" and the problem is then corrected.

Officials at the Seattle transit authority could not be reached for comment.

For additional information, contact Marty Hadfield at 206-281-5633.

FM's License Revoked

by David Hughes

Washington DC ... An administrative law judge has revoked the license of a Dallas noncommercial radio station that has broadcast only 4 of the 14 years it has held its license, paving the way for another noncommercial station to move onto the potentially vacant frequency and increase power.

Administrative Law Judge Walter Miller denied Agape Broadcasting Foundation a renewal of its license for KNON-FM, which operates with 10 kW on 90.9 MHz.

A 13 November FCC order explained that, despite having received its license in 1971, KNON did not go on the air until 1975 "because it lacked funds and technical expertise."

Interpreting Miller's decision, the

(continued on next page)

KNON 'Failed to Use Frequency'

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Commission sasid the station went off the air between 1977 and 1983 because "Agape had neither the money nor the inclination to serve the public."

Miller added that when KNON came back on the air in 1983, it operated with a "substandard transmitter" until May 1985.

"Since Agape used its frequency for only four years over a 14-year period," the FCC said, "Judge Miller concluded it was not qualified to remain a Commission licensee."

Apart from the failure to use its frequency for most of the period, Miller added that Agape also had another strike against it.

According to the FCC, Miller said that Agape misrepresented its ownership structure to the FCC by not listing the Association of Community Organizations for Reform Now (ACORN) as the "real party in interest."

He maintained that in 1981 ACORN took de facto control of Agape by placing ACORN members on Agape's board of directors and in station management positions, along with moving KNON's operations to ACORN's building.

KNON responds

KNON plans to "definitely appeal" the decision by mid-December, according to GM Jeff Murray. "The judge missed the mark in this case," he said. The process, he added, could take one to three years.

The station, which programs an eclectic mix of soul music, gospel, progressive rock, along with Hispanic and minority oriented programming on a daily basis, spent the time off the air because of a shortfall in funds, Murray said. "KNON depends on low- and moderate-income people for all its funds. We go door-to-door."

He added that part of the delay was because of FCC delays in awarding two construction permits the station had requested, one on 1979 and the other in 1982. "I think we showed good cause (for the time off the air)," he said.

Murray said that while some of Agape's board are members of ACORN, ACORN does not have de facto control of Agape. "Just because someone belongs to an organization, that does not mean that organization (ACORN) has control (over another organization—Agape)," he said. "It would be like belonging to a church."

License awarded

The judge awarded KNON's frequency to the Criswell Center for Biblical Studies, owner of another noncommercial operation in Dallas, KCBI-FM, which now operates with 9.7 kW on 89.3 MHz.

With the move to 90.9 MHz, KCBI, with its religious format, could apply to increase its power to 100 kW, something it was not able to do on its original frequency, according to KCBI GM Carl Singer.

However, in late 1985, two weeks after the FCC started holding hearings in the case, KNON applied to increase its power to 100 kW. Murray said that the judge would not allow the two stations to swap frequencies, giving KNON a low-powered facility on 89.3 MHz and KCBI a 100 kW facility on 90.9 MHz.

Singer said that KCBI had made "several overtures" since 1979 to swap frequencies; however, KNON showed no interest. Then, last spring, KNON reopened talks regarding a swap, he said.

In the most recent hearing, the FCC would not allow the swap because of KNON's alleged misrepresentation of its ownership, Singer maintained.

No timetable has been set for KCBI's move to 90.9 MHz. Singer said that KNON has "two or three" levels of the appeals process it can pursue.

The issue is contained in FCC docket MM 85-288. Contact Jeff Murray at KNON: 214-823-7490; Carl Singer at KCBI: 214-954-4444, or the FCC News Media Information office at 202-632-5050.

How to Beat Procrastination

by John "Q" Shepler

Rockford IL ... My editor sends me notes of encouragement from time to time. Sometimes it's a kind word or two, sometimes it's fan mail from readers, and sometimes I get suggestions for future columns. The latest request was for ... well, let me explain something first.

I strive to get these columns submitted well ahead of schedule. With any luck, they're in the mail to RW at least two or three months in advance. That explains why I seem to drag my feet responding to some of your requests. What gets written in one season gets printed in another.

The reason for this lead time is partly to give RW a chance to edit and layout the material. Mostly it's because I don't want to be faced with pounding out a couple of thousand words in a last-minute Saturday afternoon panic when I could be soaking up rays at the beach. It pays to work ahead, as you'll see.

Anyway, the request was worded: "How about a column someday on how to beat procrastination?" Good idea. However, it would be a fraud to write anything on procrastination "someday," maybe in a year or so. Consequently, I'm slipping this into the schedule as the very next column. How's that for nonprocrastination?

Why not now?

What's stopping you from doing what you want to do right this minute?

"Gee, I'd like to build a cart timer, but this whole box of resistors needs to be organized first, and I can't do that until I buy some plastic trays, which won't get done 'til I figure out my tray needs for the next 10 years and that has to wait for input from the management pow-wow in about three months."

Most of us are smarter than that, and can invent much more believable excuses for not getting things done. The usual generic excuse is: "I don't have time."

Why not? Everybody was supposed to get rationed 24 hours today. If you got gypped, go back and demand the rest. It's only fair.

Now that we all have the same time allotment, we should all get the same amount done, right? Strange thing is that it never seems to work out that way.

You probably have a full schedule. There are more things to do than time to do them. We all have that schedule. To get more done, you first have to accept the fact that not everything is going to get done. That means you have to consciously decide which projects will be stunning successes and which will die on the vine. That's a lot of responsibility.

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

Q-Tips

Some people never do face up to those decisions. I knew a chief engineer who had a system for handling complaints from the air staff.

"Just nod your head and ignore them," he said. "After a while they'll forget about it and you won't have to do anything."

This man is no longer chief engineer. The angry mob finally chased him out of town with a noose. The irony is that if he had spent just half-days satisfying those complaints, he could have loafed all afternoon and no one would have cared.

I guess there are a number of morals in that story. The first is that some jobs are more important than others. What's more, your own pet projects may not be top priority.

Another point is that this engineer had plenty of time to be successful. It took months for the problems to turn into a crisis. In those months a lot of magazines got read during what should have been working hours.

It is no trick to fill up a day with things to do. The trick is to figure out what really has to get done and make sure those projects are completed before you start less critical work.

The secret to success

The big secret is to be in charge. Your success is determined primarily by your ability to decide what's really critical and then doing whatever it takes to handle those critical items.

But, what about the other hundred things that you don't have time for? Too bad.

They won't get done. Maybe some of them will get done at a later date when they become more critical. As for the rest, you'll just have to let them go.

Maybe you feel uneasy about this approach. Well, Babe Ruth and Hammerin' Hank never batted 1000%. What makes you think you can?

If you foolishly try to do everything, you'll not only make yourself ill, you'll probably screw up the important stuff, too. Besides, you don't have to bat 1000% to be a star. Just hit a grand slam homer once in a while.

Once you come to grips with the

(continued on page 12)

New Angle on Phono Preamps

by James L. Dacey

Monterrey CA ... There are better and better phono preamps available to the broadcaster today, thanks to work done in the audiophile high-end world. We seem to have a choice of two good passive EQ'd brands available to us today, plus other brands that retain the active, or feedback-derived, method of EQ.

In the '40s and '50s, we used low-impedance phono cartridges, like the GE VR units, that fed directly into a well-shielded can containing a passive network and transformer that coupled into a 50 ohm or 250 ohm console input, such as a low-level flat preamp.

This old method sounded quite good —noisy by today's expectations, but transient qualities were fine.

Somewhere in tbe '50s, higher impedance cartridges started being used with tube-type preamps that employed feedback derived equalization.

Then came transistor units, again employing feedback EQ, usually using selective feedback around *one* stage of amplification. Some preamps made today still use only one stage for deriving the post RIAA/NAB disc curve. Using a single stage for this purpose is where the problems start.

There are several problems resulting from attempting to use one stage for EQ and amplification simultaneously. There is a 100:1 gain ratio, or 40 dB between 20 Hz and 20 kHz in the passband. We must boost LF by 20 dB and attenuate HF by 20 dB using a two- or three-pole feedback network around the single stage.

Here are the resulting problems, one by one: reactances inside the feedback loop are partially reflected to the input terminals, causing alterations to the HF response of the phono cartridge, also a reactive device. This is why we have HF adjustment controls on some pro-type preamps.

Second, the low impedance values of the feedback components at high frequencies are a difficult load on the amplifier stage and lead to overload at frequencies above 5 kHz.

This problem is further enhanced by the large low-frequency gain of the stage, usually 60 dB, whereby the high frequency loading (reactive) causes LF motorboating at high frequencies.

This HF loading by the feedback elements is further aggravated by the usual noninverting stage employed in many preamps where the stage cannot be brought below unity gain. This causes the HF rolloff—intended to fall in gain by 6 dB per octave below the 2120 Hz breakpoint—to reach unity, then level off and rise again at some higher frequency, instead of continuing its dropout to the megahertz region.

This further problem can cause following-amplifier power demand at high frequencies and further upsets the HF loading problems of the EQ stage itself. This HF reactive loading effect, which, as mentioned, causes low-frequency instabilities at high frequencies, is the reason that triangles and cymbals, for instance, can sound wooden and dull when trying to reproduce discs with some preamps.

These many problems may be eliminated by using a preamp with passive, or signal-throwaway type, of RIAA EQ. The signal throwaway obviously denotes the use of high gain to compensate for losses incurred after the passive elements, increasing the noise factor.

If an isolating amp (flat) is used between cartridge and EQ reactive elements, there is also a chance of HF overload occurring due to the nature of the pre-emphasized recording curve. However, passive-derived EQ enjoys some popularity largely for the reason of getting away from the problems discussed above, i.e., attempting to use a single, noninverting stage for EQ.

There is a whole new approach to phono EQ developed by the Toronto-based Bryston amplifier firm. Their new model BP-1, designed for broadcast use, uses the same circuit topology as their high-end audiophile preamplifiers, except that the BP-1 works into 600 ohm loads with a 27 dBm output rating.

Bryston has solved the problems of the "classic" feedback EQ described previously. They have done this by dividing the amplification and equalization into *two* stages.

This unique and fundamentally correct circuitry utilizes the first stage for the LF tailoring, operating noninverting for noise-reducing reasons.

The stage has high current output with 40 dB LF gain and 20 dB mid-band gain, as opposed to 60 dB of LF gain in older designs which use just *one* stage for both LF and HF amplification and equalization. Essentially, this stage acts as a flat buffer amplifier, so the phono cartridge works into a nonreactive, stable and linear input.

Bryston's second EQ stage operates inverting and with low impedance input, with 20 dB of mid-band gain, as in the first stage. The second stage, used for the HF gain characteristics, by operating inverting, carries the HF rolloff below unity and out to the MH region. Its low input impedance is made possible by the high current output of the LF first stage.

With both stages having 20 dB of mid-band gain, as opposed to the 40 dB mid-band gain of a *single* equivalent stage, we can realize over seven times lower distortion figures.

With separate stages for LF and HF amplification and equalization, there is precise predictability in choosing reactive components for each stage, with results of ±0.1 dB from true RIAA. With two separate gain stages for LF and HF, respective reactive feedback components cannot interact as they do in the single stage design. Referred to an input of 5 mV with phono inputs shorted, rated noise is −80 dBa at 1 kHz frequency.

We seem to have a very fine product here, certainly well-thought-out and built with high-grade components throughout. Its performance in the field is certainly top-shelf, with exceedingly transparent operation for on-air and disc-to-cart transfers.

Bryston deserves much credit for the creation of this preamp. It is truly unique and certainly a welcome product to the broadcast and recording industry.

Jim Dacey is CE at KDON-AM/FM, Monterrey/Salinas/Santa Cruz, CA. He can be reached at 408-422-5363. Contact Bryston Ltd. at 57 Westmore Dr., Rexdale, Ont., Canada M9V 3Y6, or call 416-746-1800 in Canada or 802-223-6159 in the US.

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How to Get Job Done On Time

(continued from page 10)
responsibility of figuring out what's important, the tool that gets the work done is called organization. You need a battle plan.

My own schemes tend to adapt and evolve as situations and employers change. What seems to work in general, though, is a one-day schedule.

This consists of a single page in a notebook or the next sheet on a yellow pad. At the top is the day and date. It is tomorrow's date because you make this up just before going home the night before. Down the page are listed the top six or so projects for the day. These are the must-do projects.

You can also include a few smaller projects in smaller print. They will get worked on only if you need a break or get all the key projects done.

I like to number the items in order of priority.

This schedule sits in the middle of my desk. It nags at me all day. The only way I get relief is to work on the projects. When a project is done, it gets checked off. If an item is started but not finished, it gets circled.

Sometimes you have to get the ball rolling and wait for somebody else to do their end before you can wrap up the task. Just circle it and go on to the next one while you are waiting.

At the end of the day, I make up tomorrow's list. The checked off items disappear. They are done. The circled items that were not later checked off are put at the top of the new schedule.

Other projects are added to the bottom. Any meeting or task to be done at a particular time has the time underlined to make it stand out.

This system works as long as you feel like a hero when all of the day's projects are checked off and feel awful when you have to put all the same items on tomorrow's list. If you have picked the right projects, you will be a hero when you check them off. The right projects are the ones that most everyone thinks are very important.

> *If you're not sure, sit down with the PD and news director and ask them what their biggest technical headaches are.*

Now, some items will get transferred from day to day until they are dropped for lack of interest. That's the way it goes sometimes; you won't win them all. If you do a good job prioritizing the work, however, the items that fall off the list were not that important to begin with.

At the end of the week, staple the week's schedules together and file them. When the boss wants to know what you've accomplished, you have ready documentation to refer to.

How do you pick the projects? Ah, that's the secret. Some items will come from a calendar where you scheduled them weeks ago. Other tasks will go on the list because someone pestered you today to get it done.

Some will be routine maintenance chores that get done every week or month at this time. The rest? You pick 'em.

If you're not sure, sit down with the PD and news director and ask them what their biggest technical headaches are. If you're ever in doubt about what's important, pretend it's your job to make everybody happy and then simply ask them what it takes.

After a while, you'll know instinctively. It's hard to go wrong with that attitude.

Emergencies and interruptions

The wire on the news reporter's microphone just fell off. He's hanging over you and dangling it in your face. Do you say "Sorry, my priority list deems that you have to wait until tomorrow?" Not if you want to live.

No schedule should be so tight that you can't squeeze in a small crisis or two. How many is a judgment call.

Some people are crybabies and will be after you every hour for some nonsense they could handle themselves. You have to find a polite way to give this type the cold shoulder.

Other problems, like severed mic cables, need and should get immediate attention. Don't brush off real emergencies even if it means interrupting a priority project.

Instant service on problems that need instant service will get you a top rating in a lot of departments. These people will then overlook the slow service they may be getting on less critical demands.

Some rules of thumb

Here's a few quick action ideas that will keep procrastination waiting forever:

- The best time to get something done is right now, while you're thinking about it. Get it out of your hair and out of your mind.
- Ask yourself what it would cost you to wait on an item. Perhaps the cost is lost opportunity. Perhaps it winds up costing you your job.
- Get ahead on projects in order to gain freedom for whatever you feel like doing.
- Reward yourself when you get something done. That makes you want to get more things done.
- Ask yourself what the best use of your time is right now. Then do it.
- Focus on the big picture—the end result. Work toward getting closer to that goal. Don't schedule every minor detail. Fill in the particulars as you go.
- Remember that you only go around once and the clock keeps ticking. Are you happy with the way your allotted time is being spent? Only you can make it happen.

Use Tech-Talk to Communicate

by Tim McCartney

Boise ID . . . Explaining technical concepts in clear language to a nontechnical person, though not always easy, offers many advantages. One is that the engineer is given a chance to illustrate many of the inner workings of one's job. However, it's a skill that requires care and consideration.

Why would an engineer deliberately talk over a manager's head? Surely it's not that there has been an overestimation of the technical cunning of the GM (a former sales manager).

Could it be that the engineer is trying to intimidate the manager? If so, why?

The engineer may feel that the technical talk helps keep him "one up" on the boss, and that without this status he fears that some of the electronics "magic" will fade.

The use of technical jargon as a weapon is not only the vice of engineers. A fellow GM often resorted to industry-specific talk with his nonbroadcast oriented upper managers whenever he was in a jam.

ERP, coverage patterns, EBS and *"The Commission"* were his answers to questions about staff training policies. What a snow job! These policy makers were only temporarily sidetracked before relieving this GM of his job.

As a former GM myself (not the one above), I learned a lot about interested CE candidates by observing how they handled this issue.

I found that the insecure, unstable types talked over my head: pilot injection, SBE, phasing, notch filters, CIE, TFT, VSWR, IF, K1—and even RW! Meanwhile, the secure and stable types said things like "I'll take care of your transmitter and studio concerns and be on call."

This sort of thing even happens *to* engineers. Recently a transmitter salesman punctuated his long and hard sell with a line that went something like, " . . . and I don't have to tell *you* how essential a double foldback, crystal-controlled, quadrature, CD-operated harmonic filter is!"

My reaction? This guy doesn't know beans about this thing or he'd tell me why I need it so darn badly! So, now neither of us knows why it's in there.

As an engineer, I'm bothered by the poor use of the English language in the manuals for our recently purchased European tape decks and cassette decks. After finally finding the sections written in English, it's disappointing to see how poorly they are translated. However, since I assume this is merely a translation problem and not a deliberate attempt to baffle us, I guess they are excused (maybe).

Let's hope these stories are the exception and that engineers truly seek communication.

If simple, clear language is used to explain a technical matter to nontechnical people, success will result at several levels.

First of all, communication occurs. Because of this, intimidation doesn't. Your audience will be more relaxed, and perhaps even more receptive—because the use of nontechnical language and your overall efforts to explain something so that it will be understandable show respect for your listener.

All of us need to select our language so that it effectively and efficiently communicates.

Remember that others can play the tech-talk game to our disadvantage. If the business manager starts a sentence with a word such as "encumbrances," I start to long for a trip to the transmitter.

So, in return for not hearing that word, I pledge to watch my use of High-Z, EQ, CRL and Dolby (both B and C), and just hope that the meaning of CE is clear.

Tim McCartney is CE at KBSU, Boise State University, Boise, ID. He can be reached at 208-385-3663.

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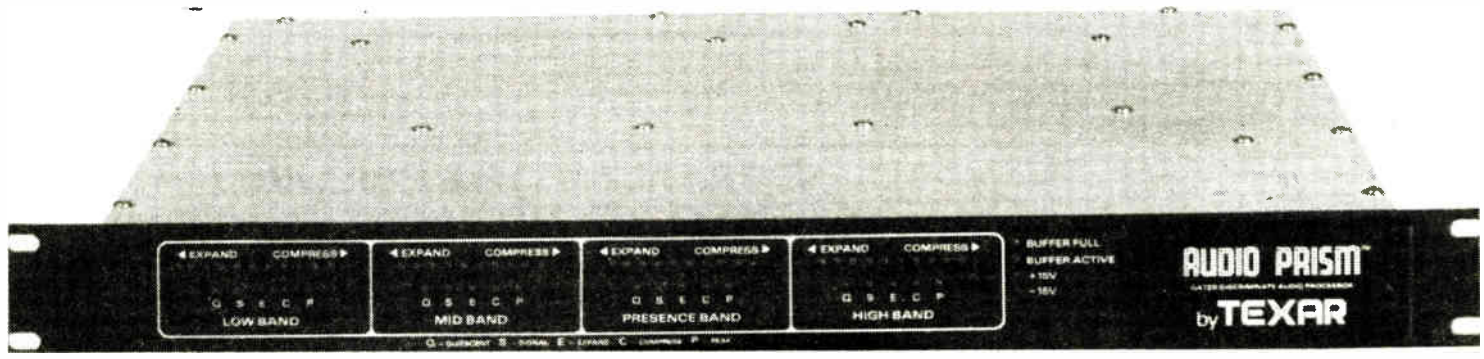

The best audio processing system money can buy just got better! The TEXAR Replacement Card Five (RCF-1), when used in conjunction with your TEXAR AUDIO PRISM'S™ and Orban Optimod 8100*, delivers an additional 1.5 dB of perceived loudness. That's a lot in today's competitive markets! In fact, the RCF-1 has more clean power than anything else money can buy.

We designed the RCF-1 in response to many telephone calls from AUDIO PRISM users over the past 18 months. While each call was unique, two recurring questions emerged: 1)"Sometime ago, we bought AUDIO PRISM'S to stand out from the crowd, but the competition has caught on and caught up. Today, they have AUDIO PRISM'S too. What can we do to re-establish our lead?" And 2)"What can we do to get more low-end bass?"

Exploring ways to further increase the modulation power of the AUDIO PRISM/Optimod combination, TEXAR engineers determined that the limiting factor was in the attack and release times of the Optimod. This is not to criticize the Optimod, a well designed and respected unit, but it is to recognize that competitive market situations require many broadcasters to use it in ways other than for which it was originally designed. Intended to operate on raw, unprocessed, console output, its operation included a generous safety margin to accomodate operator inattention. Face it: not everyone runs perfect levels.

The conservative design of the Optimod prevented these indiscretions from ever getting on the air. But today, many broadcasters precede their Optimod with the digitally controlled AUDIO PRISM. In these cases, the safety margin is no longer necessary. What if you could say to your Optimod, "I'll take care of the ups and downs in average level; you worry about making modulation?" That, in very simplified terms describes the operation of the RCF-1. (Not surprisingly, the RCF-1 should *not* be used in a barefoot Optimod, as there will be no safety margin for an overdriven board.)

Making more low-end bass available to users was a simple extension of the RCF-1. The original card 5 had a predetermined, fixed amount of bass which it would permit. Beyond that, it would reduce the gain of the low frequency stages. As you mixed in more lows on the AUDIO PRISM'S, the Optimod would simply take them right back out. Today, the RCF-1 has a "BASS BOOST" control which allows the user to dial in all the low-end bass one could want.

Card 5 is a plug in board, so installation of the RCF-1 takes less than 3 minutes. Adjustment takes less than one. No readjustment of the AUDIO PRISM is required.

To install the RCF-1, simply open the front cover and access panels of the Optimod. Turn off the Optimod power switch and pull out the original card 5. Slide the RCF-1 in its place and turn the power back on. Replace the access panel with the new one provided and set the RCF-1 controls to the recommended settings. That's all there is to it. No complicated soldering. No complicated modifications to circuit boards. No readjustment of other controls in the system.

Best of all, this additional power doesn't require giving up quality! The RCF-1 is actually *cleaner* than the original card 5 adjusted for the same loudness, so you don't have to sacrifice quarter hour maintenance for more cumes.

See what the power of the RCF-1 can do for YOUR signal. Arrange for a demo of the TEXAR AUDIO PRISM and RCF-1 today! Already own AUDIO PRISMs? You can upgrade to the RCF-1 for only $425, but act fast, because the price goes up soon. Call you favorite distributor, or call Barry Honel at (412) 85-MICRO.

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New Pole Deflection Spec Precise

by Thomas Silliman, PE

Newburgh IN . . . For many years now people have been using the figure of ¾" pole deflection per 10' of pole length to specify FM supporting structures for pole-mounted FM antenna arrays.

This figure is misleading. It was never meant to be a linear deflection figure. Rather, it was meant to be a definition of points on the surface of a circle.

The purpose of limiting the deflection of supporting poles for FM antennas is simply to avoid structural damage to the FM antenna feed harness.

Since the feed harness runs parallel to the static centerline of the support pole, pole movement alternately applies compression and tension to the coax harness. If pole movement is excessive, damage can occur to the coax, and in extreme cases the coax can actually be torn apart.

In order to define a realistic pole bending specification, I have used the ¾" per 10' deflection to calculate a minimum pole-deflection bending radius. This can then be applied to any pole using three points along the pole centerline to determine if the pole deflection is excessive.

The formula for a circle in a plane can be written as follows:

Equation 1 (*Brief Analytic Geometry* by Mason & Hazard):

$$x^2+y^2+ax+by+c=0$$

I have diagrammed a section of a bent pole with a constant bending radius, r_o, that has a pole deflection of ¾" per 10' of length. This diagram is shown in Figure 1.

In Equation 1, the origin of the circle represented by this equation is a point (x_o, y_o) where:

Equation 2:

$$x_o=a/2$$

and

Equation 3:

$$y_o=b/2$$

and

Equation 4:

$$c=x_o^2+y_o^2-r_o^2$$

Since any three points in space determine a circle, I can determine the minimum pole bending radius allowable from the three points show in Figure 1. The subsequent calculations are listed below.

Point #1:
$(¾)^2+(120)^2+a(¾)+b(120)+c=0$
$14400.5625+0.75a+120b+c=0$
$a+160b+1.3333c=-19200.75$

Point #2:
$(0)^2+(0)^2+a(0)+b(0)+c=0$
$c=0$

Point #3:
$(¾)^2+(-120)^2+a(¾)+b(-120)+c=0$
$14400.5625+0.75a-120b+c=0$
$a-160b+1.3333c=-19200.75$

Knowing that $c=0$ from point #2, these equations can be easily solved for a and b as follows:

$$\begin{array}{r} a+160b=-19200.75 \\ \underline{a-160b=-19200.75} \\ 2a \quad\quad =-38401.5 \end{array}$$

$$a=-19200.75$$

$$a+160b=-19200.75$$

$$160b=-19200.75+19200.75$$

$$b=0$$

The solution is, therefore, a radius of bending of:

$$r_o^2=x_o^2+y_o^2-c$$

$$r_o^2=\left(\frac{a}{2}\right)^2+\left(\frac{b}{2}\right)^2-c$$

$$r_o^2=\left(\frac{a}{2}\right)^2$$

$$r_o^2=\left(\frac{-19200.75}{2}\right)^2=(-9600.375)^2 \text{ in}^2$$

$$r_o = 9600.375''$$

$$r_o = 800.0313'$$

From this, we can restate the pole-bending criterion for FM antenna support poles. The new specification for pole deflection is:

- At no point shall the pole deflection

(continued on page 16)

Thomas B. Silliman, PE, is president of both Electronics Research, Inc. and ERI Installations. He is also a partner in the consulting engineering firm Silliman & Silliman, Silver Spring, MD. He can be reached at 812-853-3318.

Figure 1.

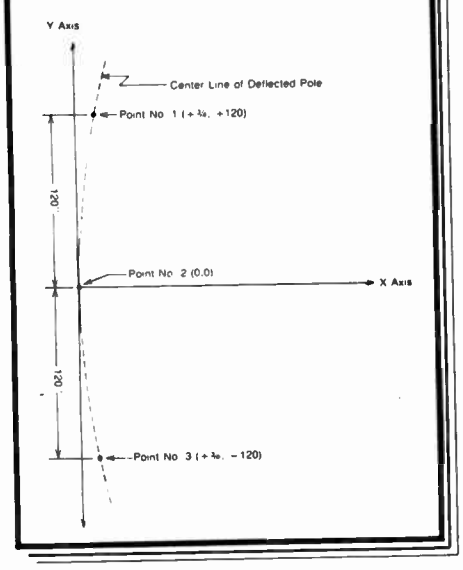
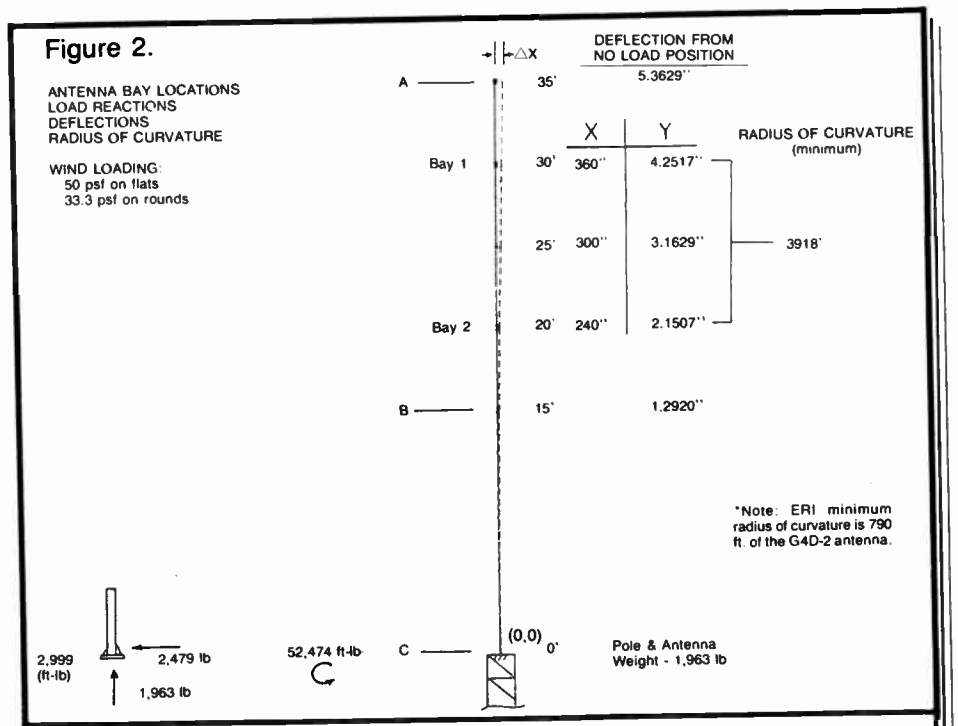


Figure 2.



Program 1. A sample run of program output (condensed).

```
THIS PROGRAM ANALYZES POLE FLEX IN THE XY PLANE (SEE FIGURE 2)
INPUT X COORDINATE OF POINT #1
? 240
INPUT Y COORDINATE OF POINT #1
? 2.1507
INPUT X COORDINATE OF POINT #2
? 300
INPUT Y COORDINATE OF POINT #2
? 3.1629
INPUT X COORDINATE OF POINT #3
? 360
INPUT Y COORDINATE OF POINT #3
? 4.2517
C1=4321014 C2=6481822 C3=-113.866 C4=-136.866 C5=60 C6=60
FLAGC = 0    FLAGB = 0    FLAGA = 0
C=-106461.5
B=-94030.02
A=1046.197
RADIUS OF CURVATURE = 3918.254 FEET
O
```

New Pole-Bending Spec Accurate

(continued from page 15)

be such that the radius of curvature for the centerline of the pole is less than 800'.

• The radius of curvature of a given pole can easily be calculated using Equation 1 through Equation 4 listed above.

Solution

This general form of the equations for a circle that was shown in Equation 1 can now be used to calculate the radius of a circle containing any three points on the centerline of a pole that is flexing under load. The three points are listed below, along with their x and y coordinates.

Point #	X Coordinate	Y Coordinate
#1	x_1	y_1
#2	x_2	y_2
#3	x_3	y_3

If these points are substituted into Equation 1, three equations with three unknowns will result. These three equations can then be easily solved to find a, b and c. The three equations are listed below:

Equation 5:

$$ax_1 + by_1 + c = -(x_1^2 + y_1^2)$$

Equation 6:

$$ax_2 + by_2 + c = -(x_2^2 + y_2^2)$$

Equation 7:

$$ax_3 + by_3 + c = -(x_3^2 + y_3^2)$$

These equations can easily be solved using a change of variables as shown below.

Define the following six variables as:

Equation 8:

$$c1 = x_1(x_2^2 + y_2^2) - x_2(x_1^2 + y_1^2)$$

Equation 9:

$$c2 = x_2(x_3^2 + y_3^2) - x_3(x_2^2 + y_2^2)$$

Equation 10:

$$c3 = y_1x_2 - y_2x_1$$

Equation 11:

$$c4 = y_2x_3 - y_3x_2$$

Equation 12:

$$c5 = x_2 - x_1$$

Equation 13:

$$c6 = x_3 - x_2$$

If these equations are substituted into the solution for Equations 5, 6 and 7, then the following solutions for a, b and c will result.

Equation 14:

$$c = \frac{(c1)(c4) - (c2)(c3)}{(c4)(c5) - (c6)(c3)}$$

Equation 15:

$$b = \frac{c1}{c3} - c\left(\frac{c5}{c3}\right)$$

Equation 16:

$$a = \frac{-1}{x_1}(x_1^2 + y_1^2 + by_1 + c)$$

This solution is very useful when analyzing pole deflections using a computer. There are several cases, however, that need to be considered prior to using this solution. In these cases, the solution appears to be indeterminate.

Case #1:

The bent pole has a point at the origin, 0,0.

In this special case, the value of c is zero. This can be seen from Equation 4, since the equation for the radius of any circle which passes through the origin is:

$$r_o^2 = x_o^2 + y_o^2$$

Where (x_o, y_o) is the center of the circle.

Case #2:

If the circle has a center point (x_o, y_o) on the x axis, then the constant b must be zero since:

$$y_o = -b/2$$

Case #3:

If the circle has a center point (x_o, y_o) on the y axis, then the constant a must be zero since:

$$x_o = -a/2$$

Case#4:

If the circle is tangent to both the x axis and the y axis, then the solution for c will be such that c is not equal to 0. If the points $(0, y_o)$, $(x_o, 0)$, and any third point are used, the variable c will be indeterminate using Equation 14.

Of these four cases, only Case #1 becomes a problem in analyzing a free-standing pole using Equations 14, 15 and 16 provided here.

In Case #1, any program analyzing the pole need only flag the solution of the constant c so that if the point (0,0) is used then $c = 0$.

Case #4 could only occur if the pole were bent completely over, and this case could not occur without system failure.

'Parts Is Parts' Ain't Quite So

by Fred Baumgartner

Englewood CO . . . If I had to pick one factor that strangles engineering departments and engineers in general, it is the lack of having parts and tools.

The reason many of our projects and emergencies lie waiting for parts is varied.

One major reason is ourselves. It's *hard* to plan ahead for projects and emergencies. Any piece of gear these days seems to have a thousand parts. We wonder if we can keep all of them in stock.

Or we'll say things like "Look, I just tossed out a whole pile of 12AX7s" (15 years ago almost everything 'ate' these). "My predecessor screwed up and ordered more than he ever needed, and I don't want to make the same mistake."

After all, engineers know items that die in stock are a total waste of money . . . or are they?

We are all familiar with the station that spent 'X' numbers of hours off the air or seriously impaired while waiting for parts of insignificant value. We have all fixed something via a quick trip to Radio Shack. Some of us have gone back and made a re-repair (with the "right" parts) later.

We all have some idea of what we cost the station, and what a day off the air (or the like) costs.

With all this information, we know that we need to provide our stations with some means of rapid repair in emergencies . . . and that means people and materials at any vulnerable time.

Still the prospect of all the deep thinking, deep digging in supply catalogs and all the bookwork necessary to order, check in, organize and store a parts inventory may not be the limiting factor.

Accounting barrier

In most organizations there is yet another barrier . . . the accountant. These folks are trained to be very myopic. That is, they understand debts and credits, and then apply pressure to decrease one and increase the other. In any business with inherent cash flow (broadcasting should be), the business decisions center on what we should spend and how much to maximize our profits.

At any given time there will be many "demands" on resources. Parts just have to be one of these. For that matter, so are tools.

Accountants and General Managers must keep engineering needs and wants in line with all of the other items that are necessary to stay in business and return a profit.

Most accountants and managers understand the *cost benefit analysis*. This is the key to any going business concern. It says, "I plan to spend so much, because these are the benefits I plan to gain and this is what they are worth." Obviously, if the resources are available and the gains are real, then the investment should be made. Yet I so often see CEs who freeze in their tracks every time the accountant asks things like "But do we need it now?"

Frederick Baumgartner, assistant CE at KWGN-TV and former CE of WIBA, Madison, WI, is a frequent contributor to **RW**. *He can be reached at 303-740-2883.*

In reality, engineering costs are fairly constant.

The owners seem to feel that if they are in a "it isn't making money any more" situation, they either spend with spigots wide open or with a "let's take our profits" approach. Engineering expense, however, appears to stay about even with depreciation costs . . . give or take year-to-year fluctuations based on major capital items.

In the 90-day world, and even moreso in the 30-day world, parts and tools are "delayable expense." They are sometimes *very* delayable expense—one can wait years for tools and spares.

> *After all, engineers know items that die in stock are a total waste of money . . . or are they?*

On the other hand, I have watched a major broadcasting group facility down for lack of spares for several days. Of course they fired the chief (who told them this would happen) and later went "on the block."

I have so often seen broadcasters that had not even a resistor run in house spend thousands on a new production "toy."

I have also seen major shops with the slickest of computerized test gear where an engineer routinely spends part of his day converting paper clips into test probes and filing nails off to make screwdrivers. These of course are easier to make than to go through the multiple steps ("Hello New York?") necessary to purchase one with a yellow handle.

A good accountant can easily control an engineering department's expense without feedback. In some cases, engineering departments with extravagant tastes and esoteric projects were brought in line with the profit goals of the station. In others, departments that provided efficient service to the station suffered budget cuts.

The scenario has been repeated again and again. For the first year not much seems to change . . . so the cuts are extended. In the second year, the lack of maintenance and supplies becomes evident. Machines don't work as well; the work flow suffers, and other departments complain about the lack of professionalism in the engineering department.

At the end of year two, the best techs have gone to greener pastures (not money so often, or hours, but places where they are considered professionals and don't have the frustrations of working without resources).

By year three, the engineering department is still pulling salaries; emergency bills for parts and repairs have increased; much work has found its way around the engineering department, while other departments have compensated for the loss of engineering.

The accountant proudly points to the reduction in engineering costs. The engineering department runs at very reduced efficiency. The differences in efficiency between an engineering department with proper resources and those that are tool- or parts-poor is frequently on the order of 20:1. Allow me to demonstrate.

Two fix-and-repair scenarios

At stations A and B, the same chip, an output amplifier, failed on a primary playback machine. Within an hour, both stations had diagnosed the problem.

At station A, the chip had been purchased and stocked. Cost of the chip from a generic parts supplier is $2.49. Since only one in three parts in the parts storage will ever be used, the real cost of the chip is $7.47. The machine is returned to service 90 minutes from beginning of project, at a combined labor cost of $30 ($15/hr and benefits × 1.5 hours). Total cost is 1½ hours down time, and $37.47.

Station B, of course, kept few spares. The first hour was spent calling for a local source—which did not exist. The second hour was spent pushing the paperwork through to authorize the expenditure ("Hello New York?"). The emergency phone call cost $8 because it was long distance and the clerk needed to find the equipment part number. The manufacturer's price for the chip was $38.95 but the minimum order is $75. The rush charges came to $32. The part arrived 36 hours later. Real cost is 37.5 hours downtime and $185.

To make matters worse, the down machine was remotely involved in several commercial losses, which of course resulted in some loss of revenue and interpersonal problems.

In both stations the story repeated very much the same way case after case. Station B still sends a man down to Radio Shack three times to obtain three resistors, with three POs and three signatures. Contrary to what you might expect, station B is a major-market station, and A is a very-small-market operation.

What goes in parts inventory?

So just what should a station have in parts inventory? Something between one of everything ever made and nothing at all. It depends on the nature of your station.

The first level is sub-subsistence. There are at least 1,000 of these stations. In this situation, being off the air is no big deal. The marginal profit is questionable, and frankly, being off the air is a great excuse to force income (or return) into "on air" hours. (Not something to get excited about . . . I still give $5/hr time to stations which work like this).

In these stations, no support and few spare parts are warranted. These are frequently great stations in terms of public service and alternative programs, or stations where there is little economic reason to exist . . . save public need (they

(continued on page 18)

Parts Supply Critical Element

(continued from page 17)
used to speak of the public convenience and necessity . . . but I'm showing my age).

At the second level, stations stock all the high-risk and obvious supplies. Fuses, tubes, a complete resistor run and capacitors are the base. The inventory should include some generic amplifiers that can be used to feed a phone line, preamp a turntable or microphone or run a small monitor speaker (they are $30 devices).

Parts likely to fail in the transmitters and mixers are also kept on hand, though not necessarily power transformers and other expensive, fairly reliable components.

Finally, at the third level, stations stock some of everything found in every piece of gear. At first that sounds like a whole bunch of parts, until you realize that once you have a complete resistor run, capacitor run, common TTL and analog chips, and a selection of generic transistors, there just isn't a whole lot left to stock.

Motors, special switches, relays, transformers, crystals, etc., make up the bulk of the remaining parts.

Stocking for home-brewed devices

Do-it-yourself projects and interface components are a major section of the parts supply. It is almost impossible to have a working station without a number of home-brewed devices. In general, it is not cost effective to make home-brewed devices.

Three exceptions are: where devices can be be built at less cost than marketed; where the device is so specific as to prevent any manufacturer from offering it, and where your application is advanced to the point where the manufacturers have not yet produced a product.

Other interface components important to have on hand at all times are connectors and, even more important, patch cords. I have seen major-market stations with no means to patch in a piece of gear on trial or a new reporter's recorder without a trip to Radio Shack. In station B mentioned above, I have watched techs spend over 10 hours per week, every week, looking for, making or circumventing appropriate patch cords.

Necessity of shrinkage

The above-mentioned items should be free flowing and almost unrestrained. Accountants will talk about justification and shrinkage. Justification is difficult on an individual-item basis. Shrinkage is rather limited, but nonetheless exists.

I argue that shrinkage is unavoidable, often represents destructive tests, home brew needs and is ultimately good for the company. The guy that just lifted the 555 timer likely did not make a necklace of it, but rather learned more than you could have paid him to—and that is good for a company.

Education and shrinkage are related. Not every "let's try this" results in a working item.

I am amazed at the number of stations that realize the expense of having to upgrade gear, but do not understand the cost of updating the understanding of the techs who have to maintain the new gear. I believe that for radio, one or two weeks of education are necessary per year; in TV, it is two to four.

In the case of station B above, after five years of no training, the highly inefficient techs, stumbling through slow and inadequate repairs, in ignorance, easily destroyed $50,000 a year worth of gear. Of course the accountant was praised for having saved $5,000 in unnecessary training expense.

Shrinkage should not be encouraged, but should be accepted within reason. Of course it is usually easier to justify a $100,000 capital expense than it is to sell the education.

Setting up your parts inventory

- It is necessary and good to spend a large portion of your time selecting, ordering and organizing your parts inventory. It is a major part of an engineer's job, unless your station is big enough to justify a full-time ordering agent.
- Waste and shrinkage are part of a reasonable inventory. If one in three parts are used in their lifetime, you are doing very well. The opposite is equally true; the $1 chip that keeps the transmitter from modulating is worth much more than $1 at 2 AM Saturday.
- There is nothing wrong with inexpensive, generic parts and surplus.
- It is a major and time-consuming task to keep your station supplied with the parts and materials needed to keep it running smoothly.

With this advice, start to monitor the number of times and the real damage done to your operation by not maintaining an adequate parts inventory. I think you will see that the cost of not having far exceeds the cost of having more than enough.

Organization

Though it's easy to leave everything in little plastic bags in a case marked "stuff," unfortunately, if you don't know where it is, you really don't have it.

Second, you need a way to keep supplies at adequate levels. The easiest way is to keep a "want" list containing anything needed by the operation and anything getting in short supply. It is my experience that in a medium-sized radio station, the want list needs about four hours per week. In major-market TV stations, it is better than 20 hours per week. Avoiding this task always results in much more time and money expended.

Remember two things:

- Even the best can't do it without the tools and supplies.
- You were never made chief to spend hours repairing the disposable cassette machine. You were made chief to achieve the needs of your station, and that requires expense for the future and hours of paperwork.
- To put things into perspective, keep in mind that a typical radio station can have parts on hand for 90% or more of the repairs needed for between $1,000 and $5,000. That isn't much, considering . . . .

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Broadcast Computing

DA Tuning Easy with Programs

by Tom Osenkowski

Brookfield CT ... The RF oscillator/receiver, impedance bridge and portable computer are essential tools for the engineer involved with MW antennas. But how can a computer save time and money? We'll explore some software which can be invaluable in tuning and broadbanding directional arrays.

Did you ever wonder how a consultant tunes up a newly constructed multitower array?

One way is to set up to the theoretical parameters, send a bunch of radio-equipped, FIM-equipped engineers into the field, crank and pray. This is costly in both time and equipment.

If you had a four tower in-line with sample lines of unequal lengths, things could be a little tougher. Tall towers with toroid samples at the base are even tougher. Enter TALKIN.

TALKIN

TALKIN is a computer program which uses vector math (although the user doesn't even have to know what a vector is) to analyze array operation.

TALKIN works, first, by entering the theoretical licensed parameters. TALKIN then cranks out a set of parameters which will produce zero (null) field on the azimuth (1) to be protected.

With only one man in the field, the phaser is adjusted to actually "TALK IN" the radial to zero. Those actual antenna monitor readings are then input to the program. Any "error vector" values are taken into account and figured into the final parameters which will produce the licensed pattern.

Error vectors are generated when N+1, 2, etc. (re)radiators appear in the system. These can cause asymmetry in the theoretical pattern. TALKIN takes these parasitics into account (only in moderate cases) and generates final parameters which will produce the licensed pattern. The licensed pattern will probably have minima as opposed to zero theoretical field.

Using the TALKIN procedure, only one field man, one FIM and a pair of walkie-talkies or cellular phone are necessary. As a matter of fact, one person need not be an engineer—just someone proficient in reading a dial and a preset meter.

TALKIN can be used with existing arrays where the operation is in question. If your array has never been "converted" to standard pattern, direct ratio bases for monitor point limits, you can be in for a pleasant surprise. You might be able to relax your MP limits to realistic values and, by "calibrating" your sample system, ensure proper operation of your array.

In some arrays, unwanted nulls can appear in the pattern. TALKIN can help ensure these don't appear and cause you lost coverage.

FIELDTAB, MASTER, DETUNE

Along the lines of array tune-up, did you ever wonder which phaser controls do what in the field and by how much? FIELDTAB answers those questions.

For years, RF engineers and consultants have used vector analysis to perform tedious calculations which answer the "which-one-how-much?" question. FIELDTAB requires absolutely no math background.

Just type in your present antenna monitor readings and FIELDTAB will show you the no-loss theoretical and standard fields. You may then manipulate any one or all parameters (ratio and phase) and see the new value of field.

The process of hemispherical integration is used to determine the fields during each run. Unlike similar attempts in the past, the RMS, RSS, K and Q are recomputed for each run. By using this method, an engineer can quickly and easily determine which controls on the phaser affect which monitor points and by what percentage, based on actual comparison.

This can be very useful in multitower arrays where one MP is slightly high and you want to walk it in without affecting the other MPs. FIELDTAB will provide this information and, as long as you remain within the ±5%, ±3° FCC window, you need not complete a partial proof of performance. The essential method of operation of FIELDTAB is to recalculate the field radials for each run with manipulated parameters.

If you have looked at a recent, well-prepared 301 application for a directional array, you will see a myriad of values generated by computer. The FCC uses a program called RADIAT to calculate fields, loop currents, losses and loop impedances.

MASTER is a program designed to perform the functions of RADIAT and then go beyond to predict base impedances for tall towers for the purpose of phaser design.

Base impedance calculation is a bit tricky. For sinusoidal current distribution, use the formula below.

$$R_L/\sin^2 G \text{ and } X_L/\sin^2 G$$

For the real-world case, this is not at all valid. It is certainly not valid for the 180° tower case. MASTER gives you the $\sin^2 G$ values for reference. It then goes on to three other translation methods from loop to base.

Most consultants agree on a 92% velocity of propagation for most towers. By this we mean there is a delay in the propagation of the wave along the tower; it takes longer to propagate on the tower than in free space.

A practical example of this effect is the fact that most towers resonate (zero base reactance) at about 80° instead of 90° (¼

(continued on next page)

Tom Osenkowsky, a regular RW *columnist, is a radio engineering consultant and president of MASTER Software. All referenced software is licensed for sale and available from MASTER Software: 203-775-3060.*

Broadcast Computing

DA Tuning Program Saves Costs

(continued from previous page)
wave). Simply stated, the tower appears 8% taller. Thus, MASTER allows the user an option to add 8% to the tower heights for impedance calculations.

RADIAT, along with some other in-house computer programs, uses an assumed zero-loop self reactance for the drive point impedance calculation. This provides the answer for coupled reactances only.

MASTER, while giving the user this option, also calculates self reactances by a proprietary spacing method. This then provides the actual loop drive point resistances and reactances, which may then be translated to the base values in the tall tower case. Mutual impedances are user selectable between the Cox and Schelkunoff methods of calculation.

When losses are calculated, the FCC requires that a 1 ohm loss be inserted at the current loop in each tower. MASTER allows insertion of any loss from 0 to 10 ohms.

The "Equivalent Power Radiated" is then calculated. This can be the ERP of the station. In other words, if this "ERP" were input to the program with a loss of 0 ohms, the fields would be identical.

The "Power Radiation Efficiency" is given in terms of percent and the G_0, or gain figure, is calculated. The reference for G_0 is calculated by hemispherical integration on the reference tower and then compared to the no-loss horizontal RMS of the array.

G_0 is a valuable factor in that one can determine if an array is a gainer or loser in terms of comparison to its nondirectional counterpart.

Other features of MASTER include search for minima and maxima, graphic polar plot of the pattern (transferable to the line printer), individual tower fields and calculation of Schelkunoff's self-loop impedance for each tower. Any combination of spacing, height, top load and orientation may be used. Both theoretical and standard pattern values are given. Output may be directed to a line printer, if desired.

MASTER outputs data (in the user-selectable automatic mode) from 0° to 60° vertical for use in FCC 301 applications, in 5° increments. MASTER can be invaluable for analyzing an array from both the standpoint of fields as well as impedances.

Did you ever have to perform a nondirectional proof on a directional array? This means detuning unused towers. Simply detuning for minimum base current does *not* ensure proper detuning.

DETUNE was written for the purpose of determining the exact location on a tower where one would tune (a variable inductor at the base of the tower) for minimum current. The current indicator is usually a (temporarily modified) FIM, carried to the correct location by a tower man. By using DETUNE, the most accurate ND results can be obtained knowing that unused towers have been properly detuned.

> *The reader is well advised that a variety of software is available at reasonable cost for antenna analysis.*

TANALYZ, XMSNLINE

A number of "toolbox" programs are used in the analysis of ATUs. TANALYZ will analyze actual ATU operation regardless of the state of adjustment. This is especially helpful where the ATU is not properly adjusted. TANALYZ will find the actual network phase shift so that a mismatched network can be recomputed and adjusted for a proper termination, thus improving bandwidth.

XMSNLINE simulates a transmission line length so that, for a given load impedance, the input impedance may be found. If the load impedance is not equal to the characteristic impedance of the line, not only will the input impedance be different than the load impedance, but the actual current phase shift of the line will no longer be equal to the electrical length of the line. The SWR will be greater than 1:1, as well.

XMSNLINE will determine all of the above for a given line length and load impedance.

DAPROX, RXCP

Anyone who has dealt with directional antenna proofs knows that measurements performed within close range to the array may be distorted by "proximity effect." This is why the FCC recommends that measurements on a partial proof commence at a distance greater than 10 times the spacing of the farthest elements in the array.

For measurements close in to the array, DAPROX will calculate an appropriate correction factor to apply to each reading on each radial. DAPROX is also a nifty partial analysis program which stores data on disk for future reference.

Proximity correction is an overall option. Standard and log ratio analysis is shown for all readings. Input data may be the original proof or latest proof for the purpose of analysis.

For anyone who measures common point impedance or base impedance in nondirectional stations, RXCP© makes graphing and tabulation easy. Simply enter the measured data; either the actual reactances or bridge (uncorrected) reactances, frequency and resistance will be automatically tabulated and graphed. Data can be dumped to a line printer for inclusion with FCC 301 forms, or be kept on file as current rules require.

RXCP© can be a real time saver and also allow analysis on-screen by enabling the engineer to visualize the shape of the curve prior to finalizing adjustments.

Existing arrays may be analyzed in terms of their mode. That is, for in-line and parallelogram antenna arrays without complete nulls there are 2^{N-1} number of parameter options that will produce the same pattern but widely different power distribution and operating impedances. In some cases, negative and zero-resistance towers can be converted to a positive value and vastly improve bandwidth.

MODE

MODE is a computer program written to determine the parameter option when you only know the theoretical parameters on the station license or CP. MODE utilizes a Newton-Rhapson solution for complex polynomials to derive the original multiplication pairs. Those pairs are then moded and remultiplied in order to derive the new operating parameters.

MODE can provide the answer to a low RMS situation due to original poor design (ie., low drive point resistances) and improve bandwidth and efficiency by deriving a more desirable set of operating parameters.

The reader is well advised that a variety of software is available at reasonable cost for antenna analysis. All programs are written in user-friendly style so that a minimum of knowledge is necessary in order to obtain the data desired. An investment in software can easily pay off in dividends of saved time and minimized field work.

Moding of DA System Revealing

by Tom Osenkowsky

Brookfield CT ... In my last column, we had taken numerous readings throughout our DA system in order to track down sources of power lost.

Before we get involved in redesigning networks, let's reflect on the actual design criteria of our array. Is there any way to ensure the array *itself* is OK? Let's consider *moding of the system.*

Most antenna systems have several sets of parameters (i.e., field ratios and phases) which will produce the identical radiation pattern. For an in-line array of N elements, equally spaced and of equal

RF Readings

height, there are 2^{N-1} sets of parameters available. If all nulls are complete nulls (zero field), the array cannot be moded.

Let's look at two cases, both 5 kW (see Table 1). I have used two towers for the sake of simplicity and because two towers constitute the basic building block of most complex arrays.

Case #1 is a fictional array. Note that the power distribution is very poor in that one radiator carries the bulk of the power. Case #2 is an actual array in Maryland. We "mode" the array by swapping the field ratios (see Table 2).

Table 2 shows a marked improvement. Case #2 had a similar power distribution problem. Let's see what happened when we "moded" this array (see Table 2a).

Case #2 was better off in its original form. A negative tower has developed in Tower 2, meaning that power is returned to the common point from the tower.

In-line arrays and parallelograms can be moded in this way, provided no complete null exists. In-line and parallelogram patterns are usually designed by multiplying two-tower pairs together. By knowing these original pairs, we can remultiply each inverted pair and find out the new operating impedances, given the new parameters.

Where the original pairs are not known, we use a PC computer program called MODE© to break down the parameters, find the original pairs and then reconstruct the pattern. We use the MASTER© program to find out the new drive point impedances.

Note that while tower arrays with unequal heights may be moded by the above procedure, the vertical radiation patterns will be different. The nighttime pattern will no longer conform to FCC Rules and will cause skywave interference to other stations.

Dog-leg and offset arrays can sometimes be moded, but you would need to relocate the offset tower(s) to the opposite side of the array to utilize the second option.

Another way of looking at the moding process is by moving the tower orientation 180° and reversing the phase angle.

There are two more important considerations on operating parameters.

First, how tight are your nulls? If they are tighter (pulled in) than necessary, you are not only losing coverage, but your drive point impedances may not be optimum as well. In fact, moding an array with ratios that are closer to unity than not does not produce widely varying results ... it may not be worthwhile.

If you're serious about checking your pattern, I strongly suggest completing a non-DA-to-DA proof of performance. I say "non-DA-to-DA" due to seasonal variations. For older arrays, your monitor point limits may not be determined by the direct ratio basis. I will be addressing proofs, talk-down procedures, analysis, proximity effect, and reradiation in future columns, but suffice to say it is important to ensure that the pattern be right before going into the phaser.

The second point concerns the number

(continued on next page)

Tom Osenkowsky is a radio engineering consultant. He can be reached at 203-775-3060, or by writing to 5 Beechwood Grove, Brookfield CT 06804.

Table 1.

Case #1

Tower	Field	Height	Spacing	Loop Z	Loop I	Power
1	1 /0	90	0	41.8+j32.3	10.9	4954
2	.5/100	90	90	1.6−j14.2	5.4	46

Case #2

1	1 /0	88.3	0	6.5+j58	6.21	250
2	2.25 /157	88.3	90	24.3+j15	13.98	4750

Table 2.

Case #1

Tower	Field	Height	Spacing	Loop Z	Loop I	Power
1	.5/0	90	0	57.4+j66	5.4	1702
2	1/100	90	90	27.8+j12.2	10.9	3298

Table 2a.

Case #2

Tower	Field	Height	Spacing	Loop Z	Loop I	Power
1	2.25/0	88.3	0	29.0+j21.5	13.98	5666
2	1/157	88.3	90	−17.3+j24	6.21	−666

Table 3.

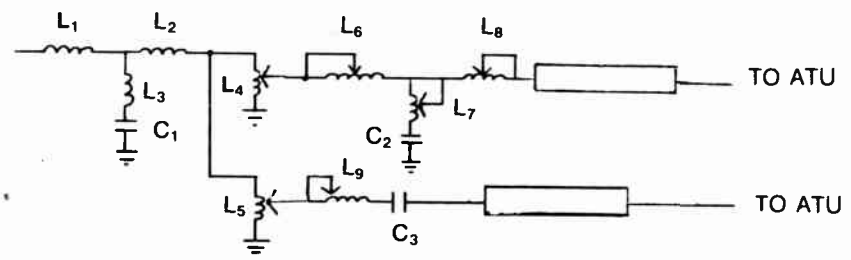
X_1 Input Branch $\frac{R_L}{\tan\Theta} - X_3 = \frac{50}{4.70} - (51.1) =$ j61.74

X_2 Output Branch $\frac{R_i}{\tan\Theta} - X_3 = \frac{50}{4.70} - (51.1) =$ j61.74

X_3 Shunt Branch $\frac{\sqrt{R_i \cdot R_L}}{\sin\Theta} = \frac{50}{-.978} =$ −j51.1

WHERE Θ phase shift of network = −78°
R_i input reactance = 50 ohms
R_L load resistance = 50 ohms

Figure 1.



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January 1, 1987

New Bulletin Board

by David Armstrong

Houston TX ... The Radio Engineer Bulletin Board is an electronic bulletin board designed primarily for broadcast engineers. It evolved from a computer program I wrote for my own use—that is, to consolidate engineering formulas I work with on a regular basis into an easy-access format.

The engineering formulas are reached through the D)oors system from the main menu of the bulletin board. I use the well-known RBBS (remote bulletin board system) to control communications. There are 25 engineering formulas on the bulletin board at present, many of them multifunction in nature. More will be added as time permits.

The Radio Engineer Bulletin Board also provides three separate C)onference areas for engineers to use as a vehicle to communicate with other engineers.

ENGHELP CONFERENCE is an area where engineers may exchange ideas, and provide or get help with a technical problem they may be having with a piece of equipment or a directional array.

JOBOPEN CONFERENCE is an area where stations having an engineering position open can post a message for engineers using the system to read.

JOBLOOK CONFERENCE is an area where engineers wishing to relocate can post a message on where they would wish to relocate.

Use of The Radio Engineer Bulletin Board is free to anyone who wishes to take advantage of it. The only cost to the user outside of the Houston, TX area is the price of the telephone call.

Anyone wishing to upload a computer program for other engineers to use, as long as it is a public domain program, are urged to do so. There are engineering programs on the system now that may be downloaded by those who wish to do so.

The main menu you will see after using the D)oors system of the main bulletin board is shown in Table 1.

David Armstrong is the chief operator of KEYH, Houston, TX. He can be reached at 713-466-7687 (Voice) and 713-937-9097 (Data).

Table 1.

```
ENGINEERING FORMULAS                    Page 1 of 2 Pages

A...Determine changes in Base (I) on Antenna Monitor.
B...Convert from Feet to Wavelength & Degrees.
C...Solve Tee-Network for proper match.
D...Solve for Tower Seperation in Degrees & Feet.
E...Complete Ohms Law Formula.
F...Convert Wavelength from/to Frequency.
G...Admittance & Susceptance Formula.
H...VSWR formula.
I...Determine RF power in Lobes & Nulls.
J...Determine DA expected from N-DA measurements.
K...Calculate R & C of a Resonant Frequency.
L...Vertical Distribution of a 90 Degree Tower.
M...Inductive & Capacitive Reactance Formula.
N...Resonant Frequency Formula.
O...Solve for Length of Coax per 1 Degree change.
P...Line Input Impedance.
Q...Multi Parallel & Series formulas.
Enter the formula you wish to use ( A thru Q), [NP] Next Page
[END] To End.

ENGINEERING FORMULAS                    Page 2 of 2 Pages

R...Capacitive & Inductive Reactance formula.
S...L Network formula.
T...Calculate RF reading for Bridge indications.
U...Find Transmitter Efficency.
V...Calculate RF Power @ 1 Mile.
W...Calculate Z at Distance End of a Feed Line.
X...Find Distance between Two Geo. Co-ordinates.
Y...Lost Tower Emergency.
Enter formula you wish to use [ R thru Y ]. [PP] Previous Page
[END] To End.
```

Moding of DA System

(continued from previous page)

of nulls in the pattern. I'll deal with pattern theory in upcoming installments, but bear in mind that a pattern may analyze correctly at proof time and yet generate unwanted nulls or minima due to misadjustment. Here again is a good cause for poor driving point impedances.

I make these two points because it will save time and money prior to ATU and phaser redesign.

We made several measurements in the antenna system in the last column. Now, we'll move into the phaser. A typical phaser is shown in Figure 1.

Moving from the ATU back toward the phaser, we see the transmission line (we may model a tee network as a transmission line) and a phase shift network.

Let's look at the tee network consisting of L6, L7, L8 and C2. By design, the network calls for −78° of phase lag. An easy way to remember if a network is leading or lagging is to look at the shunt leg. It will have a reactive component opposite the input and output legs. A capacitive shunt branch will constitute a lagging network, and an inductive shunt branch will be a leading network.

The load impedance of the phase shifter should be $50 \pm j0$. The design formulae for the tee network are as shown in Table 3.

The network consisting of L9 and C3 is usually tuned to resonance where $X_L = X_C$. The network is a fine tuner panel control to compensate for minor variations. It's phase shift is determined by the following formula:

$$\arctan (X/R_l)$$

WHERE X = reactance of circuit (either X_L or X_C)
R_l = load resistance

Next month, we'll get into actual adjustments, starting right at the phase shifters.

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RadioWorld

Broadcast Equipment Exchange

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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/ch RMS at 8 ohms. $525. R McMillen. 13515 SW 72nd. Tigard OR 97223. 503-684-1973.

Hafler 220, rack mounted. 130 W/ch. 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.

Schafer stereo PB preamp. goes w/Ampex G440. $75. C Cornett. Cornett Tech Srvs. 3127 Bailey. Lincoln MI 48146. 313-928-6238.

Crown DC-300A, gd cond. $475; BGW 250. older style. gd cond. $350. CK Bucy. Cisco Snd. Box 16583. Lubbock TX 79490. 806-763-3537.

Belar RFA-1 AM RF amp, solid state. $175. D Doelitzsch. WDDD. 1 Bdct Ctr. Marion IL 62959. 618-997-8123.

Crown D150A '150 W power amp. $290. B DeFelice. DeFelice Consulting. 621 Bishop. Bridgeport CT 06610. 203-336-5606.

Harman-Kardon Citation 12 (2), rack mountable power amps. gd cond. BO. J Von Vleck. Aras Consultants. 2321 N Utah. Arlington VA 22207. 703-524-5067.

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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

Dynaco ST35 & MK III. M Disch. HumanKind Software. 427 W Capital Dr. Hartland WI 53029. 414-367-5719.

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Phelps Dodge CPFMHD10 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 & adapters $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. KFYR. 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.

Crouse-Hinds FCB-12 tower beacons for 2-620 W lamps (w/o red filters; Harris ERI FMS-5. 5-bay CP FM antenna at 106.5 MHz. P Wells. KLZZ. 8665 Gibbs Ste 201. San Diego CA 92123. 619-565-6006.

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ERI G5CPS 5 bay FM antenna for 94.7 MHz. $4000. M Raby. WFBQ. 6161 Fall Creek Rd. Indianapolis IN 46220 317-257-7565

AM tower, 150' self supporting w/four legs. approx 7' sq base w/insulators. tower is tapered. right angled steel. obstruction lights. currently on ground. avail immed. BO. C Thornton. WAGE. 711 Wage Dr. Leesburg VA 22075. 703-777-1200.

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FM antenna, low power. horizontal tuned to 102.3. M Brasher. 216 Zenalona. Albuquerque NM 87106. 505-242-7163.

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Misc gear inc: consoles. cart machines. R-R. TTs. generator. & much more. call for details. C Condron. KMGR. 5282 S 320 W. Ste D-272. Salt Lake City UT 84107. 801-264-1075.

AKG BX20E1, smooth. transmission line reverb. 2 chan w/remote. excel cond $1800. B Matta. Matteson/Drum Inc. 5001 Baum Blvd. Pittsburgh PA 15213. 412-683-2020.

Audio gear inc: limiters. xformers. mixers. amps & much more. call for details. L Oliver. Oliver Stds. 304 W 89th. NY NY 10024. 212-874-7660 aft 1PM.

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

Orban 516EC 3 chan sibilant controller. 23 hrs total use. $400/BO. B Matta. Matteson/Drum Inc. 5001 Baum Blvd. Pittsburgh PA 15213. 412-683-2020.

Jasoni TAS-1000 prototype audio tape analyzer. $285. D Peluso. DGP Consultants. 2900 E Charleston #197. Las Vegas NV 89104. 702-384-0081.

Technics SH-8065 1/3 octave EQ. mint. $250. W Laughlin. KDCV. 2636 N 56. Lincoln NE 68504. 402-466-8670.

Gates remote amp w/telephone. VU meters. preamps. parts. connectors. 1-5/8" coax connectors. J Phillips. All-American Bdct. 414 Washington. Defiance OH 43512. 419-782-8591

Eventide BD931, SN: 931A-4086. 3.2 sec 15 kHz audio delay. new. w/manual. $1400. K Harnack. WPAD. 1700 N 8th. Paducah KY 42001. 502-442-8231.

Shure M610 feedback controller w/rackmount. gd cond. $95. CK Bucy. Cisco Snd. Box 16583. Lubbock TX 79490. 806-763-3537.

UREI Vidigraf 1970 bargraph display gen. $300/BO. A Tucker. Foothill Prod. 70 W 83rd. NY NY 10024. 212-879-0973.

Orban 8100A/ST studio chassis for 8100A. $600. B Anderson. WRCN. 72 W Main. Riverhead NY 11901. 516-727-1570.

Comex ABC Network command decoder for talk radio. B Korngald. Box 2621. Savana GA 31402. 912-355-9926.

Eventide BD955 digital delay. 7.5 kHz. 6.4 sec. 2 yrs old. only used 1 yr. $2000/BO. D Sharp. WKAI. 119 W Carroll. Macomb IL 61455. 309-833-5561.

Sony R-R, (3) portable. solid state elecs. $35. J Lipski. KIQO. POB 1456. Lompoc CA 93436. 805-865-6536.

Eventide 932 3.2 sec digital delay stereo. $1500; Aphex type II aural exciter. $1500. A Bater. WPIX. 220 E 42nd. NY NY 10017. 212-210-2773.

Comex digital delay 7 sec. simple to work. 1 yr old. $1000; ABC Network cue command decoder. brand new. $1150. B Korngold. Ben Bdctg. POB 2621. Savannah GA 31402. 912-355-9926.

Shure 610 feedback controller. $90; Realistic stereo mixer. compressor. $100; 10 band EQ. $90; dbx 155 4 chan. $325; Shure gated. all excel. D Kocher. 1901 Hanover. Allentown PA 18103. 215-776-1455.

Telex CS61 sport headsets. 3 pair. $50/pr. C Springer. KLMR. POB 890. Lamar CO 81052. 303-336-2206.

Want to Buy

Pultec, Lang. or API EQ. D Kocher. 1901 Hanover. Allentown PA 18103. 215-776-1455

Misc elect: Westrex 10A. RA1979. Fairchild 627. Davin 910-911. Davin 833A. Davin 811A. Gray 208. Altec 759. many early mono-stereo cartridges. C Dripps. Kurlaff Enter. 4331 Maxson Rd. El Monte CA 91732. 818-444-7079.

AUTOMATION EQUIP.

Want to Sell

SMC 792, BC. 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.

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.

Cetec 7000 level 2 extended memory. VEL logger. realtime clock. (2) 48 tray Audiofiles. extra source cards & manuals. $17,000. G Ramsey. WQSF. POB 180. Williamsburg VA 23187. 804-874-3696.

Harris System 90 automation. complete system. excel cond. BO. H Allegood. WALG. POB W. Albany GA 31702. 912-436-7233.

IGM stereo Go-Cart 42, (3) ARS100DS reproducer. Anidex printer w/stand. IGM source cards. (3) for Go-Cart 42 w/random select. (3) for ARS100 w/25 Hz cue. (3) for cart decks w/logging. 1 for live studio. other IGM parts avail. BO all or part. C Gustafson. WKZO. 590 W Maple St. Kalamazoo MI 49008. 616-345-2101.

Allison/Valley People Gain Brain (2) plus LX100 power supply. peak & RMS limiting. $400 for all 3 items. Cascade Recg. 2115 N Vancouver Ave. Portland OR 97227. 503-287-1662.

SMC Carousels (2). $250 ea. E Moody. KJEM. 216 N Main. Bentonville AR 72712. 501-273-9039.

IGM 48 tray Instacart, mono. needs work. BO. B Brown. WPRS. Box 367. Parris IL 61944. 217-465-6336.

Autogram 581A, Autogram brain. (6) SMC Carousels. (2) time announcers. BO. C Veers. WBHT. Box 198. Brownsville TN 38012. 901-772-3700.

IGM R-R & Carousel. clock & net switcher w/rack & misc equip. $3500. K O'Malley. WLRW. POB 3369. Champagne IL 68121. 217-352-4141.

Harris R-R source interface cards for System 90 or 9000 (2). #995-7867-001. $150 ea. C Bryson. Comserve. 93 Robinhood Dr. Zeliemople PA 16063. 412-776-5204.

IGM System 700 w/digital PDP8/M computer & remote entry console. call for details. $13,000 takes all. J Whitmer. WNBS. POB 1340. Murray KY 42071. 502-759-1300.

Microprobe 100 automation programmer w/manual & cables. looks nice. $950/BO. J Whitmer. WNBS. POB 1340. Murray KY 42071. 502-759-1300.

Control Design CD-28 automation system. (4) Scully LJ-10. (4) Carousels; Extel; CRT. more. mostly junk. gd for parts only. J Seaman. WFLY. POB 12279. Albany NY 12212. 518-456-1144.

Harris System 90, comp w/3 racks. programmer. remote console. (4) ITC 750 reels. (3) stereo SMC Carousels. 2 Harris single play cart decks. Extel printer. 1024 event memory & lots more. $10,000/BO. K Harnack. WPAD. POB 450. Paducah KY 42001. 502-442-8231.

IGM 48 tray mono Instacart. includes IGM Mk I remote controller. $6000/BO. P Finken. KHHT. Box 1686. Minot ND 58701. 701-852-0361.

Schafer GLS7000 stereo, interface w/music networks. 2 Audiofiles. $23,000. E Reynolds. WTJZ. 553 Michigan Dr. Hampton VA 23669. 804-723-3391.

Cetec Series 7000 automation. complete w/4 ITC 770 R-R's. (2) Audiofile cart machines. CRT terminal & software in 4 racks. 5 yrs old. A Bishop. WZSH. POB 111 E Rochester NY 14445. 716-586-2263.

RCA DAP-5000 automation system control w/Instacart interface. clock & audio switching panel. $1800. D Doelitzsch. WDDD. 1 Bdct Ctr. Marion IL 62959. 618-997-8123.

IGM 78 tray Go-Cart, excel cond. stereo. $2900/BO. D Workman. KPPL. RR 1 Box 203. Stockton IA 52769. 319-785-6069

Harris System 90, 3 racks. 4 ITC reel recorders. 3 stereo SMC Carousels. 10242 events & more. $13000/BO. B Bereman. WPAD. POB 450. Paducah KY 42001. 317-297-1300.

Want to Buy

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

Tone gen, 25 Hz. T Welch. WROD. 991 Daytona Bch FL 32105. 904-253-0000

CAMERAS (VIDEO)

Want to Sell

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. Box 12127. Tallahassee FL 32317. 904-575-6689.

Sony DXC-1640 (2) & CMA-6 CCU packages; one excel cond. $800 & one fair cond w/lots of use. $450; 50' 14 to 14 pin cable. $75. will consider donating before 12/31/86. R Weller. RSBS 6117 Code Ave S. Edina MN 55436. 612-925-2162 aft 6PM

Ikegami HL-33 camera. 1" plumbs. comp rebuilt. excel cond. many extras. $2500. U George. George Assoc. 175 5th Ave #3206. NY NY 10010. 212-475-3330.

Ikegami HL79A w/Angenieux lens. 9 5-126. w/wide angle adaptor. w/case. batteries. battery charger. AC adaptor. rain cover. T Cereste. Lightscape. 420 W 45th. NY NY 10036. 212-757-0204.

Want to Buy

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

JVC CCU & cable for use w/JVC KY2000 camera. J Owens. Asbury College. Wilmore KY 40390. 606-858-3511 X757.

Sony DXC 1210 & DXC 1600 Trinicon for Sony DXC 1210 needed. also viewfinder. any cond & DXC 1600 camera head for cabinet parts. C Lund. Cycle Snd & Video. 167 Madison. Waterbury CT 06706. 203-756-7761.

Fujinon zoom & focus controls for 1-1/4" lenses. H Henson. Henson Prod. 4569 Haven Crest Rd. Winston-Salem NC 27106. 919-924-8717.

RCA TK-44's, needed for bdct museum. need not work. H Henson. Henson Prod. 4569 Haven Crest Rd. Winston-Salem NC 27106. 919-924-8717.

CART MACHINES

Want to Sell

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.

ITC 3D stereo PB w/new heads. H Leupp. KFYR. Box 1738. Bismarck ND 58502. 701-223-0900.

Circle Reader Service 39 on Page 22

RW Broadcast Equipment Exchange

CART MACHINES ... WTS

Mono play heads (tape) for ITC 3D machines. $60 ea or $145/all; (5) 2 trk stereo play heads for ITC R-R decks. Vikron 5742. $50 or all for $200. D Peluso. DGP Consultants. 2900 E Charleston #197. Las Vegas NV 89104. 702-384-0081.

Collins 642E1 twin tape PB (2). $400 ea. M Matius. WSSA. POB 832. Monroe GA 30260. 404-361-1570.

ITC 99-A, stereo. R/P. H Leupp. KFYR. Box 1738. Bismarck ND 58502. 701-223-0900.

Collins Twintapes w/record amps. BO. L Thompson. WCLT. Box 880. Newark OH 43055. 614-345-4004.

RCA RT-7 (5) cart decks. H Leupp. KFYR. Box 1738. Bismarck ND 58502. 701-223-0900.

ITC SP Premium series mono. mint. BO. J Phillips. All-American Bdct. 414 Washington. Defiance OH 43512. 419-782-8591.

ITC RP Premium (3). R/P mono. $1000 ea. B Mishkind. KFXX. 3222 S Richey. Tucson AZ 85713. 602-748-1450.

Spotmaster 400A RP. mint cond w/manual. J Phillips. All-American Bdct. 414 Washington. Defiance OH 43512. 419-782-8591.

Tapecaster X700RP mono w/sec tones. $425/BO. B DeFelice. CKSN Cable Radio. 621 Bishop Ave. Bridgeport CT 06610. 203-336-5606.

RCA RT-7 (2) type record amps. H Leupp. KFYR. Box 1738. Bismarck ND 58502. 701-223-0900.

Tapecaster 700RP cart machine,. $300. C Hampton. WXBM. 1687 Quintet Rd. Milton FL 32470. 904-994-5357.

ITC Mono RP in vgc. P Wells. KLZZ. 8665 Gibbs Ste 201. San Diego CA 92123. 619-565-6006.

Tapecaster X700RP (4) mono. currently in use. $700/BO. A Searfoss. WIIN. 2707 Atlantic Ave. Atlantic City NJ 08401. 609-348-4646.

Gates PB only mono cart machines (4). $300. A Loera. Anthony Bdct. 10419 Haddon. Pacoima CA 91331. 818-897-2688.

BE5304 triple deck stereo w/all tones & 5310 recorder w/tones. needs several parts. as is $1000. B Hawkins. WENS. 1099 N Meridian. Indianapolis IN 46204. 317-266-9700.

BE FSD-100 splice finder. vgc w/manual. $275. B Hawkins. WENS. 1099 N Meridian. Indianapolis IN 46204. 317-266-9700.

BE 3100P play only. all aux tones. vgc. $700. L Snyder. Box 182. Floral Park NY 11001. 718-347-2940.

BE 5304 triple deck stereo w/all tones & BE 5310 stereo record module w/all tones (3). mint cond. light use. $3000 ea. B Hawkins. WENS. 1099 N Meridian. Indianapolis IN 46204. 317-266-9700.

BE 3200RP w/all aux tones. FF & mic input. vgc. $950. L Snyder. Box 182. Floral Park NY 11001. 718-347-2940.

BE 3300RPS, like new. used 20 hrs. stereo R/P. no aux tone. L Snyder. Box 182. Floral Park NY 11001. 718-347-2940.

CCA-QRK cart play w/aux det. vgc. $150 or BO. W Hoisington. WTCG. 303 S Three-Notch St. Andalusia AL 36420. 205-222-8849.

Record amp for ITC 3-D cart machine. mono 3 tone. $500. D Doelitzsch. WDDD. 1 Bdct Ctr. Marion IL 62959. 618-997-8123.

Want to Buy

ITC RP Series, 3 tone high speed cue detector card. also mono amp card. C Lund. Cycle Sound & Video. 167 Madison. Waterbury CT 06706. 203-756-7761.

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.

BE Spotmaster 500C recorder plug-in relays & plug-in cards. C Lund. Cycle Sound & Video. 167 Madison. Waterbury CT 06706. 203-756-7761.

McCarta MS-502 MK II amplifier module for McCarta cart player MS-502 MK II. C Lund. Cycle Snd & Video. 167 Madison. Waterbury CT 06706. 203-756-7761.

ITC RP mono or stereo 3 tone in operating cond. R Roiseland. KMAJ. Box 4407. Topeka KS 66604. 913-272-2122.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Nakamichi 680ZX 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.

Akai GX220 R/P. gd cond. 1/4 trk. $100. T Ford. WBVR. POB 298. Nassellville KY 42276. 502-726-3555.

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 15/7.5. 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 Mattews. Rockwell Collins. 3318 Shield Ln. Galand TX 75042. 214-996-6844.

Ampex AG-350 1/2T head assy. spare motor. pinch roller. Inovonics 375 elec. gd cond. manual. $600 ppd UPS. G Finerman. Advanced Media. 17 Hillcrest. Suffern NY 10901. 914-368-1143.

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.

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.

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.

Ampex 350 transport, FT heads. very clean. $200/BO. C Larko. Audio Prods. 230 Gaskins Bldg. 124 W Washington Blvd. Ft Wayne IN 46802. 219-424-2405.

Ampex AG 350 elec unit. $50/BO. C Larko. Audio Productions. 230 Gaskins Bldg. 124 W Washington Blvd. Ft Wayne IN 46802. 219-424 2405.

Ampex 600 FT. old tube type. $100/BO; Ampex AG350 transport. 2 trk heads. fair cond. $200/BO. C Larko. Audio Prods. 230 Gaskins Bldg. 124 W Washington Blvd. Ft Wayne IN 46802. 219-424-2405.

Uher 4000 Report. 2 trk stereo w/battery. power unit & mic. BO over $300 or trade. F Harrell. WZYC. 1400 Ocean. Beaufort NC 28516. 919-728-2019.

Ampex E65 portable case. 7-1/2 ips. built in amp & speaker. vgc. BO. D Hastings. WKYB. Box 1000. Hemmingway SC 29554. 803-558-2558.

TD700 rack mount, 3 motor drive 3 speed full trk solonoid operated 10-1/2" reels. BO. D Hastings. WKYB. Box 1000. Hemmingway SC 29554. 803-558-2558.

Ampex AG500 stereo 1/2 trk w/elect. $250; AG500D 4 trk w/elect. $550. F McCall. Performance Srvs. 1521 W St Marys Rd. Tucson AZ 85745. 602-323-0901.

Magnecord 1022 (2) w/electr. 1/2 trk. $250 ea; (2) 1022's w/o electr. $150 ea; spare elect. $100. F McCall. Performance Srvs. 1521 W St Marys Rd. Tucson AZ 85745. 602-323-0901.

Presto 825 1/2" & 1/4" head assembly w/dual amps & case. $75. P Russel. Bowdoin College. Sills Hall. Brunswick ME 04011. 207-725-3066.

Tascam 80-8, rack mount. w/DX8. cords. Teac patch bay rackmount. 2 reels new tape. Teac alignment tape. manuals. vgc. $2100. B Busetti. 1124 W 2nd. Florence CO 81226. 303-784-3540.

Ampex ATR102 15 & 30 ips. 1/4" half trk. vcg. $5200/BO. Cascade Recg. 2115 N Vancouver Ave. Portland OR 97227. 503-287-1662.

Otari MX-7000, 1/2 trk stereo. 3-3/4. 7-1/2. 15 ips inc rec/PB amps. $450. W Laughlin. KDCV. 2636 N 56. Lincoln NE 68504. 402-466-8670.

ITC 750 stereo recorder; Ampex 351 reel deck w/mono heads & Inovonics 375 solid state R/P elec. P Wells. KLZZ. 8665 Gibbs Ste 201. San Diego CA 92123. 619-565-6006.

Ampex 352 PB stereo. Ampex elect. BO. P Finken. KHHT. Box 1686. Minot ND 58701. 701-852-0361.

Ampex 352-2 stereo P/R w/Inovonics 375 elec. BO; Ampex 352 mono P/R. w/Inovonics 375 elect. BO. P Finken. KHHT. Box 1686. Minot ND 58701. 701-852-0361.

Gonnsett G50 swap Nortronics cart alignment tape for R/R align tape 7.5" reel. stereo. R Koch. WQFF. Box 5195. Greensboro NC 27435. 919-273-1385.

Nagra III (2). bought overseas. gd cond. $800 ea or $150/both. Mr. Eng. Aust Bdctg Comm. 1 Rock Plaza. NY NY 10019. 212-755-1177.

Otari ARS1000 (2) mint cond. 6 mos old. must sell. BO. B Williamson. WHVW. 435 Violet Ave. Hyde Park NY 12548. 914-471-9500.

Ampex 440A elec. also Teac 505 tube elect 2T w/1¼T play. 3-3/4 & 7-1/2 ips. needs some work. BO. R Tilkens. Ambient Recdg. 9622 52nd Ave. College Park MD 20740. 301-982-9288.

Ampex 601 in portable case. mono tube-type. BO. D Hastings. WKYB. POB 1000. Hemmingway SC 29554. 803-558-2558.

Otari MX 5050B (4). excel cond. $1100 ea. M Dibennedetto. Colony Comm. 401-277-7845.

Revox A77, $400; Pioneer RT-701. BO. C Hampton. WXBM. 1687 Quintet Rd. Milton FL 32470. 904-994-5357.

Ampex 350 (4) mono. all in cabinets. in excel cond. BO. N Schnapf. Assoc Recording Studios. 10 Swirl Ln. Levittown NY 11756. 516-796-3698.

Scully 280 R-R 2 trk in Ruslang cabinet. gd cond. $595; Ruslang R-R cabinet. excel cond. $175. B Levine. The Flamingo Network. 411 S Woodward Ste 502. Bham MI 48011. 313-642-7426.

Revox PR99 MKII, brand new (3). BO. J Hebner. KVXO. E 2211 W Sprague. Spokane WA 99202. 509-534-1059.

Technics SV-100 digital audio processor for R/PB. $500. B Graifman. 3111 Broadway-4E. NY NY 10027. 212-866-1099.

Revox A-77, 2 tk. w/manual. 3 3/4-7 1/2 ips. gd cond. $550 inc ship or BO w/PU. K Buckley. Group W Cable. 3970 N Milwaukee. Chicago IL 60641. 312-794-2174.

Ampex PR500 1/2". 7 trk data recorder. excel cond. transport speeds 15/16. 1-7/8. 3-3/4. 7-1/2. 15 & 30 ips. $4000/BO. Doug. POB 417. Springfield VA 22150. 703-922-7829.

Ampex 300 FT mono. in roll around cabinet. solid state elect. BO. S Morse. Morse Prod. 19 12th. Carle Place NY 11514. 516-334-5216.

Nagra 4.2 mono w/case & power supply. excel cont. $1800. S Morse. Morse Prod. 19 12th. Carle Place NY 11514. 516-334-5216.

Uher Report 4000S w/case. mic. power supply. etc. vgc. $300. L Waddington. Les Waddington Engr. 16 Garden City Rd. Noroton CT 06820. 203-655-2160.

Ampex AG350 4 trk. 1/2". $1200. D Hill. Dimension Snd. 368 Center. Jamaca Pl MA 02130. 617-522-3100.

Ampex 351-2 recorder. BO & high speed cassette duplicator. stereo. BO. H L Sewell. Oak Ridge Music Recdg Srvs. 2001 Elton Rd. Ft Worth TX 76117. 817-838-8001.

Tascam DX-8 8 chan NR. mint cond. $580. D Kocher. 1901 Hanover. Allentown PA 18103. 215-776-1455.

Revox A-77 R-R 2 trk recorder w/manual. 3-3/4-7-1/2 ips. gd cond. $550 includes shipping/$ negotiable w/pickup.

Revox A77 (2). R/P. gd cond. $400 ea; Sony TC-640 (2). R/P. bad switches. $75 ea; Sony TC-645 R/P. bad switches. R McDaniel. KJRG. 209 Meridian. Newton KS 67114. 316-283-1678.

Otari MX7308, 1" 8 trk very low hrs. excel cond. w/remote control. $5800. L Wagner. ARN Prod. POB 1788. Orlando FL 32802. 305-299-1299.

Ampex 2 trk (2); FT; 3 trk; 4 trk; 8 trk. w/sel-sync. BO. A Oliver. Lynn Oliver Studios. 304 W 89th. NY NY 10024. 212-874-7660.

Otari ARS1000 1/4". 2 chan 1/2 trk PB only. 7.5-15 ips. in Ruslang cabinet. practically new. J Green. WHPL. Stuart Ave. Garden City NY 11530. 516-222-7438.

Telex Magnacord 10-24, stereo. mint cond. w/portable cases. BO; Crown 800 mono. FT. vgc w/case. matching amp/speaker unit. 4 chan MicMix built in. BO. B Weiss. KLSI. 1722 Main. Kansas City MO 64108. 816-474-6400.

Scully 280 1" 8 trk. 1/2 & 4 trk heads. block inc synchmaster. custom roll around. T Cereste. Lightscape. 420 W 45th. NY NY 10036. 212-757-0204.

Scully 280B 1/2 4 trk. 15-30 ips. varipitch w/console. gd cond. $1500/BO. J Von Vleck. Aras Consulting. 2321 N Utah St. Arlington VA 22207. 703-524-5067.

MCI JH110C-8 w/autolocator. 3 transformerless elect. factory cabinet. $8200/BO. D Green. Wayes Snd Recdrs. 1956 N Cahuenga. Hollywood CA 90068. 213-466-6141.

Technics RSM85 cassette deck. under 200 hrs. $350. M Fiedler. Mayoney-Fiedler Prod. 5346 DuPont Ave. S Minneapolis MN 55419. 612-822-0013.

RW Broadcast Equipment Exchange

CASSETTES . . . WTS

Scully 14" PB R-R decks (2), suitable for prod or automation, excel cond, $500/BO. D. Workman, KPPL, RR 1 Box 203, Stockton IA 52769. 319-785-6069.

Technics SV-P100 digital audio cassette rec. BO. J Sulik, WGBA, 1145 Pine St, Green Bay WI 54305. 414-437-2626.

Tascam 32 (6) just removed from service, very clean. J Rockwell, MGC Corp, 904 Lakeside Dr, Lynchburg VA 24501. 305-744-8751.

Want to Buy

Pioneer RT2022/2044 must be in working usable cond w/ or w/o elec. C Larko, Larko Prod, 230 Gaskins Bldg, Ft Wayne IN 46802. 219-424-2405.

Tapesonic 70 TRSH stamped metal head cover, 15 ips bushing cast metal lower head cover, original knobs for electr & reel hold-down for 10-1/2 reels. C Lund, Cycle Snd & Video, 167 Madison, Waterbury CT 06706. 203-756-7761.

CONSOLES

Want to Sell

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.

Harris/Gates Executive 10 ch stereo. K O'Malley, WLRW, POB 3369, Champaign IL 61821. 217-352-4141.

Micro-Trak 6618 stereo console, 6 chan, 18 input stereo/mono out, 10 W monitor amp, like new, $1500. M Jones, WIVK, 6711 Kingston Pike, Knoxville TN 37919. 615-588-6511.

Gates 9 chan, 2 prog amps, 5 mic's lines, 4 line level w/PS, newly painted, $500. J Corrigan, WELR, 216 Hope St, Providence RI 02406. 401-421-8100.

Ampro Microtouch 5 chan stereo, gd cond, $1500. M Persons, WCMP, RR 2, Pine City MN 55063. 218-829-1326.

Harris Mono 5, rebuilt, $950. M Matius, WSSA, POB 832, Monroe GA 30260. 404-361-1570.

Studiomaster 18×8×2, mic/line inputs, 3 band semi-parametric EQ, internal routing, Anvil case, Koss headpones, like new, $1800. B Busetti, 1124 W 2nd, Florence CO 81226. 303-784-3540.

Shure SE30 mixer, rackmount, gd cond, $300; McMartin LX-40A mixer, works, as is, $50; Biamp 2442, custom roadcase, vgc, $2700 plus ship. CK Bucy, Cisco Snd, Box 16583, Lubbock TX 79490. 806-763-3537.

Altec 600/600 sliding faders, 15 single, 1 double & double rotary, removed from operating console, entire lot for $50. I Kaufman, Natl Recd Stds, 460 W 42nd, NY NY 10036. 212-279-2000.

Ramko DC-8M 8 chan, 18 inputs, completely rebuilt, proof measure provided, $1200. C Bryson, Comserve, 93 Robinhood Dr, Zeliemople PA 16063. 412-776-5204.

Autogram AM8, BO. B Hughes, POB 649, Palestine TX 75801. 214-729-6077.

Langevin AM 16 preamp; AM 17 prog amp; EQ 251-A EQ's; PS 221 power supplies, mounting trays & instruction books, excel cond. B Anderson, Anderson Prod, 11557 Sunshine Terr, Studio City CA 91604. 818-769-6569.

Electrodyne/Cetec SM-9 modules, 9 switches, 8 buses, 1 solo button (20). BO. R Robinson, TNA, 10 George, Wallingford CT 06492. 203-269-4465.

Spotmaster stereo 5 chan w/preamp, schematics & manual, vgc, $900. K Harris, WPWC, POB 189, Dumfries VA 22026. 703-221-1124.

Soundcraft Series II, 16×8×16, $3500. T Bartlett, North Country Snd, 175 Bunker Hill Rd, Auburn NH 03032. 603-483-2662.

McMartin B-801, B-501, B-801 mono 8 ch w/spare parts inc B-501 mono 5 chan. R Gwyn, WLFA, Box 746, Layfayette GA 30728. 404-638-3276.

Melcon 1731 opamps (26) & 8 API 2520, removed from operating console, $100. I Kaufman, Natl Recd Stds, 460 W 42nd, NY NY 10036. 212-279-2000.

McCurdy 7600 19 chan board, mint cond, stereo, $5000. A Loera, Anthony Bdct, 10419 Haddon, Pacoima CA 91331. 818-897-2688.

Interface 200, 8 in 2 out w/EQ, pan & echo send on ea input, 600 out, in rugged alum case, remote or prod console, $600; McMartin Accu-Five, 5 chan, mono console, 19" rack mt, cue buss, moni, cue, & TB amps, 13 input cap, like new, $600, w/UREI LA-5 leveling amp, $850. E Helvey, Successtrax, POB 1357, Winchester VA 22601. 703-877-1191.

Opamp Labs 2008-4E, 20 in 10 out, gd cond, $6500. L Wagner, ARN Prod, POB 1788, Orlando FL 32802. 305-299-1299.

Ampro Micro Touch 5 chan stereo, gd cond, $1500. M Persons, WCMP, RR 2, Pine City MN 55036. 218-829-1326.

Gatesway mixer board w/power supply, 10 ch mono, fair cond. I Baron, WCUA, Box 184 Cardinal Station, Wash DC 20064. 202-635-5106.

BE 8M150, mono 8 chan rotary, gd cond, w/manual, $1500. R Laine, United Cable of CO, 4757 S Salida Ct, Aurora CO 80015. 303-680-1910.

Howe 9000 Series stereo console, 30 input sources, all elect w/slide faders, less than 2 yrs old, gd cond, $7500/BO. A Sutton, WMGA, POB 1380, Moultrie GA 31776. 912-985-1130.

Want to Buy

Parts for RCA 76B-2 Consolette, need service manual. L Scott Jr, POD 1729, Bartow FL 33830. 813-533-4654 eves.

Collins 212F-1 or individual amps for this model. T Spencer, WODY, POB 545, Bassett VA 24055. 703-629-2509.

Solid state production console. C McGinty, WMAK, 109 W 5th, London KY 40741. 606-864-7843.

Stereo board, 6-8 chan, solid state pref, working or repairable cond, w/manuals, reasonable. W DeFelice, CKXN, 621 Bishop Ave, Bridgeport CT 06610. 203-336-5606.

DISCO & SOUND EQUIP.

Want to Sell

Blonder Tongue B9, $75; Pultec EQP1A, $950. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

E/V 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 & highs, 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.

ADC Spectrum Analyzer, $125; Sansui RA-990 reverb amp, $85. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

Symetrix 511 NR for any source, does not require encode/decode process, new, $450/BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

Eventide RD-770 w/dbx, 2 chan mono/stereo record/repro w/dbx to eliminate cart phase error, new, $450/BO. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

AKG BX20 spring reverbs, $100 ea. R Robinson, TNA, Box 57, Wallingford CT 06492. 203-269-4465.

Oberheim synthesizer, (2) voice w/midi sequencer, $350. P Cibley, Cibly Music, 138 E 38th, NY NY 10016. 212-986-2219.

Mixers inc: Ampex, Altec, Sigma, call for details. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

UREI 530 9 band 2 chan graphic EQ, $250. Cascade Recg, 2115 N Vancouver Ave, Portland OR 97227. 503-287-1662.

Roseberry freq shifter, ±5 Hz, voice range, $50. R Robinson, TNA, 10 George, Wallingford CT 06492. 203-269-4465.

CL&S Levi bass cabinets, w/extentions, Gauss speakers, (8) $450 ea plus ship; CL&S RH-60 Gauss 4000 (6), $250 ea plus ship; JBL N500 crossover, $250; Altec 811 horn w/806A driver, gd cond, $95. CK Bucy, Cisco Snd, Box 16583, Lubbock TX 79490. 806-763-3537.

Carvin 2029 EQ (2) less than 1 yr old, 1/3 octave EQ's, $250 ea. R Dietterich, WLTJ, 1051 Brinton, Pgh PA 15221. 412-244-7600.

GLi 5990 production controller/mixer, new, factory boxed, shipped prepaid freight upon receipt of first $850 check. F Luppino Jr, Marketing Insights, 1445 Sunset Ridge, Glenview IL 60025. 312-729-2047.

Recording Studio, 8 trk, all pro gear, tape machines almost new, Scully, Neumann, Crown, McIntosh etc, sacrifice price, $7500 for all. WC Burchitt, Bur-K Inc, 842 Bellefonte Princess Rd, Ashland KY 41101. 606-324-8812.

EMT 140 reverb unit in gd working cond w/inst, you pick-up, $850. I Kaufman, Natl Recrd, 460 W 42nd, NY NY 10036. 212-279-2000.

MXR digital delay, $250. D Kocher, 1901 Hanover, Allentown PA 18103. 215-776-1455.

Valley People rack, 3 gain brains, one Maxi Q, excel $1000; Accesit noise gates 3 chan w/PS, $250. D Kocher, 1901 Hanover, Allentown PA 18103. 215-776-1455.

Echoplate 2, BO. H L Sewell, Oak Ridge Music Recdg Srvs, 2001 Elton Rd, Ft Worth TX 76117. 817-838-8001.

Thiel 03A speakers, $700/pr. B Graifman, 3111 Broadway-4E, NY NY 10027. 212-866-1099.

Ursa Major digital reverb, $850; Delta Lab DL-2 accustic cumputer, $850; Marshall 5002, time modulator, $900, all excel. D Kocher, 1901 Hanover, Allentown PA 18103. 215-776-1455.

Altec 604C Cab (2) speakers, $400. A Oliver, Lynn Oliver Studios, 304 W 89th, NY NY 10024. 212-874-7660.

MXR pitch transposer w/display & foot switch, original boxes, perfect, $600. R Robinson, TNA, 10 George, Wallingford CT 06492. 203-269-4465.

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.

Technics SB7000 time aligned speakers, $400/pr. L Synder, Box 182, Floral Park NY 11001. 718-347-2940.

Want to Buy

SEAS tweeters, to fit Dynaco A-35 speakers, new/used or blown okay; also working or blown A-35 sneakers. A Tucker, Foothill Prod, 70 W 83rd, NY NY 10024. 212-879-0973.

API 550, Pultec, Sontec EQ's. D Kocher, 1901 Hanover, Allentown PA 18103. 215-776-1455.

Older speakers by JBL, Altec, Jensen, Tannoy, WE. C Dripps, Kurlaff Enter, 4331 Maxson Rd, El Monte CA 91732. 818-444-7079.

Dolby B encoding system. F Forest, Musical Star Streams, POB 44, Mill Valley CA 94942. 415-383-STAR.

LIMITERS

Want to Sell

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 Ritz AGC amp (tubes). H Leupp, KFYR, Box 1738, Bismarck ND 58502. 701-223-0900.

Gates Solid Statesman AM peak limiter. H Leupp, KFYR, Box 1738, Bismarck ND 58502. 701-223-0900.

Aphex Compellor, simultaneous compression, leveling & peak limiting, 14 hrs total use, $900. B Matta, Matteson/Drum Inc, 5001 Baum Blvd, Pittsburgh PA 15213. 412-683-2020.

Marti CLA-40A compressor/limiter amps (3), $150 ea. B Stuart, Radio Lassen, 3015 Johnstonville, Susanville CA 96130. 916-257-2121.

Fairchild 600, $325; Gates Sta-Level, $225. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

Metron tube type compressor, $50. J David, KMPL, POB 907, Sikeston MO 63801. 314-471-1520.

Audimax 4450, gd cond, $400; Volumax 4111, gd cond, $300. D Byrd, WZGC, 603 W Peachtree, Atlanta GA 30308. 404-881-0093.

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, KFXX, 3222 S Richey, Tucson AZ 85713. 602-748-1450.

Dorrough 310 comp/exp w/AM peak limiter card, tri-band unit, $700. A Caswell, C&G Bdctg, Box 171, Linden MI 48451. 313-735-4545.

Delta AME-1 AM mod controller (2), one complete, one for parts, $300/both. R Dietterich, WLTJ, 1051 Brinton, Pgh PA 15221. 412-244-7600.

DAP 310 AM Compressor/Limiter, looks gd, snds fine, just removed from service, $500/BO. J Whitmer, WNBS, POB 1340, Murray KY 42071. 502-759-1300.

Gates Sta-Level compressor, needs some work, $50 plus ship. K Harnack, 895 Mt Rushmore, Richmond KY 40475. 606-624-2181.

CBS Volumax 400 excel cond, $95, call after 6PM CDT; CBS FM Volumax Stereo 411, excel cond, call after 6PM CDT, $150. R Moen, Radio Srvs, 402-334-8767.

UREI BL-40 Modulimiter, appears to work fine, specs-out OK, w/manual, $300. K Harnack, WPAD, POB 450, Paducah KY 42001. 502-442-8231.

Orban 8100ST studio chassis for FM, $600; Orban 8100 AXTZ, 6 band processor for FM, $2000. H Ginsberg, WXXX, 150 Kennedy Dr, S Burlington VT 05403. 802-863-4487.

CBS Audimax Stereo, looks like 400 series, cond unknown, $200 plus ship. J Whitmer, WNBS, POB 1340, Murray KY 42071. 502-759-1300.

Volumax FM 4110 & Audimax 4450A, BO. C Hampton, WXBM, 1687 Quintet Rd, Milton FL 32470. 904-994-5357.

Harris MSP-90 stereo AGC, $800/BO. R Dietterich, WLTJ, 1051 Brinton, Pgh PA 15221. 412-244-7600.

Harris MSP100 FM audio processor, recent factory updates, excel cond, $1200. J Gerlkey, KRES, 300 W Reed, Moberly MO 65270. 816-263-1600.

Harris MST90 tri-band AGC, limiters & main frame, $1000; Harris AM 80 mod mon w/175% PK indicator, $300. T Hawks, Radio Bdctg Srvs, Box 8316, Amirillo TX 79114. 806-372-4518.

Volumax 400; Volumax 411 stereo for FM; Dorrough DAP-310 FM audio processor, missing Lo EQ card, w/extra FM peak limiter PCB; Inovonics 215 processor w/chassis, pwr supply & basic output card. P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123. 619-565-6006.

Distributor Directory

The following distributors serving the broadcast industry would be glad to help you with any of your requirements.

Can't Find It? Call 1-800-426-8434 For Immediate Action! Want To Sell It?

RW Broadcast Equipment Exchange

LIMITERS . . . WTS

Aphex Compellor, $900. B Anderson, WRCN, 72 W Main, Riverhead NY 11901. 516-727-1570.

CBS Labs Volumax 4110, gd cond, $100/BO. B Weeks, WBFL, POB 107, Bellows Falls VT 05101. 802-722-4890.

Orban 424A studio Optimod, $750 or trade for Aphex stereo Compellor. B DeFelice, DeFelice Consulting, 621 Bishop, Bridgeport CT 06610. 203-336-5606.

CBS Audimax 4450A stereo in mint cond; $600; CBS Volumax 411 stereo in mint cond, $300. J Michaels, WZZK, 530 Beacon Pkwy W, Birmingham AL 35209. 205-942-7800.

CRL AM processing system inc APP-300A, SEP-400A, PMC-300A, $1600; UREI 527-A graphic EQ, $250. M Ripley, KOZE, Box 936, Lewiston ID 83501. 208-743-2502.

dbx 162 compressor limiter, stereo balanced in & out, excel cond, $550. L Wagner, ARN Prod, POB 1788, Orlando FL 32802. 305-299-1299.

UREI LA5, same as LA4, brushed alum panel, w/rack mount, $300. E Helvey, Successtrax, POB 1357, Winchester VA 22601. 703-877-1191.

EMT PDM 156 limiter/compressor, like new cond, $2500. A Zentz, Zentz Recdg, 688 S Santa Fe #205, LA CA 90021. 213-683-1096.

Orban Optimod 8100A, 18 mos old, $3500. K Thomas, Thomas Bdctg, Box 1146, Ardmore OK 73402. 405-226-2524.

CBS 4450A AGC & matching FM limiter, both vgc, $250 ea or BO. W Hoisington, WTCG, 303 S Three Notch St, Andalusia AL 36420. 205-222-8849.

Want to Buy

Orban 8000A. J Howell, Howell's Audio, 521 Park St, Kingman AZ 86401. 602-753-3054.

MICROPHONES

Want to Sell

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: Altex, E-V's, Shure, call for details. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

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 rebilt 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.

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.

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 Stds, Box 57, Wallingford CT 06492. 203-269-4465.

RCA boom stands (3), $200 ea plus ship. I Kaufman, Natl Recdg, 460 W 42nd, NY NY 10036. 212-279-2000.

Sony ECM56F (2) electret condenser, phantom or battery mic, $200 ea; Sony ECM33F phantom or battery power mic, $100 ea. J McComb, Boogie Bdct, 820 N Lasalle, Chicago IL 60610. 312-328-8494.

AKG 224E excel, $140. D Kocher, 1901 Hanover, Allentown PA 18103. 215-776-1455.

Luxo mic booms (3), $35 ea. H Ginsberg, WXXX, 150 Kennedy Dr, S Burlington VT 05403. 802-863-4487.

Shure, EV, Telex, M67, 635A, CS91A, $400 for all. S Strouf, Sound Inovations, 8705 Albien Ct, Tampa FL 33634. 813-886-3150.

EV RE-20 (2), gd cond, $225 ea; Shure SM-54 (2), gd cond, $125 ea; Shure SM-53, gd cond, $125; EV RE-16 (3) switched flat, fair cond, $95 ea; RCA 77D (2) work, fair-poor cond, $150 for both. CK Bucy, Cisco Snd, Box 16583, Lubbock TX 79490. 806-763-3537.

RCA 44BX, (2), $275 ea; (2) 770DX, $400 ea; 77, $595, all w/stands & booms; Neumann U-47, $1200. A Oliver, Lynn Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660.

Neumann U47 (3) mics, C Hertzburg, Kinura Records, Box 660236, Miami Springs FL 33166. 305-887-5329.

Shure SM-81 condenser mics (2) plus AC PS to trade for 1 Neumann U-87. Shure's in mint cond. J Newman, Sound Results, POB 7703, Atlanta GA 30357.

Want to Buy

RCA BK5B w/windscreens (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.

AKG CK4 capsules; sell Sennheiser MKH416T w/windscreen & T48 converter, $425/BO. R Tilkens, Ambient Recdg, 9622 52nd Ave, College Park MD 20740. 301-982-9288.

MISCELLANEOUS

Want to Sell

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, $188; 19522-21 reconditioned, $150. T Keegan, KSP, Box 137, Maple Glen PA 19002. 215-646-5142.

Weston 2031 power meter for Continental Power Rock & FM, $45. D Peluso, DGP Consitants, 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 5160 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.

Budd 77" equip rack, $150. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Powerstat T5007 variable auto xfmr, 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.

Mitsubishi P50U printer for video, 3-1/4×4" printers from video inputs w/4 rolls of printer paper, demo use only, $75. B Watrous, Watrous Prod, 745 S Orange Ave, Sarasota FL 33577. 813-366-3316.

Misc gear: including oscillators; limiters; AM xmtr; printers; amps; consoles & much more, call for details. L Lindstrom, WPOK, 315 N Mill, Pontiac IL 61764. 815-844-6101.

Walnut finish racks, (3) wall mount, holds 100 carts, $45 ea. L Snyder, Box 182, Floral Park NY 11001. 718-347-2940.

Stabiline EMS64275YC, never used, $20,000/BO; Aerovent PB12B-3 blower, never used, $300/BO; Electro Impulse 20 kW, never used, $1700/BO. L Maines, Quincy Prod, 707 S 18th, Quincy IL 62301. 217-222-5267.

Alden 9271 D/H/AEC facsimile recorder for NWS map repro by satellite or landline, 4 yrs old, 24 hr clock & stand, 30 rolls of paper & spare blade, BO. C Lewis, KLMS, 1540 S 70th, Lincoln NE 68506. 402-489-6500.

Cabinet, 19"×62"×21" depth inside dim, full rear door, 2/3 front door, cutouts for filters, BO plus frgt. C Zalemski, EDS Comm Service, POB 92, Johnson City NY 13790. 607-798-7111.

Atlas gas detector, works well, $25. J Cunningham, YSDA, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Symetrix 104 telephone interface system, like new, 3 mos old, $800. B Bereman, WPAD, POB 450, Paducah KY 42001. 317-297-1300.

Symetrix TI-101 telephone interface, never used, great cond, $300. D Walker, KTAM, 1240 Villa Maria Rd, Bryan TX 77805. 409-776-1240.

Want to Buy

Vacuum crystal, 1490 kHz, for CCA AM100D or Harris BC1T xmtr. B Sitzman, IBC Engr, RD1 Box 312, Trumansburg NY 14886. 607-273-2970.

Sansui QS quadraphonic 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.

Want to talk to anyone getting audio Hits from SA-9000 system. J Schloss, KICD, 2600 Hiway Blvd, Spencer IA 51301. 712-262-1240.

Fixed mica caps, 002 5 kV, 510 μF (10), 120 μF, 3300 μF all at 2,500 V, .018 600 V, .01 10 kV, 2D21 tubes, $5 ea or you decide. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

Deisel electric gen, around 50 kW. A Weiner, Weiner Bdct, 4 Second St, Presque Isle ME 04769. 207-764-8300.

Schematic and/or service manual for Fisher 90T receiver. M Johnson, KCYX, POB 207, McMinnville OR 97128. 503-472-2151.

Fixed mica caps, 0.002 5 kV, 510 mmf (10), 120 mmf, 3300 mmf, all at 2,500 V, 0.018 600 V, 0.01 10 kV, 2D21 tubes, $5 ea/BO. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

Service manual for Sony SEG-1 special effects gen. L Auman, Auman Recdg, Rt 1 Box 368, Dover OH 44622. 216-343-2297.

MONITORS

Want to Sell

McMartin TBM2200A, TBM3700, BO. L Thompson, WCLT, Box 880, Newark OH 43055. 614-345-4004.

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, WNTE, Box 84, Mansfield PA 16933. 717-662-4600.

Belar AMM1, $750. B Jeffreys, WYBR, 2830 Sandy Hollow Rd, Rochford IL 61109. 815-874-7861.

Nems-Clark 112 phase monitor w/remote panel; McMartin TBM-2500 FM RF amp for mod monitor. P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123. 619-565-6006.

Belar AMM-3 mod monitor, excel cond when removed, set for 1520. C Jednorski, WTRF, Box 248, Brunswick MD 21716. 301-694-8111.

Rust SFM 19 monitor, BO. C Hampton, WXBM, 1687 Quintet Rd, Milton FL 32470. 904-994-5357.

Harris STS-1 AM stereo monitor, perfect cond, never used, $465. L Maines, Quincy Prod, 707 S 18th, Quincy IL 62301. 217-222-5267.

McMartin TBM 2200A stereo monitor FM; TBM 4000A SCA monitor; TBM 2000A, won't sell separately, $1500 firm. B Coleman Jr, Coleman Bdctg, 114 Circle Dr, Rocky Mtn NC 27804. 919-443-7870, aft 5PM.

Tek RM 529 waveform monitor, gd working cond, $500. V Ranieri, 354 Bloomfield, Caldwell NJ 07006. 201-226-4356.

Want to Buy

FM baseband & composite mod monitors, solid state, working or in repairable cond. W DeFelice, CKXN, 621 Bishop Ave, Bridgeport CT 06610. 203-336-5606.

MOVIE PRODUCTION EQUIP.

Want to Sell

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.

Magna Sync Moviola G962A, solid state studio consolette, 8 mic or line bal inputs, mono & stereo outputs w/echo & headphones, built in osc, EQ's & talkback, comp w/inst & exterior wired patch panel, 20 dB headroom, $500. I Kaufman, Natl Recdg Stds, 460 W 42nd, NY NY 10036. 212-279-2000.

Want to Buy

Photosonics 70mm mdl 10 camera & drive take up motors, will pay full price. H Deans, Deans Prod, 170 Grand, White Plains NY 10601. 914-949-5920.

Flight Research 35mm mdl 207 pulse/sign camera, AKA multi-data, will pay full price. H Deans, Deans Prod, 170 Grand, White Plains NY 10601. 914-949-5920.

Zmar 180mm f1.3 refractor lens, will pay full price. H Deans, Deans Prod, 170 Grand, White Plains NY 10601. 914-949-5920.

RECEIVERS & TRANSCEIVERS

Want to Sell

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 spkr & CW filter, mint cond, $900. G Finerman, Advanced Media, 17 Hillcrest, Suffern NY 10901. 914-368-1143.

Motorola UHF ENG system w/6 MX-300-S 5 W HT's, 6 Syntor 100 W mobile units, Spectra-Tac receiver & comparator, antennas, chargers, other access, system mod for wide audio bandwidth, 1 yr old, details avail. P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123. 619-565-6006.

Crown FM2 tuner, excel cond, BO. P McManus, McManus Enter, 4011 Orchard, San Diego CA 92107. 619-223-1730.

Want to Buy

Sansui QRX Series quadraphonic 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 bridge 4-100 MHz. M Disch, Select Snd Srvs, 427 W Capital, Heartland WI 53029. 414-367-5719.

REMOTE & MICROWAVE EQUIP.

Want to Sell

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.

Employment

To place ads in this section, use the Action-Gram form. To respond to box numbers, write Radio World, Box 1214, Falls Church VA 22041, Attn: __.

POSITIONS WANTED

News pro avail now, looking for small/med ND position. Phil, 216-882-3387.

Tech oriented person seeks bdct engr position. ISCET, CET, genrl, amateur license, HBO MDS exper, NBN CE, exper studio repair & maint. M Rakoff, 114-41 Queens Blvd Ste 148, Forest Hills NY 11375. 718-591-0002.

Video tech desperately seeking a PT/FT position in Colorado, will take anything, salary req 18-20K w/benefits, 9 yrs exper, college grad, military training. S Smith, 9645 W Ohio Dr, Lakewood CO 80226. 303-985-7485.

Seeking group chief position, 19 yrs exper in major market (15 yrs as CE) AM stereo/DA, FM, STL, RPU, satellite, studio/Tx construction. FCC, SBE certified. Also commercial pilot. Write to: RW, POB 1212, Falls Church VA 22041. Attn: Box 12-1.

CE Radio, general, ham, non-drinker, former CE Boston, Houston, Miami, heavy theory, avail immed. M Gottesman, 3377 Solano Ave #312, Napa CA 94558.

CE, AM/FM, all phases including construction & high power & AM directional. Write: RW, POB 1214, Falls Church VA 22041. Attn: Box 11-1.

Corp CE, hard working, self-starter, wanting FT position, 9 yrs hands-on exper in AM/FM would like single or group owned stations, for KS, CO, MO, NE, OK & Chicago IL, avail immed. Larry Timmons, 913-425-6509.

REGIONAL SALES MANAGERS

Growing marketing organization seeking experienced radio broadcast equipment sales person with ability to sell and manage regional rep network. Salary, commissions and expenses. Resume to:
CSI Marketing
POB 6135
Lakeland FL 33807-6135

HELP WANTED

CE wanted for 3 station group, $18,000-24,000 depending on exper, must have AM/FM & automation exper. Ric Murphy, Calnevar Bdctg, 2332 Hwy 95, Ste A, Bullhead AZ 86442. 602-763-5227.

Bdct Eng openings (2), Midwest, FCC certificate, 5 yrs minimum exper, studio maintenance, directional exper required. J Henkel, WMEE, POB 6000, Ft Wayne IN 46896. 219-447-5511. EOE.

CE, KBUC AM/FM San Antonio, resume & salary requirements to: Bruce Hirsh, TK Comm, Inc., 3000 SW 50 Ave, Ft Lauderdale FL 33314. EOE.

Asst CE, WCLY-FM/WPGC-AM. Call 301-441-3500. Tom McGinley

Consultants

Broadcast Equipment Exchange

REMOTE . . . WTS

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.

Marti STL 8 (2) w/R-200/950 receivers, SCG8H subgen 39 kHz, (2) 4' grid Scala parabolics, all in gd operating cond, $4000 FOB Blythe CA. J Mayson, KIMB, 2222 Kansas Ave Ste L, Riverside CA 92507. 714-682-2222.

S-A dish/Series 9000 satellite system, receiver/DAT 32 for ABC network complete w/2 dual audio decoder cards & cue decoder, BO. C Hampton, WXBM, 1687 Quintet Rd, Milton FL 32470. 904-994-5357.

Harris 6550 SCPC satellite rcvr, set up for Brownfield, but can be recrystalled, $1800. D Doelitzsch, WDDD, 1 Bdct Ctr, Marion IL 62959. 618-997-8123.

Want to Buy

Marti RPT 25 Systems remote pickup units, prefer RPT25. T Duffy, KOFE, 1525 Main Ave, St Mary's ID 83861. 208-245-4559.

Advanced Comm 7010, tuneable FM demod for Harris 6550 receiver, thumbwheel or DIP switcher, must be in excel working cond. D Voss, KADR, RR1 Box 86, Elkader IA 52043. 319-245-1400.

RPQ type accepted equip in 450 MHz band. R Morlino, WEQX, Elm St, Manchester VT 05255. 802-362-4800.

Dual audio decoder, 7.5 for Scientific Atlanta 7325 digital processing unit, will trade a 15 card for it. M Shannon, WAMJ, 1129 N Hickory Rd, Southbend IN 46615. 219-287-8375.

Flexible x-mission line, 1-5/8". A Weiner, Weiner Bdct, 4 Second St, Presque Isle ME 04769. 207-764-8300.

RPU solid state VHF xmtr & rcvr needed. R Johnson, WRKR, 2200 N Greenbay Rd, Racine WI 53405. 414-637-3036.

Digital satellite system for ABC network, from dish to demod. K Thomas, Thomas Bdctg, Box 1146, Ardmore OK 73402. 405-226-2524.

Remote control for 1 kW AM station. C McGinty, WMAK, 109 W 5th, London KY 40741. 606-864-7843.

STATIONS

Want to Sell

AM 10,000 W, 1 MHz. D Hastings, WKYB, Box 1000, Hemmingway SC 29554. 803-558-2558.

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.

AM station, 1 kW, FT, bldg, land incld, part ownership, 5K min, loc Ark. M Gottesman, 3377 Solano Ste 312, Napa CA 94558. 501-856-2212.

Radio station, AM, 1 kW, only station in county. N Crum, WABV, Box 700, Abbeville SC 29620. 717-334-1833.

Colorado mountain town station, 250 W, AM. G Zellmer, KDMN, Box 639, Buena Vista CO 81211. 303-395-2072.

AM 1 kW daytimer 1580 kHz; FM 3 kW 105.5 MHz, comp automated, equip excel, Sunbelt, ideal for owner/operator, only station in market, $250K, call or write. JP Robillard, 1803 N First East St, Haynesville LA 71038. 318-624-0105.

FT AM stereo station in top 100 markets, due to heart attack must sell, favorable terms to qual buyer, positive cash flow, on air 40 yrs, class B FM avail for comboing in 1987. J Rockwell, MGC Corp, 904 Lakeside Dr, Lynchburg VA 24501. 305-744-8751.

Want to Buy

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

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.

RCA BTX101 SCA gens (2), $200 ea. A Bater, WPIX, 220 E 42nd, NY NY 10017. 212-210-2773.

SWITCHERS (VIDEO)

Want to Sell

GVG 1600-1X switcher w/EMEM chroma key, serial editor interface, excel cond. P Scholes, Ardent Teleprod, 2000 Madison Ave, Memphis TN 38104. 901-725-0855.

Want to Buy

GVG production switcher. H Henson, Henson Prod, 4569 Haven Crest Rd, Winston-Salem NC 27106. 919-924-8717.

TAPES, CARTS & REELS

Want to Sell

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.

Ampex 671, three groups to choose from: 7"×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.

Metal reels, 10-1/2", all for 1/4" tape, all NAB hub, large stock, guar in excel cond, 1 to 10, $1.50, 10 to 100, $1.25, 100 plus, $1 ea, COD, shipped UPS, approp charges added to total invoice & KY sales tax added as applicable. G Falk, Falk Recdg, 7914 Fegenbush Ln, Louisville KY 40228. 502-239-1010.

Fidelipac carts (300), mostly 20 & 40 sec, $100. D Markegard, KTCA, 1640 Como, St Paul MN 55108. 612-646-4611.

Mastercart II's (100) 70 sec, (70) 40's, $3.75 ea/BO; also several hundred Fidelipac 300's. D McGroom, WNDH, 419-592-8060.

Capital A2's, approx 200 various lengths, $400 takes all. K Hunter, KLKT, 774 Mayes Blvd, Incline Village NV 89450.702-832-1000.

Fidelipac 300's (300), gd cond, in use, mostly 70 & 40 sec, $1 ea. R Molino, WEQX, POB 1027, Manchester VT 05255. 802-362-4800.

Urgent, fire destroyed record/tape collection, no insurance, need immed copies of records/tapes of top 100 or some under each year '53-'85, also copies History of Rock & Roll & other programs etc, leave message. S Stevenson, Stevenson Corp, POB 735, Blaine WA 98230. 604-531-4576.

Metal reels, 14", NAB 1", like new, minimum order 20, $3 ea. D Hill, Dimension Snd, 368 Center, Jamaca Pl MA 02130. 617-522-3100.

Fidelipac carts, approx 2000, gd shape, BO for all or partial. A Zenn, KGV, 2255 Kuhio #1201, Honolulu HI 96815. 808-923-7600.

Audiopak AA3, 1000 carts various lengths, $1 ea. P Christensen, WIVY, 3100 University S, Jacksonville FL 32216. 904-721-9111.

Reels, 5" (1000) w/NAB hub. S Voros, Voros Enter, 1537 S 81st, Milwaukee WI 53214. 414-475-6200.

Want to Buy

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.

Good adult music record collection, light & jazz & jazz vocals pref, must be in gd cond. S Weber, Fred Arthur Prod, 1218 E 18th, Denver CO 80218. 303-832-2664.

Top 40's/oldies music libraries on 2 trk reels, automation compatibility desired. W DeFelice, CKXN, 621 Bishop Ave, Bridgeport CT 06610. 203-336-5606.

TAX DEDUCTION EQUIP.

MW school needs prod gear to support news & prod program: R-R, carts & cass machines, entire studio, tax deductable. D Silcott, Creighton Univ, 25 & Calif Sts, Omaha NE 68178. 402-280-3014.

Mic mixer, 6-8 chan & other PA equip for church. P Johnson, Pilgrim Baptist Church, Hebron Ave, Glastonbury CT 06044. 203-633-7190.

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 69001. 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).

Non-profit college station needs: stereo or mono cart machines w/manuals. F Thomas, Muskegon Comm College, 221 S Quarterline Rd, Muskegon MI 49442. 616-777-0330.

El Salvador Christian station needs remote RF link, 892R tubes & submergible water pump. J Counter, YSLE, 5484 San Patricio Dr, Santa Barbara CA 93111. 805-967-6410.

FM xmtr, 10 kW, need for public radio in Pittsburgh. P Rosenfeld, WYEP, 580 E End Ave, Pittsburgh PA 15221. 412-765-1170.

TEST EQUIPMENT

Want to Sell

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.

Tek 491 spectrum analyzer, $4500. J Gagliardi, Harvard Univ, 69 Fruit, Norfork MA 02056. 617-732-1752.

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.

HP 606B signal gen, 50 kHz to 65 MHz, excel cond, $250 w/manual. M Mattews, Rockwell Colllins, 3318 Shield Ln, Galand TX 75042. 214-996-6844.

Tek 564 storage scope, $500; Tek 502 scope dualbeam, $100. J Gagliardi, Harvard Univ, 69 Fruit, Norfork MA 02056. 617-732-1752.

GR 1606A RF impedance bridge, gd working cond, $750; GR 916AL RF impedance bridge, gd working cond, $450. V Ranieri, 354 Bloomfield, Caldwell NJ 07006. 201-226-4356.

HP 400D AC voltmeter, $60. D Hill, Dimension Snd, 368 Center, Jamaca Pl MA 02130. 617-522-3100.

Tek 555 dual beam scope w/extra power supply & manuals, needs cal, $250. J Kipski, KIQO, POB 1456, Lompoc CA 93436. 805-865-6536.

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.

2-3 tower phase monitor. T McGinley, 1st Media Corp, POB 10239, Wash DC 20018. 301-441-3500.

TRANSMITTERS

Want to Sell

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.

RCA BTF10D w/exciter & spare parts & remote control panel, $6000. K O'Malley, WLRW, POB 3369, Champaign IL 61821. 217-352-4141.

Circle Reader Service 25 on Page 22

ACTION-GRAM

EQUIPMENT LISTINGS:

Radio World's Broadcast Equipment Exchange provides a FREE listing service for all broadcast and pro-sound end users. Simply call 1-800-426-8434 to place your listings courtesy of Broadcast Supply West.

Brokers, dealers, manufacturers and other organizations who are not legitimate end users can participate in the Broadcast Equipment Exchange on a paid basis. Listings are available on an $18/25 word basis. Call 800-336-3045 for details and complete display rates.

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.

Check as appropriate: ☐ Help Wanted ☐ With Box Number ☐ Positions Wanted ☐ Without Box Number

Text (25 words maximum): _____

Name _____ Title _____

Company/Station _____

Address _____

City _____ State _____ Zip _____

Telephone _____

BROADCAST EQUIPMENT EXCHANGE
PO BOX 1214
FALLS CHURCH VA 22041

RW Broadcast Equipment Exchange

TRANSMITTERS . . . WTS

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, WCBC, POB 1290, Cumberland MD 21502. 301-724-5000.

Gates TE-3 working when removed. $900. B Greenough, WNTE, Box 84, Mansfield PA 16933. 717-662-4600.

Collins 21E 5 kW AM xmtr, 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, KFYR, 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.

RCA TTU1B TV xmtr, UHF 1 kW, gd cond, spare cavities, diplexer, comp set of tubes. L Nixon, WTKV, 601 N Lee St, Valdosta GA 31601. 912-247-3333.

QEI FM xmtr meter bridge, reads SWR/voltage/current, Vp to 150 W. $250. Stan, KAK-FM91, Box 91, Villa Grande CA 95486. 707-528-4055.

FM plate for Collins 831D, 200-250 V primary nominal 5160 V sec at 1 A w/taps 3600 & 4400 V. $500. J David, KMPL, POB 907, Sikeston MO 63801. 314-471-1520.

Continental 2 yrs old, 1 kW, mint cond, all current updates, $12000 terms, $10000 cash. D Jack, KNTA, Box 6528, San Jose CA 95150. 503-234-8448.

WE D151170 250 W AM, looks very clean, needs only minor work, on-air recently, tuned to 1340 kHz. $800 & ship. J Whitmer, WNBS, POB 1340, Murray KY 42071. 502-759-1300.

Collins 1 kW xmtr, in service, 1978 model, station now 5 kW. V Arnold, WJEM, POB 368, Valdosta GA 31603. 912-242-1565.

RCA BTF-5D 5 kW FM xmtr, 94.7 MHz. $8000. M Raby, WFBQ, 6161 Fall Creek Rd, Indianapolis IN 46220. 317-257-7565.

Gates FM-1 xmtr. $6500. C Hampton, WXBM, 1687 Quintet Rd, Milton FL 32470. 904-994-5357.

AEL 10KB 10 kW xmtr. $5000. E Fears, KHBN, POB 31235, Jackson MS 39206. 601-981-4245.

AM xmtrs crystals, one 1320 kHz & one 1390 kHz. BO. D Workman, KPPL, RR 1 Box 203, Stockton IA 52769. 319-785-6069.

Wilkinson exciter, excel cond, up to 15 W, tuned to your freq, has AFC metering & full sys metering, avail immed. L James, WROC, 975 S Florida Ave, Tarpin Springs FL. 813-937-3429.

RCA BTA50F 50 kW AM xmtr, excel cond, in storage ready for immed pickup, all manuals, electrostatic air filter, solid state rectifiers, proof RF perf avail. $18,000 plus PU & ship. G Heldenselt, Heidenselt Bdctg, 2880 W Lake, Wilson NY 14172. 716-751-6187.

RCA BTA5F 5 kW AM xmtr, excel cond, in storage for immed pickup. $10,000 plus PU & ship. G Heldenselt, Heidenselt Bdctg, 2880 W Lake, Wilson NY 14172. 716-751-6187.

Collins 20V2, 1000/500 W; Collins 550A2, 500/250 W. G Zellmer, KDMN, Box 639, Buena Vista CO 81211. 303-395-2072.

QEI exciter & meter readout bridge, new cond. $2000. S Lawson, KAK FM, 928 Hyland, Santa Rosa CA 95404. 707-528-4055.

McMartin B-910 FM 15 W exciter, factory tuned & tested to your freq, w/ or w/o stereo modules. Goodrich Ent, 11435 Manderson, Omaha NE 68164. 402-493-1886.

Collins FM 5B, 5 kW FM, gd cond. BO. D Workman, KPPL, RR 1 Box 203, Stockton IA 52769. 319-785-6069.

Collins 300J 250/100 W AM xmtr, can be used for PSSA, you pick up. $800. D Doelitzsch, WDDD, 1 Bdct Ctr, Marion IL 62959. 618-997-8123.

Want to Buy

Gate 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 xmtr, 5000 W w/solid state drivers. J Meeker, Family Radio, 4609 78th Pl SW, Mukilteo WA 98275. 206-348-3322.

FM xmtr, 1 to 3 kW. J Bruce, Thoen Comm, 407 N Swenson, Stamford TX 79553. 714-761-4377.

Solid state FM exciter in working order. Stan, KAK-FM91, Box 91, Villa Grande CA 95486. 707-528-4055.

Collins 21-E, 5 kW AM; 1-10 kW FM, any age or cond; chan 12 & 16 or low UHF TV xmtr 1-20 kW peak output, any age or cond, needed immed. J Kouch, KJKL, 105 Gemini Pl, Syracuse NY 13209. 315-487-2393.

Xmtr, 500 W or 1 kW tube or solid state. WLMV, Box 187, Vernon Hills IL 60061. 312-680-7557.

FM, 1 kW or 3.5 kW. L Logan, Family Stations, Oakland CA 94621. 415-568-6200.

CCA or CSI 25-27.5 kW FM xmtr, any cond. T McGinley, 1st Media Corp, POB 10239, Wash DC 20018. 301-441-3500.

Harris MW10. D McDonald, Big M Bdct, POB 700, Ennis MT 59729. 406-586-6541.

McMartin BA-2.5K 2.5 kW AM, any cond. Goodrich Ent, 11435 Manderson, Omaha NE 68164. 402-493-1886.

5 or 10 kW in gd cond. G Bicochi, IBS, 1771 N Powerline Rd, Pompano Beach FL 33060. 305-977-9111.

TUBES

Want to Sell

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.

EIMAC 833A modulator final tubes, new, $100 ea. J Bruce, Thoen Comm, 407 N Swenson, Stamford TX 79553. 714-761-4377.

4CX250FG, 23 avail, call for info, $40 ea or less if you buy more or BO. J Schloss, KICD, 2600 Hiway Blvd, Spencer IA 51301. 712-262-1240.

Econco rebuilt 4CX5000A, $650 & 5CX1500A, $450, never used. G Hill, KSHA, 1151 Hilltop, Redding CA 96003. 916-223-5742.

Want to Buy

Vidcon E5080 tube for a Concord TV camera. L Auman, Auman Recdg, Rt 1 Box 368, Dover OH 44622. 216-343-2297.

TURNTABLES

Want to Sell

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.

Grampian cutter heads type 1D feedback (2), one $300 & other $275. L Oliver, Oliver Stds, 304 W 89th, NY NY 10024. 212-874-7660 aft 1PM.

Gates CD77 as is. BO. B Greenough, WNTE, 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.

Technics SL10 MKII TTs (2), $350 ea. C Hampton, WXBM, 1687 Quintet Rd, Milton FL 32470. 904-994-5357.

QRK 12-C excel cond w/tonearms, $95 ea, call after 6PM CDT. R Moen, Radio Srvs, 402-334-8767.

Rek-O-Kut 12" Rondine deluxe 3 speed TT, w/non-descript viscous dampened tone arm & GE cartridge, $35 plus ship. C Brennan, 661 Horseshoe Curve, Pike Road AL 36064. 205-277-0139.

Presto mono cutting lathe, 3 speed, 1D & 1C heads, 2 doz styli, blanks, gd cond, $350/BO. D Kocher, 1901 Hanover, Allentown PA 18103. 215-776-1455.

Presto 1936, 28" recording lathe w/2 16" cutters. P McManus, McManus Enter, 4011 Orchard, San Diego CA 92107. 619-233-1730.

Russco Studio Pro B, 2 sp, vgc w/Audio Technica tonearm; Gates CB500 transcription TTs w/one Gates base, fair cond. I Baron, WCUA, Box 814 Cardinal Station, Wash DC 20064. 202-635-5106.

QRK & Maze TT, parts & Micro-Trak 303. I Baron, WCUA, Box 814 Cardinal Station, Wash DC 20064. 202-635-5106.

BE Spotmaster Studio Pro TT w/Micro-Trak tonearm, low hrs, $200. L Wagner, ARN Prod, POB 1788, Orlando FL 32802. 305-299-1299.

Want to Buy

RCA 16" in RCA floor cabinets, also parts for 70D & BQ2 TTs. L Scott Jr, POD 1729, Bartow FL 33830. 813-533-4654 eves.

Transcription TT, 16", motor & arm, cartridge & base for use with 78 rpm/33 rpm records. F Luppino Jr, Marketing Insights, 1445 Sunset Ridge, Glenview IL 60025. 312-729-2047.

TV FILM EQUIP.

Want to Sell

Beaulieu R16 camera w/Ang 12-120 zoom lens, 4-gang, synchronizer, rewinds, sound readers, viewers, B&H 816 hot splicer, B&H 202 optical magprojector, w/sync motor, B&H 385 projector, recording amps, light meter, reels, other misc access & equip. Polecat lighting mounts. BO. B Howard, Academy Film Prod, 3918 W Estes Ave, Lincolnwood IL 60645. 312-674-2122.

VIDEO PRODUCTION EQUIP.

Want to Sell

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.

Chyron VP1 character gen w/software & gen lock upgrades, $2100. L Froom, SPS Video Prod, 1901 Chapel Hill Rd, Silver Spring MD 20906. 301-598-5392.

NEC DVE controller, $1500. C Malcom, Video Srvs, 1599 Superior #B2, Costa Mesa CA 92627. 714-631-1144.

Mole-Richardson 126B perambulator. BO. M Fiedler, Mayoney-Fiedler Prod, 5346 Du-Pont Ave, S Minneapolis MN 55419. 612-822-0013.

Telestrator 400 video graphics system, $3500; Sony CMA-6 (2) camera adapters, rack mountable, mint cond. BO. J Von Vleck, Aras Consulting, 2321 N Utah St, Arlington VA 22207. 703-524-5067.

CMX I squares, (2) 2860; AVR2; MM1200; (2) GV1600; VR1200, as lot. H Casteel, Technichrome, 1212 S Main, Las Vegas NV 89104. 702-386-2844.

Want to Buy

Shintron 383 color bar/black/bkgd signal gen, any cond. G Odell, The Film Group, Box 9, Wethersfield CT 06109. 203-527-2972.

Unimedia SMT-12 video monitor schematic. J Balter, Maine Reel Prod, 67 Green St, Augusta ME 04330. 207-623-1941.

JVC TN-3P video monitors. M Adler, Sherwood Comm, 1310 Industrial Hwy, Southampton PA 18966. 215-357-9065.

VIDEO TAPE RECORDERS

Want to Sell

JVC 5000 3/4" U-matic player, recently overhauled, $300. M Taylor, AliMar Prod, 274 County Rd, Tenafly NJ 07670. 201-569-1717.

Panasonic NV9400 3/4" portable VCR w/charger & 3 batteries, great shape, $650 plus ship. J Owens, Ashbury College, Wilmore KY 40390. 606-858-3511 x757.

JVC 6060U 3/4" VCR, $800. R Robinson, TNA, 10 George, Wallingford CT 06492. 203-269-4465.

JVC 8500 U-matic editing system, all 3 pieces complete, gd cond, $4000. U George, George Assoc, 175 5th Ave # 3206, NY NY 10010. 212-475-3330.

Sony 2850, Sony 2860, JVC 3/4" U-matic recorders (18). BO. H Casteel, Technichrome, 1212 S Main, Las Vegas NV 89104. 702-386-2844.

Sony RM420 (3) U-matic remote control boxes. BO. B Hawkins, WENS, 1099 N Meridian, Indianapolis IN 46204. 317-266-9700.

VR2000B (3) gd cond. $2500. H Casteel, Technichrome, 1212 S Main, Las Vegas NV 89104. 702-386-2844.

Sony BVH500 1" video w/Anvil case, batteries, charger, AC500 AC adapter, HT 500A chroma stabilizer. T Cereste, Lightscape, 420 W 45th, NY NY 10036. 212-757-0204.

JVC 1" editing system. $5000. C Malcom, Video Srvs, 1599 Superior #B2, Costa Mesa CA 92627. 714-631-1144.

Want to Buy

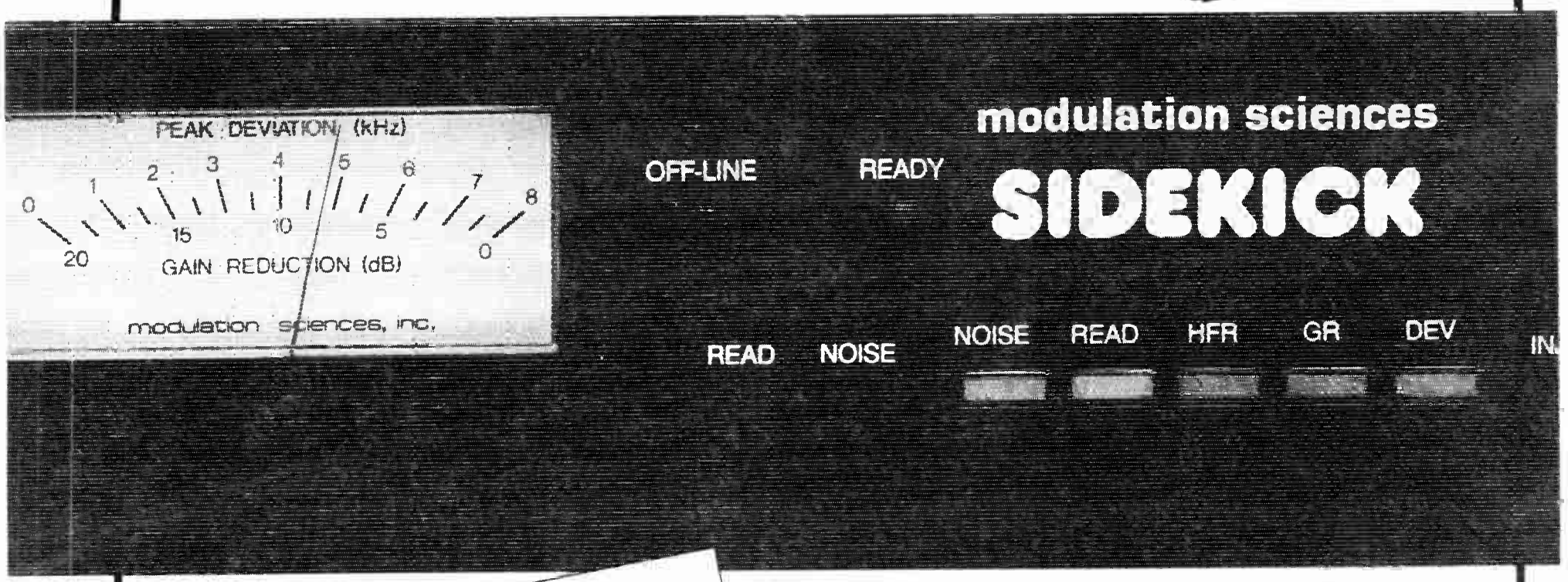
Sony BVU-110 or 150 3/4" portable VCR or equiv. M Glaser, MRG Assoc, 2 Floyd Ln, Massapequa NY 11762. 516-489-1071.

RCA TR800 & access, need not be working. H Henson, Henson Prod, 4569 Haven Crest Rd, Winston Salem NC 27106. 919-924-8717.

IVC 700 & 800 color boards (2), (2) guide rollers & (2) ribbed rubber counter drive rollers for 700 models & one color board for 800 model. C Lund, Cycle Snd & Video, 167 Madison, Waterbury CT 06706. 203-756-7761.

Panasonic NV9600/NV9240XD, working 3/4" edit decks & other assoc edit equip, could also use NU8500 VHS decks. B Chapman, Video Effects, POB 6316, Napa CA 94581. 707-257-7669.

THE ONE BOX SOLUTION THAT MADE SCA WORK

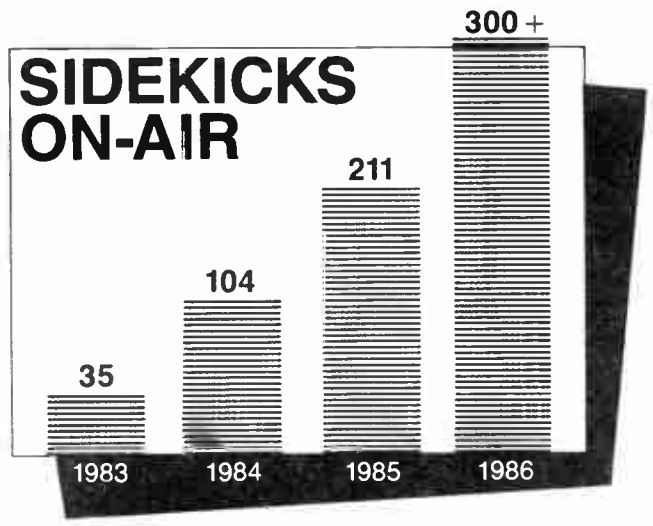


RF IDEAS

E.J. PRYOR, JR. — *Broadcast Technologies, Inc.*

"I have been operating one SCA on 67khz on my Dallas, TX station for some years. After many years of the normal problems of crosstalk, noise, etc., Modulation Sciences came forward with the 'Sidekick' SCA generator. I have never spoken out for a particular device in this column before, but I found that virtually every problem I had been experiencing, disappeared when I finally got one of these units and installed it at the studio between my stereo generator and composite STL. I found that the crosstalk, main to sub and sub to main, was improved almost 20db and the system noise was markedly improved also. There is no measurable degradation to the stereo performance or loudness whatever. With the new rules allowing stations to increase their total modulation 5% for each 10% of injection, the main channel (mono) level suffers a negligible 0.5db reduction in loudness."

Reprinted by permission from Broadcasters ID. Aug/Sept 1985



Here's how Sidekick® makes SCA work:

Sidekick installation is quick, easy, and problem-free:
- Install at studio or transmitter.
- Insert anywhere in chain via Sidekick's loop-through composite input/output (SCA input NOT required).
- Remote control provisions standard.

Sidekick's elegant circuit design takes the hassles out of SCA:
- Sidekick is tweak-free and drift-free.
- Crystal-locked synthesizer is stable over time/temperature.
- Excellent RF and EMI shielding.
- Performance certified by an independent P.E. (to receive a copy, just call).

Sidekick's "One Box Solution"™ builds in everything you need:
- Integrated audio processor for superb SCA performance.
- Noise generator and synchronous AM meter lets you tune transmitter for minimum crosstalk.
- Super-accurate peak & hold SCA deviation monitor.

30-Market Survey Results:
SIDEKICK IS THE #1 CHOICE OF MUSIC SCA OPERATORS.
From SCA: Radio Subcarrier Report 9/85
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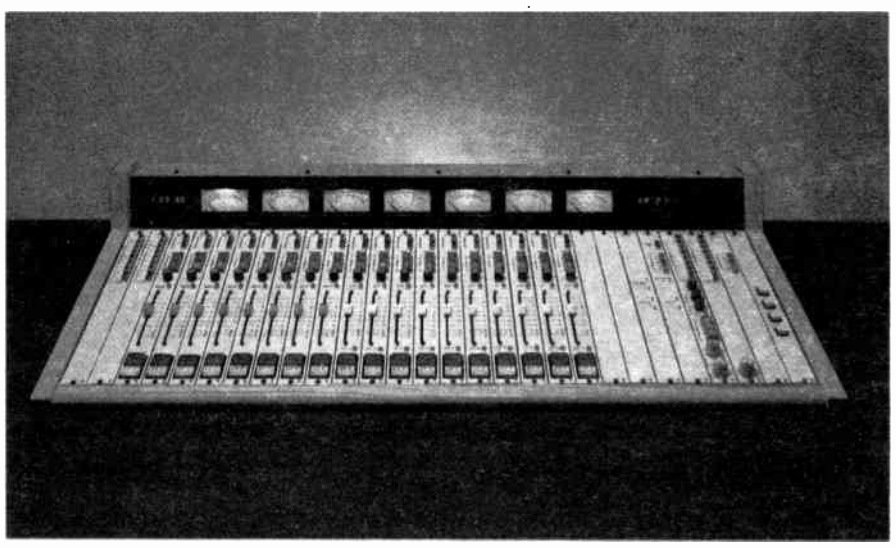
Call **Toll-Free (800) 826-2603**
And Get Sidekick Working For You.

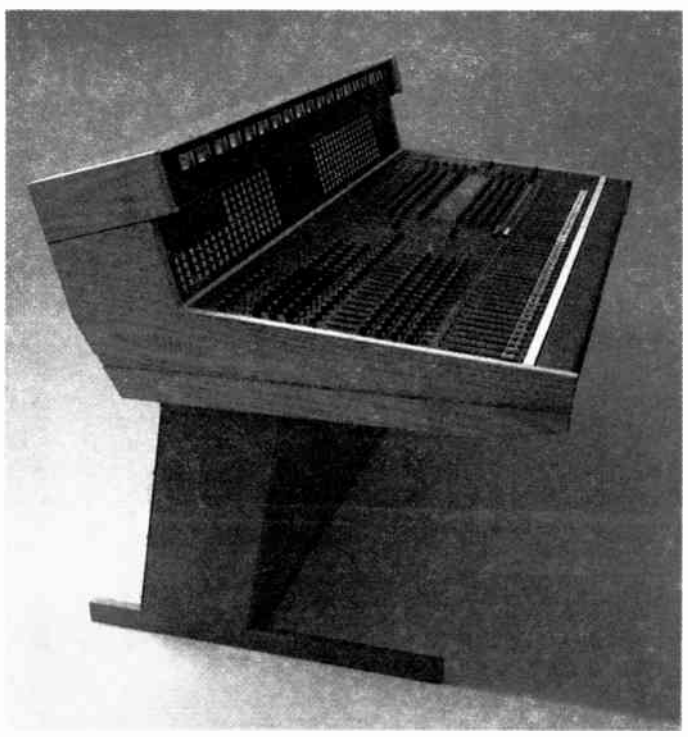
Circle Reader Service 27 on Page 22

Multiple Choice:

What do you need in an audio console?
Every application is different; what are *your* requirements? Should the input section be stereo or mono, mic or line? What kind of outputs and subgrouping do you need? Is a matrix mix important? Do you require mix-minus capabilities? What about metering, timers, tape remotes, mainframes, future expansion?



A-500 Radio On-Air

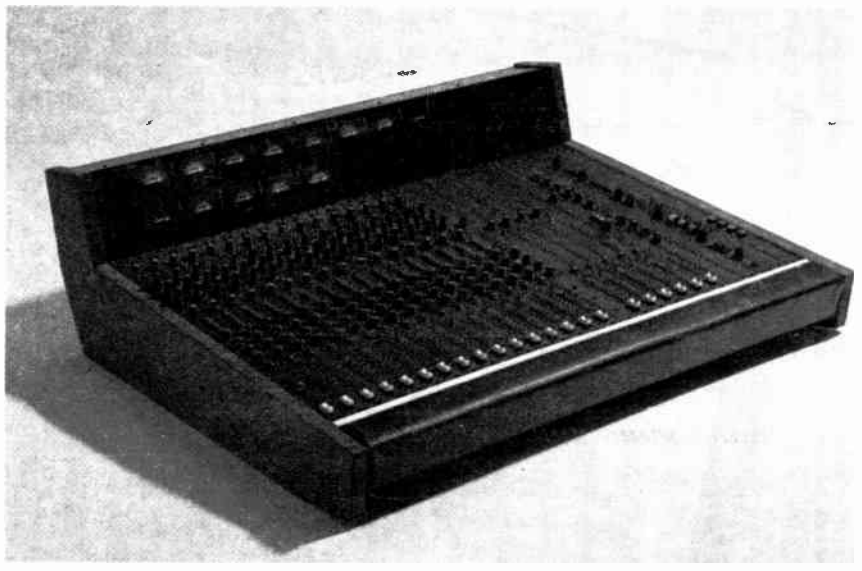


TV-80 Television Master

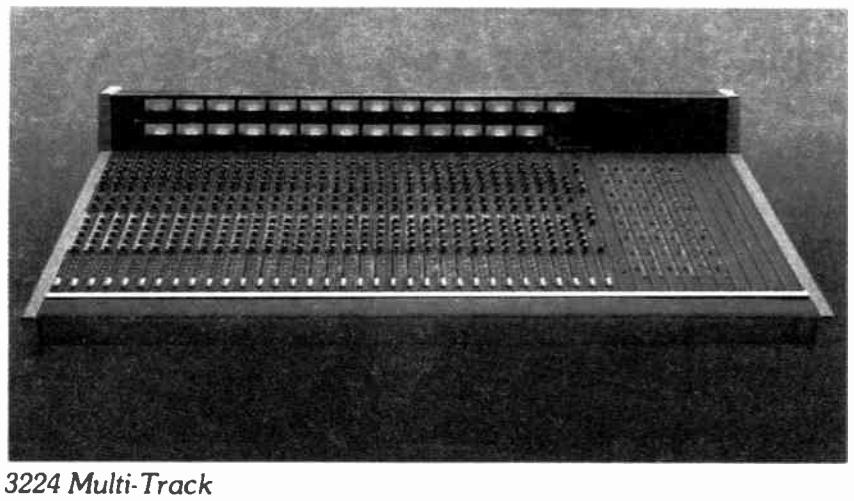
WHEATSTONE consoles give you all the choices. Our sales engineers listen to your requirements, then work with you and plan your console from the first module to the last VU meter. The result is custom-configured equipment built specifically to your needs.

The truth is, there's only one choice when specifying broadcast equipment: QUALITY. There's simply no room in broadcast for cutting corners; when you're on-the-air the phrase "Time is Money" takes on real meaning.

SP-5 Stereo Production



So whatever your application, stereo or multitrack production, television master control, on-air, video edit, or mobile installation, consult WHEATSTONE.



3224 Multi-Track

QUALITY

There's No Better Choice.

Wheatstone Corporation

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