

## Canadian Operations Intact

by David Hughes

**Washington DC ...** Former daytimers on Canadian clear channels that have added nighttime operations should not be affected by a recent court decision that overturned last year's FCC order authorizing those night operations, according to the Commission's legal staff.

The US Court of Appeals in New York in early June overturned the Commission's May 1985 order (Mass Media Docket 84-281), which, in part, opened up seven Canadian AM clear channels for nighttime operation by daytimers.

The court said its action was based on the fact that the FCC did not adopt eligibility criteria favoring minority and non-commercial station applicants for any

new channels that could be created on the Canadian and Mexican (and one Bahamian) clear channels addressed by the 1985 order.

Despite the court's action, no changes will be made in nighttime operations by daytimers on Canadian clears, according to FCC General Counsel David Silberman.

"It is our initial interpretation that the court's decision won't affect daytimers," he said. The ruling should only affect applicants for new stations on the Canadian, Mexican and Bahamian clear channels.

NAB Deputy General Counsel Barry Umansky agreed: "There is nothing in the court decision that affects the expanded daytimer operations." Daytimers

on Canadian clears that have already added nighttime hours will get to keep their authorizations, he said.

The court's order, Umansky said, would only affect the procedure the FCC has used to select license applicants for new stations made possible by the May 1985 clear channel order.

Daytimers on Canadian clears were authorized to add night hours last fall following the signing of an agreement with Canada.

Daytimers on the Mexican clears are still awaiting the signing of a final agreement with Mexico before beginning operation. Though a preliminary agreement was signed with Mexico in August, 1985, formal approval is still pending. No action has been reported with the

Bahamian government on the one Bahamian clear channel.

Silberman said that the court's ruling will not prohibit daytimers on the seven Mexican clears to add nighttime hours, once the final Mexican agreement is signed. "The same reasoning that applies to the Canadian clears also applies to the Mexican clears," he said.

The court action came after the National Black Media Coalition (NBMC) appealed the FCC's May 1985 clear channel order, which set the policy for clear channel nighttime operations.

In its ruling, the court agreed with the NBMC that the Commission had not given proper notice that it had decided not to include the minority preference policy in the final report and order.

This was in spite of the fact that, the court said, the FCC had included the minority provisions, adopted in 1980, in previous rulemaking proposals regarding clear channel operations.

Umansky said the court's decision, which objected to procedural rather than substantive issues, would only address the "relatively small number of new stations" that could start up because of the clear channel order.

Silberman maintained that since the FCC saw little or no opportunities for new stations on the Canadian, Mexican and Bahamian clears, it did not adopt any nontechnical criteria specifically for new stations. He stressed that the Commission did not just drop the minority provision, per se.

"There is little, if any, opportunity for new stations on the foreign clears," Silberman said. "We determined there was (continued on page 14)

## NABET 'Neutral' on Cap Cities

by Edward Wytkind

**Washington DC ...** The bargaining team for the National Association of Broadcast Employees and Technicians (NABET) announced 12 June that it has taken a position of "neutrality" on whether the union membership should accept Capital Cities/ABC's "final offer." NABET said the votes would be counted by 9 July.

This follows NABET's announcement in early June that it would strongly recommend rejection of the final offer.

At the conclusion of the last round of talks, NABET Network Coordinator Tom Kennedy informed Cap Cities/ABC that it would recommend rejection of the package affecting more than 3,200 network radio and television employees. The previous national agreement expired 31 March 1985.

However, after several off-the-record discussions, the two sides resolved "some misunderstandings," NABET reported.

ABC owns nine major-market radio properties, including WABC/WPLJ, New York, WLS/WYTZ, Chicago, KABC/KLOS, Los Angeles, KGO, San Francisco and WMAL/WRQX, Washington, DC.

The network has been given an 18-month waiver to sell its New York, Chicago and Los Angeles radio stations—all markets where ABC also owns TV properties—due to FCC cross-ownership restrictions involving its merger with Capital Cities. Previously, the stations had been covered by a grandfather clause.

Although no indication has been given that the union will strike if the offer is rejected, in July of 1985 NABET received overwhelming authority from its general assembly to call a strike, if necessary.

Cap Cities/ABC bargaining spokesperson Dick Freund emphasized that the latest proposal was the company's "final offer." If it is rejected by the union's membership, "there would be no purpose in starting negotiations again."

Freund added that if the proposal is not approved by employees by 31 July, the network "reserves the right to withdraw or revise the offer—including the

proposed retroactivity."

However, Kennedy said the union "doesn't see this (vote) as do or die. It's unfortunate the company has taken that position."

"Their position was that if this offer was taken to a vote, the membership would accept it," Kennedy said. "We'll find out in July what the membership (continued on page 3)

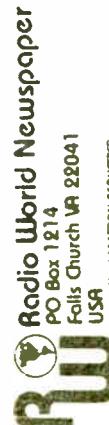
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## Regulatory News

# EPA/FCC Set RFR Tower Study

by Edward Wytkind

**Portland OR . . .** Two broadcast towers in the Healy Heights section of Portland, Ore. will be the focus of a four-day radio frequency radiation (RFR) measurement survey to be conducted jointly by the Environmental Protection Agency (EPA) and the FCC 28 July to 1 August.

Portland's RFR standard-setting proceedings have been in limbo since last January, when the city council voted to defer its decision on whether to adopt new standards until the EPA determines RFR levels in residential areas adjacent to the antenna farm and at the base of the two towers.

"We'll be there to determine the absolute highest levels of RF radiation in and around the area," said Richard Tell, chief of the EPA's Las Vegas-based Office of Radiation Protection. "One of our main intentions is to measure the fields at the AM stations' tuning circuits, which can often result in high magnetic fields."

"We expect to find high (RFR) levels at the base of the towers. But this won't surprise anyone," Tell added. "The major question to answer is whether there are people living in areas with levels exceeding the ANSI (American National Standards Institute) limit."

The Portland case is one of several around the US where local or state officials have adopted, or have considered adoption of, nonfederal RFR standards. To date, such activity has occurred in Washington, Oregon, New Jersey, Massachusetts, New York, Texas, California and other states.

A local Portland citizens group has

battled city government officials since last summer over what constitutes safe public RFR exposure levels. The group, called the Southwest Hills Residential League, has argued that the Healy Heights towers are a "nuisance" to the quality of life.

### Disagreement on standard

The controversy surfaced late last summer after the city's Bureau of Planning recommended RFR exposure standards equal to 1/10 the ANSI standard. However, policy officials in the Portland Planning Commission disagreed with the recommended levels, and instead relaxed the recommended standard to equal 1/5 of the ANSI standard.

Because of the uncertainty caused by the inter-agency disagreement over exposure levels, the Southwest Hills Residential League, led by William Conley, has lobbied for the originally recommended level of 1/10 of the ANSI standard.

Meanwhile, Portland city council members say they will delay action on the matter until the EPA concludes the site survey to determine whether residential hazards exist.

### Inconsistency cited

Portland broadcasters have argued that their main intent is to spur adoption of standards that are consistent countywide.

For example, Multnomah County (which includes Portland) in 1982 adopted standards equal to 1/5 of the ANSI standard. However, exposure-limit calculations are based on 30-minute (instead of 6 minute) time-averaging, which can substantially vary calculated energy

fields.

Broadcasters want "uniform" standards so facility siting decisions can be facilitated.

In related RFR news, the Accredited Standards Committee on Radio Frequency Radiation, which is responsible for updating the 1982 ANSI RFR standard (C95.4), voted in May to consider a "two-tier" standard that would differentiate between worker and public standards.

ANSI standards are considered for revision every five years. The most recent such RFR exposure limit must be revised by 1987.

"This could be a very substantial development," said the EPA's Tell, who is a member of the revision committee.

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## FCC Clips

### Unified Agenda

The latest edition of the FCC's "unified agenda" is now available. The agenda lists proceedings, including technical items, that are currently being developed or reviewed by the Commission.

The most recent semi-annual listing, current as of late April, features 25 items, each bearing a title, a description, timetable, staff contact and a rulemaking or docket number.

Copies can be obtained from the Superintendent of Documents, Government Printing Office (202-783-3238), or by contacting the International Transcription Services (202-857-3800).

For more information on the unified agenda, contact Claudette Pride at the FCC: 202-632-6390.

### FM Applications

The FCC has released a public notice that clarifies the operation of the new FM applications processing systems contained in Docket MM 84-750.

In that docket, the Commission instituted two new systems governing FM applications—the "window" system and the "first-come/first-serve" system.

The public notice clarifies FCC policies on FM applications, including application filing schedules under the two systems.

The notice, 86-265, is dated 22 May. For a copy, contact the FCC's news media information office at 202-254-7674.

### Marine Channel Abuse

The Commission on 2 June said a Maple Shade, NJ man has pleaded guilty in federal court to charges connected with the broadcast of false distress calls to the United States Coast Guard.

According to Thomas Grelish, US attorney for the District of New Jersey, the man used marine distress channel 16, transmitting messages claiming that he was on a vessel that was sinking or on fire.

"As a result of these broadcasts, the US Coast Guard and other rescue agencies dispatched personnel and equipment on at least 15 occasions," the FCC said. "This was very costly and subjected personnel and equipment to needless risks."

The investigation was conducted by FCC engineers from the Philadelphia office, the Coast Guard and FBI agents. The man faces a maximum sentence of five years imprisonment and a \$25,000 fine.

For more information, contact Gertrude Anderson at the FCC's Philadelphia office: 215-752-1324.

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## Regulatory News

# Daytimers Opposing DST Bill

by David Hughes

**Washington DC . . .** AM daytimers, upset with a plan to extend daylight savings time (DST), planned to meet with FCC officials in mid-June to discuss the loss of up to four weeks of lucrative morning "drive-time" programming.

Recent bills passed by both the Senate and the House propose starting DST on the first Sunday in April, rather than the last Sunday of the month, thereby adding three weeks of later sunrises and sunsets.

The House bill would also extend DST one week beyond its traditional end on the last Sunday of October, to give Trick-or-Treaters an extra hour of evening daylight on Halloween.

At press time, a Congressional conference committee was examining both bills and working out differences, according to the NAB. The final version must then be signed by the president to become law.

With the extra hour of darkness each morning in early and mid-April, AM daytimers fear they will suffer audience losses because they will not be allowed to broadcast at their full power level until sunrise.

### "AM drive" losses

"We'll have to give up an hour of AM drive time in exchange for an hour of PM drive," said NAB Daytimers Committee Chairman David Palmer of WATH/WTXQ, Athens, Ohio.

AM drive time is the most important part of the day for most daytimers, Palmer said, when most stations emphasize information and news services.

"People deserve information in the mornings. Surveys show that is when it is the most important," Palmer said.

He added that 43 million people, or about 20% of the population, live in an area where a daytimer provides the only local radio service. These people will essentially lose an hour of important

radio coverage each day for three or four weeks, Palmer said.

If DST is extended, daytimers will be forced to utilize their much lower pre-sunrise authority (PSA) power levels for an hour of prime morning drive time instead of operating at full power. Many PSAs are below 50 W.

### Meeting planned

At press time, Palmer said members of the NAB Daytimers Committee planned to meet in mid-June with FCC Mass Media Bureau Chief James McKinney to discuss possible solutions for the DST extension.

Palmer said some daytimers would like to see a 50 W minimum power level be instituted for PSAs. Even with that, a station still cannot cover the same area as if it were operating with its full daytime power of 500 W, 1 kW or 5 kW.

Another possible solution mentioned would be to allow daytimers to increase

to full power at a specific time, such as 6 AM, rather than at local sunrise.

Aside from stopping the Senate and House DST bills outright, as with a presidential veto, observers say there is little the Commission could do to increase PSAs across the board.

McKinney reportedly told the NAB that since the "laws of nature" and the "immutable laws of physics" govern radio wave propagation, there is little the FCC can do to change PSA levels.

However, the NAB also reported that its Radio Board Chairman, John Dille III, said the new DST law would give the FCC the authority to "make power and operating adjustments that may be permitted under existing treaties."

"We're upset with the entire concept" of the DST extension, said NAB General Counsel Barry Umansky. "It will upset a delicate balance."

For more information, contact Barry Umansky at NAB: 202-429-5430.

## NABET Neutral on Offer

(continued from page 1)  
thinks."

Kennedy said the company's "final economic offer did not live up to what we wanted." He also said the provisions dealing with equipment and duty jurisdiction were unacceptable.

Key issues throughout the 16-month negotiations have included jurisdiction, general salary and benefit issues, per diem hires, job security measures, and grievance and arbitration.

According to international and local

union officials, NABET has placed great emphasis on job security measures due to the increasing number of corporate takeovers in the broadcast industry.

Since approval of the Capital Cities/ABC merger late last year, the network has laid off an undisclosed number of employees. ABC spokesperson Julie Hoover said the layoffs, which affect both union and nonunion employees, are part of Cap Cities' overall plan to make the network a "leaner company at year end."

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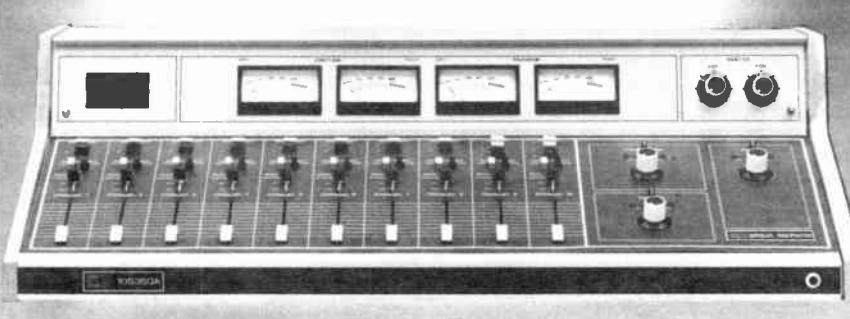
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# NAB Eying Extra Exhibit Day

by Edward Wytkind

**Washington DC . . .** NAB officials are considering opening the 1987 spring convention exhibit area on Saturday, the same day that the engineering conference traditionally opens.

Meanwhile, the NAB Exhibitor Advisory Committee, comprised of representatives from seven manufacturers, met 1 May with NAB officials to discuss booth assignment procedures and other convention operations.

According to NAB Convention Director Hank Roeder, "NAB is considering opening the exhibit area early, but the decision is pending formal discussions with the (NAB) Executive Committee and the convention committee."

The NAB convention committee, chaired by the yet-to-be elected vice-chairpersons of the radio board and the television board, is comprised of broadcasters who are elected by the membership to serve on the committee. At press time, elections were scheduled for mid-June.

Roeder added that there are "numerous possibilities" for adding extra exhibit time. "We could open the floor on Saturday or possibly expand to a full day on Wednesday," he said.

The rationale for expanding the convention, Roeder said, is that "attendees complain it's hard to see the whole thing."

At press time, Roeder said the matter would be discussed "informally" in late June, and that a decision would be made "sometime this summer."

According to NAB Engineer Ed Williams, the decision to increase the number of exhibition days, which is still pending action by NAB convention offi-

cials, could push the engineering program back one day as well.

"However, this may put us in a tough situation because attendees would probably have to take an extra day off from work," Williams said. "But this might also mean that we wrap up the engineering sessions on Tuesday instead of Wednesday."

*The rationale is that attendees complain it's hard to see the whole thing.*

Williams added that the engineering department's "success in starting the (engineering) sessions on Saturday has made other NAB officials consider expanding the exhibit area as well."

#### Advisory committee meets

The 1 May meeting between the NAB Exhibitor Advisory Committee and NAB officials was held to discuss booth assignment procedures and to address complaints expressed by exhibitors at the advisory committee meeting held at the 1986 convention in Dallas.

The advisory committee was created following the 1985 show in Las Vegas to address exhibitor complaints regarding convention operational problems and procedures.

Among the long list of topics discussed at the May meeting was the "seniority,"

or tenure, policy employed by the NAB for assigning booths.

The NAB's current policy for assigning booths states that companies with the greatest seniority receive preference. However, if a company skips the convention one year, then seniority rights are stripped, according to NAB officials.

#### Not a problem?

NAB Exhibit Director Edward Gayou said the committee "agrees on our seniority policy . . . I don't really see it as a problem."

Advisory Committee Chairman Al Fisher of Ampex Corporation could not be reached for comment.

One problem, among the several raised after the 1986 show, was that some companies were given worse booth assignments than firms with less seniority.

"It's tough to please everyone," Gayou said. "As much as we try to rectify any problems, special cases will always arise."

NAB Secretary/Treasurer Michael Harwood, who also attended the meeting, said, "The committee suggested that it would be a good idea for NAB to come out with a succinct statement on seniority procedures."

Harwood said the NAB plans to publish a definitive statement on its seniority policies, but a timetable was not revealed.

Gayou said the committee also urged the NAB to send contracts to exhibitors who have reserved booth space (with exhibit rules and regulations) within "45 days" of the May meeting. At press time, he said the St. Louis-based exhibit office was trying to meet the late June deadline for distributing contracts and booth

information.

Assigning booth numbers early is "crucial" to exhibitors because it allows them to advertise their equipment and to make the proper booth construction plans, according to Harwood.

A topic raised at last April's committee meeting was the nonrefundable \$500 deposit exhibitors had to pay by 16 May to reserve the same booth space at next year's show.

Exhibitors either had to pay the (\$500) deposit by 16 May, Gayou said, or "ignore" the rule and take the chance of not receiving any booth allocation.

Gayou, however, explained that this booth reservation policy was the result of the committee's guidelines, and therefore it did not attract much attention at the 15 May meeting. "They wanted to implement this," he added.

"Fortunately, this has not been a problem thus far," Gayou explained. "Seventy-three percent of 1986 exhibitors have already reserved their same booth location . . . The rest will fall into a tough situation, and will face being left out."

"I have problems with having to tell a company it lost its space, but that's the policy," he added.

For more information on next year's exhibit area, contact the NAB exhibit office in St. Louis: 314-721-7717. For other information, call the NAB convention office at 202-429-5353.

## Mexican Levels Sent

by David Hughes

**Washington DC . . .** The FCC has started sending orders that specify nighttime power levels to daytimers operating on Mexican clear channels, despite the fact that the final clear channel agreement with Mexico has not yet been signed.

Show cause orders were mailed out in early June, FCC officials said, to many of the daytimers operating on the seven Mexican clear channels—540, 730, 800, 900, 1050, 1220 and 1570 kHz.

However, until the final agreement is signed, stations cannot legally implement their assigned powers.

The final agreement was expected to be signed in April (the preliminary agreement was signed in August 1985), but US/Mexican relations on other issues have been strained. Some industry observers say that has caused a further delay in the unrelated broadcasting agreement.

Once the agreement is signed, the Commission will then notify each station that it can add night operations, provided it has responded to the earlier show cause order.

"There is no substantive issue holding up the signing," NAB Legal Counsel Barry Umansky said. He added that daytimers are reporting night power levels in the same range as their lowest post-sunset authorization.

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## Opinion

# Readers' Forum

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### Poor marketing

Dear RW:

I know that the AM stereo controversy has been beat to death, but after reading John Cummata's recent column "Marketing Basic to Business" (RW, 15 March), I would like to add my thoughts to this subject.

About a year ago, I borrowed a Sony all-mode AM stereo receiver and spent a considerable time listening to the signals from several stations in the San Francisco bay area broadcasting in AM stereo (both Kahn and C-QUAM), at a distance from me of about 100 miles.

During daytime hours, I could not hear any difference between these competing systems.

At night, however, I found that the C-QUAM system is much more susceptible to propagation artifacts than is the independent sideband system. Therefore, in my opinion, the Kahn system has the advantage here.

Other engineers who have spent some time comparing the two systems usually share this opinion.

Yet, if you count the number of stations using the C-QUAM system as opposed to the Kahn system, as well as the selection of the C-QUAM system as a national standard by several foreign countries, it would seem that C-QUAM is fast becoming the de facto standard in the broadcast world.

This brings me to the thrust of Mr. Cummata's column, which points out the importance of product marketing.

Any good salesman will tell you that a good product can fail miserably in the marketplace due to poor marketing strategies, while an inferior competing product can be successful because of effective marketing.

I believe the apparent failure in the marketplace of the Kahn AM stereo system to be a good example of this. If you compare the marketing strategies of Kahn and Motorola, I think you will see my point.

In my opinion, Kahn Communications has conducted one of the poorest marketing programs imaginable, and the result is that their system, which many engineers consider superior, may not succeed in the marketplace. Mr. Kahn is a brilliant engineer who has developed some excellent products, but he should have left the marketing program for his AM stereo system to people who know how to mount a successful marketing campaign. He chose not to and is now facing the consequences.

There is a lesson for us in all of this. I was recently in the San Francisco area on business. I stopped in at four of the many large home entertainment equipment outlets there and asked them to show me some AM stereo equipment. Only one of the many salespeople I talked with was aware that there was such a thing.

(continued on page 6)

Daytimers faced with an extension in Daylight Savings Time (DST) are justifiably upset. A three-week extension in April will mean three weeks of lost morning drive time. Another extension in the fall could add a fourth week of dark mornings at a time when they are noticeably darker, even on DST.

Already faced with a hostile economic environment in the all-too-familiar AM versus FM war, this four-week period of artificially imposed dark will hurt in lost ratings and lost listeners, and only serves to highlight the disadvantages of being an AM daytime station.

Despite the all-out efforts of the NAB, the DST bills (one in each house of Congress) are similar enough and politically "safe" enough to almost ensure quick agreement and passage.

Looking to the FCC for action, the daytimers have found that research by the Commission on across-the-board or selective power increases, even if possible under rules governing its authority, would result in increased interference.

Or, as the FCC's Mass Media

Bureau Chief, Jim McKinney, put it: "The laws of physics are immutable." Since the AM band is already congested and suffering from adjacent channel interference far more than it should, any further power increase at an extra-early hour, such as 6 AM, would defeat the daytimers' purpose, and is a poor tradeoff for what is being lost.

The NAB should explore other solutions on the order of a political quid pro quo for daytimers to suggest to the FCC. These could come in the form of preferential processing of CP applications, a financial break on fees which will be charged to broadcasters beginning in 1987 to offset Commission costs, or some other area.

Short of a presidential veto or a sudden national proclivity for going to work an hour earlier during DST, fallout from the extension is a pending fact of life. Daytimers' interests are best served by seeking a tradeoff that, though it may not result in the usual numbers in AM drive time, will help daytimers advance their positioning in the marketplace.

—RW

# AM Improvement Lost Cause

by Bruce F. Elving

Adolph MN . . . Recent discussions on ways to save AM radio—including debate over different AM stereo systems, the FCC's action ending AM-FM program nonduplication rules and the proposal to explore AM synchronous transmitters—may all be for naught.

In publishing the "FM Atlas and Station Directory" the past 15 years, I've had a chance to talk to a wide variety of people in and about the industry, and to form a few opinions.

I developed a mild interest in FM at an early age. Maybe my father, having

Bruce F. Elving, an occasional RW contributor, has a PhD in instructional communications from Syracuse University. His 1986, Tenth edition, "FM Atlas and Station Directory," will be available shortly at \$8.95 plus 55 cents shipping. The book lists FM stations on maps and in directories according to geography and frequency. It lists FM station main channel programming, shows FM translators, and lists stations having a 67 or 92 kHz subcarrier. Write him at Box 24, Adolph MN 55701-0024; 218-879-7676.

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the initials F.M. Elving, had something to do with it.

As a college undergraduate some 30 years ago, I foresaw FM's ultimate dominance. A former professor, Dr. Robert Haakenson, now with Woehr Associates, consulting psychologists, Philadelphia, recently wrote: "... be sure someone trumpets your vision of FM's future. You are the only one I know who, at the time, accurately predicted the reality we now enjoy."

**Guest Editorial**

In a 1967 letter to another trade publication, I predicted FM would supplant AM, and compared AM to the 78-rpm phonograph record, which was then already obsolete.

Later, as a guest on author Harry Maynard's program, "Men of Hi Fi" on WNYC-FM New York, in 1977, I mentioned that FM would completely replace AM, just as had happened for such voice-only forms of communications as police and other point-to-point services.

Important as stereo, high fidelity and

wide-appeal programming are to FM, I believe the major thing going for the medium is that it resides in the very high frequency (VHF) portion of the spectrum.

Ed Montgomery, in the 1 April RW, summarizes the difference well: "VHF communications have proven to be quite a reliable form of transmission. Although FM transmission lacks the groundwave signal that AM has to promote reception, the smaller size of the antennas required to receive the FM signal makes FM radios ideal for installations on vehicles and aircraft."

"When the transmitting antenna is located high enough, a large area can be covered at these frequencies without interference associated with skywaves reflected back to earth at night in the medium wave band."

(The article, however, is a little inaccurate in ascribing tropo ducting for extremely long FM reception paths. Reception at distances over 1,200 km on FM frequencies is usually caused by sporadic-E skip, which is at its annual peak during daytime hours in May, June and July. For more information on FM

(continued on page 7)

# 'Dear Radio World:'

(continued from page 5)

As you can imagine, I was amazed that in a market the size of the San Francisco Bay Area, where AM stereo broadcasts are readily available, the radio listeners are not aware that this is the case.

I am convinced that if we want AM stereo to survive at all, we must stop arguing about which system is the best and put our energies into an aggressive marketing campaign to sell the AM stereo concept to the listening public. If we don't, we will face the consequences.

F. William Rett  
Chief Operator, KXBK/KWTR  
Lakeport, CA

## Pirate's view

Dear RW:

I am appalled at your apparent anti-pirate stance (FCC Clips, 15 February).

I have been a radio pirate most of my life, although now I'm trying to go legit. Some of my broadcasting highlights include: running messages for the US Army hometown news service during the height of the Vietnam war, so families in my coverage area could hear their sons and know that they were still alive. You'd have messages like, "Hey, Ma, I wish I was home!" and in the background you'd hear KABOOM! It was enough to make you all misty.

Not only did the families thank me,

but one morning early (6 AM), I got a call from the Army thanking me for being the only station in Los Angeles to carry their service. The *only* station! I was proud, and perplexed. I guess other stations were too busy making money.

My investigative reporting revealed that during the course of two years, three people were murdered in a gay bar in San Francisco. It was obvious to me that the killer was a person who frequented that bar, but no radio station, or even the police, knew that information. That newscast apparently caused enough calls to the police department to cause them to investigate and apprehend the killer. Too bad there wasn't a reward.

Speaking of gay people, did you know that at this writing in San Francisco there are approximately 30 people dying from AIDS who have handcuffed each other to the doors of the Federal building? They've been there for something like 150 days now, sleeping in tents at night, and by day battling drunks, punks, street people, the elements, and their terminal disease—and not one radio station, or TV station could give a damn! They're more interested in reporting Scare Tactic headlines, like "100 people diagnosed with AIDS this week." There ought to be a law!

Or, how about Adam Clayton Powell, Jr., who buys a station in SF for \$2 million, runs it for a month, never pays

anybody, goes bankrupt, stays off the air for 5 months, and sells it back for \$5 mil, with a profit of \$3 mil.

Is this right? I know a lot of people who are pirates who could serve the public better!

There are many pirates like me—who can develop meaningful programs without interfering by using open channels and professional or homemade equipment—but who can't afford a f—g piece of paper!

Somewhere I read that the airwaves belong to the public. Maybe the FCC should change that to ... belong to the public *for a price*. What's the difference between here and Russia? If the FCC had any sense, they'd OK the proposed 1605-1705 kHz for pirates who can't afford the \$30,000 lawyer fee, per hearing.

Name withheld for obvious reasons  
San Francisco, CA

## Testimonial

Dear RW:

I read Readers' Forum, from the 1 April issue, pertaining to AM stereo.

I do not claim to be an engineer, but I do have good hearing. My ears tell me the C-QUAM stereo system is a good one.

Let me fill you in on our station. We are a 1 kW, 24-hour station on a local channel. Our transmitter is located atop Look Out Mountain with a tower height of 202'.

We recently installed the C-QUAM stereo system and we've never had a sec-

ond thought about doing it. We have yet to experience any of the problems the Forum writers have indicated.

If anyone asks me for my suggestions on how to improve the sound of an AM station, my answer is C-QUAM stereo and Optimod-AM for the best possible sound.

Chris C. Folsom  
WFPA  
Ft. Payne, AL

## Sage?

Dear RW:

Enuff is enuff already!! It was back in "ought eight," I think, or does it just *seeem* that long ago, that we all gathered in those smoke-filled rooms and listened to the many tirades about Leonard's magnificent machine ... usually given by Leonard himself.

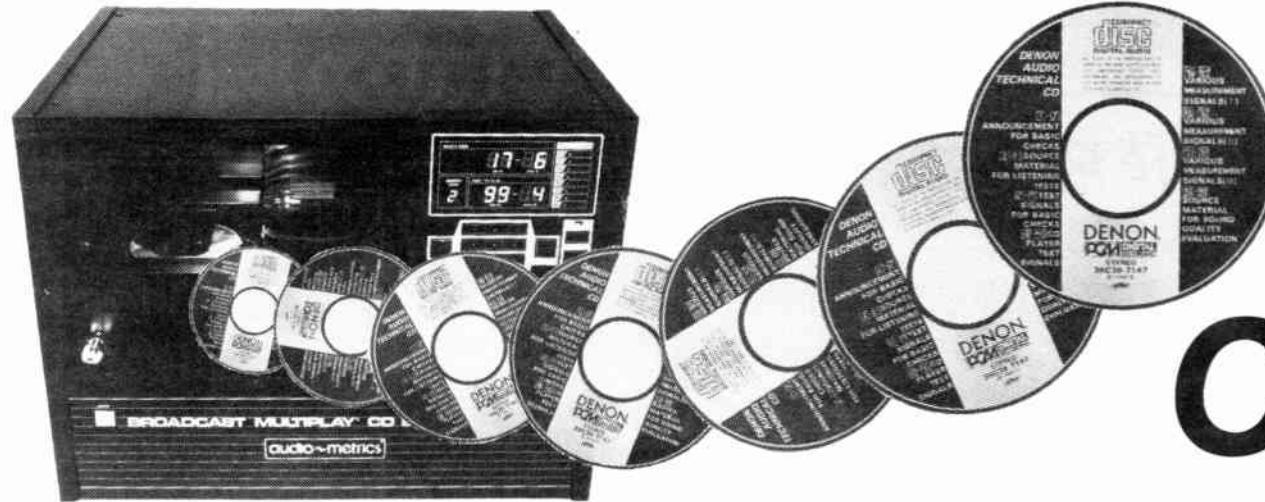
Finally we stopped hearing from Leonard, or at least I did, because after about five years of hearing the same harangue, I quit attending those smoke-filled sessions.

Then the deluge began in the various periodicals I read. You guessed it ... from everybody that had *bought* Leonard's magnificent machine. New words like "platmo" were being coined by "fully qualified engineers" who were almost deaf. Overnight, the newest miracle piece of precision test equipment became the SRF-A100.

Now comes Gerald M. Lebow (RW Guest Editorial, 15 April). This "Execu-

(continued on page 7)

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# AM Improvement Lost Cause

(continued from page 5)

DX, write the nonprofit Worldwide TV-FM DX Association, PO Box 514, Buffalo NY 14205-0514. Send \$1.50 for a sample of their monthly bulletin, or \$15 a year's membership.)

Our interest in nostalgia notwithstanding, Americans will not go back to AM, which languished for decades in its shadow, is destined to not just dominate radio broadcasting, but to take a rightful place as the only purveyor of broadcast communications worldwide (save perhaps for international shortwave broadcasting). Thinking that "it does not matter whether it is AM or FM, the important thing is that it is Radio," is a fallacy that has been embraced not just by radio management and by the regulators, but unfortunately by the engineering community.

We are accustomed to driving the freeways, under overpasses, on steel bridges and through short tunnels and enjoying our FM radios. No longer need we be content with an inferior system that is subject to interference from other stations, from the roadway signal washouts and from "static" received from both natural and manmade sources.

Where FM needs help in covering difficult reception areas, there are translators and boosters that can be legally utilized. People who live in the suburbs, as well as the large group of people who have moved back to the country, do not want a system that will bring interfering stations through their local programming.

Too, the idiosyncrasies of directional antennae at a high proportion of AM stations, daytime operation and presunrise powers often of just a few watts militate against the older medium.

Once the broadcasting community perceives the inevitable, it can then do

something about it. A solution I see is for AM broadcasters to cooperate with nearby FM or TV stations and send their programming out via subcarrier.

In deregulating FM-SCA, or "SCS" (Subsidiary Communications Services), the FCC gave each FM station at least two subcarriers in addition to its stereo main carrier. It also deregulated the aural basebands of television stations, creating a "Secondary Audio Program" at 78.67 kHz and a "professional channel" at

102.271 kHz. While receivers for these services generally are not in the public's hands, they could be, if the industry were to work toward such a goal.

By going to SCS, AM programming will finally be found on VHF (or in some instances, UHF) in a way that promotes frequency efficiency far more than having AM and FM stations duplicate each other.

The idea is not as far-fetched as it may seem. Already some AM stations are

sending out their programs on FM subcarriers. Some use it for sports relay; others to enable outlying cable systems to pick up the AM programming, and then the cable system processes the AM signal and sends it out on a cable FM channel.

Survival is the name of the game in AM radio. You may read this and regard it as something from an FM zealot, which of course, I am. However, the sooner the industry works toward achieving full VHF distribution for what was once known as AM radio, the sooner, and the only way, I perceive, broadcasters' investment in AM stations will be, in any measure, protected.

## 'Dear Radio World:' Continued . . .

(continued from page 6)

tive VP" must have the same feeling of omnipotence that the Irish have every March 17th and Texans have all year round. I mean, if ABC News is "uniquely qualified to bring you the world," Mr. Lebow is surely "uniquely qualified to determine who is and isn't a knowledgeable engineer."

Let's quote paragraph four . . . "Since all knowledgeable engineers and virtually all of the major broadcast groups have already decided that the Kahn/Hazeltine system is technically superior, let's take the final step and move forward with it."

Can you imagine my dilemma? After installing, or advising to have installed, several of those "other" systems, I must now call these stations and tell them they can't move forward because they didn't retain a "knowledgeable engineer." Imagine the dilemma of Jack Layton of KDKA-AM in Pittsburgh. He must explain why KDKA can no longer be included in one of the "major broadcast groups" of our nation.

Yes, Mr. Lebow, you are unique. Only, in your case, that word stems

from the Latin words "uni," meaning "one," and "eek," meaning "horse."

It dumbfounds me how you could ever be connected with anything that's sage.

Wm. L. (Bill) Spitzer  
WLS Communications  
Rapid City, SD

FMX fan

Dear RW:

Hooray for CBS.

I think CBS Technological Laboratories deserve credit again—this time for the new FMX transmission and receiving equipment. This is not just another noise reduction system.

Having been in the recording business for 17 years, I am an avid supporter of

CBS products. As an engineer, I have used SQ (Quadraphonic) encoding/decoding processing gear and CX (Compatible Expansion) encoding/decoding systems.

I would like to be the first consumer to purchase an FMX encoded receiver or FMX auto sound system.

We need actual audio comparisons and tests between Dolby "FM" versus FMX transmission and decoding equipment.

Another thought comes to my mind about the consumer. Who will purchase these FMX decoding systems, except we recording enthusiasts and broadcast engineers?

David S. Pulwers  
Dave's Price Audio Productions  
Alexandria, VA

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# CCIR 57 kHz Stand Pleases US

by David Hughes

**Washington DC . . .** Both US and European officials appear to be satisfied with the International Radio Consultative Committee's (CCIR) adoption of a 57 kHz FM subcarrier (SCA) standard for data transmission.

While the CCIR, at its plenary assembly in May, approved the 57 kHz European Broadcasting Union (EBU)-backed subcarrier standard (called the Radio

Data System, or RDS), the international standards setting group also attached a footnote to its final adoption which recognized that the standard may not be applicable outside Europe.

US officials were concerned about the adoption of a SCA standard here because the FCC has essentially deregulated subcarrier operation. US stations commonly utilize other noncompatible subcarrier frequencies, such as 67 and 92 kHz, in addition to the RDS 57 kHz.

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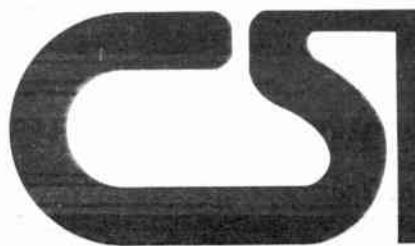
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CSI is celebrating its 10th anniversary this year and now is part of the Cutler-Federal family of companies, headquartered in Lakeland, Florida.



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Circle Reader Service 12 on Page 28

According to NAB Engineer Ralph Justus, who serves as chairman of CCIR Working Group 10-B, which deals with FM (VHF) radio, the footnote said: "Some administrations outside of Region 1 (Europe) still have some of these (SCA

"

*The footnote  
satisfies the US  
and (the FCC's)  
deregulatory  
stance.*

standards) issues under study and require more time before they can accept this recommendation."

### Satisfies US stance

The CCIR's action, which caps its latest four-year standards-setting cycle, recognized the US situation, Justus said.

"The footnote satisfies the US and (the FCC's) deregulatory stance," he added.

While the RDS standard would not be appropriate here, US officials also did not want to "hold up the Europeans' development of the standard,"

Justus said.

Even if the standard was adopted without the footnote, it could not be enforced in the US, he added. "It would be ridiculous."

Justus said that the CCIR also noted opposition to the standard from nations that do not use the Roman alphabet, notably Japan and Middle Eastern countries. Japanese and Arabic script are said to be incompatible with RDS.

### History

The US CCIR committee voted April to submit the footnote plan at CCIR's plenary assembly meeting, which was held in May in Dubrovnik, Yugoslavia. Justus' 10-B study group tackled the issue in March.

According to FCC official Neil McNaughton, chairman of CCIR Study Group 10, parent of 10-B, US officials examined the possibility of downgrading the standard recommendation to a "report."

However, one 10-B participant said that "it would look bad" if the US had, at the last minute and after several years of European studies into the SCA standard, "dug in its heels and opposed the standard."

The situation existed, the participant added, because the US last year was not keeping close watch when the 57 kHz "signaling protocol" SCA standard was being developed, especially with its application to data transmission.

For more information, contact Ralph Justus at the NAB: 202-429-5346.

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Circle Reader Service 40 on Page 28

# Earth Station Dereg Continues

by David Hughes

**Washington DC ...** The Commission has issued a second order on its plan to deregulate licensing rules for receive-only satellite earth stations.

The first order in the issue, implemented several years ago, made the Commission's licensing program for receive-only earth stations voluntary. The FCC also streamlined its licensing procedures for those who want to obtain a license at that time.

The licensing program was directed toward providing interference protection to particular earth stations. Radio stations that utilize FCC licensed earth stations for programming services are protected from future causes of interference.

In the latest order, released in April, the FCC said that still more streamlining is needed. It wants to "improve the effectiveness of ... (the) receive-only earth station licensing program through the elimination of unnecessary regulatory policies."

This second order examines problems that have developed with the "optional licensing program," with a goal of eliminating additional application requirements, the Commission said.

The changes, which took effect 19 May, include the removal of a rule that requires applicants for a license to submit a performance analysis with their receive-only earth station application. The FCC also agreed to routinely license small diameter antennas, such as 1.2 meter equipment.

The FCC, in the order, also said it will not require or accept applications for any receive-only facility in the 12 GHz band.

Also, processing of receive-only earth

station license modifications for "minor modifications ... that do not change the degree of agreed-upon terrestrial interference protection" will not be handled any more.

However, changes for major technical modifications related to "interference protection" will continue to be processed.

The Commission said it will issue a public notice on the various filing requirements involving receive-only facilities. "No new information will be requested, and in most cases we are now

requiring less information than before."

Despite the changes, the FCC maintained that it still supports the voluntary licensing program.

"A fundamental part of the licensing program is the frequency coordination process which provides the means for protecting proposed earth station sites from interference caused by terrestrial point-to-point microwave transmitters," the FCC said in the order.

"We have previously recognized the effectiveness of this progress in achiev-

ing its objective and no parties have questioned its efficacy," the Commission added.

The FCC said it will continue to specify the "particulars of operations" for the basic emissions and frequency band coordination, such as ranges involving azimuths, antenna elevation angles and satellite longitudes.

Docket number is CC 78-374. For more information, contact the FCC's Common Carrier Bureau at 202-632-7553.

## FCC OKs RCA Transfer to GE

by Edward Wytkind

**Washington DC ...** The FCC has authorized the transfer of RCA Corporation and its wholly-owned subsidiaries, including the NBC network, to General Electric Company (GE).

This action, taken 5 June, followed an announcement in late May by the US Justice Department's Antitrust Division that it would not block the proposed \$6.46 billion merger.

The proposed merger was announced by both companies 11 December 1985, following a \$66.50 per share offer by GE for RCA's common stock. RCA's stockholders approved the acquisition 13 February 1986.

In approving the merger, the FCC also rejected petitions to deny the transfer of control to GE filed by Wilbert Tatum, chairman of the board of the New York Amsterdam News and Western Slope Communications, Anthony Martin-Trigona and John S. Shipp.

The petitions, among other concerns,

alleged that the proposed transfer violates certain aspects of the Communications Act, and that GE does not have the "requisite character qualifications to be a (broadcast) licensee," according to the FCC.

The Commission said it investigated the allegations and found them to be "incorrect."

The FCC also ordered the Fairfield, CT-based GE to sell, within 18 months, NBC's WNBC-AM and WNYN-FM, New York, WMAQ-AM and WKQX-FM, Chicago, and WKYS-FM, Washington, DC. FCC rules prohibit ownership of a radio and television station in the

same market.

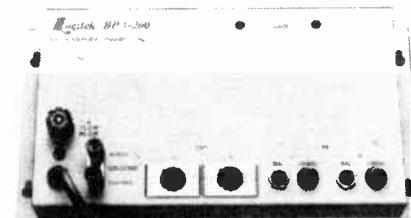
In a related matter, the Justice Department found GE's vidicon (TV camera tubes) business to "conflict" with RCA's camera tube business, in a ruling late May, according to GE spokesperson Samuel Egbert.

However, without saying whether GE is in the process of divesting its Owensboro, KY-based vidicon business, Egbert said, "we'll do whatever the Justice Department tells us to do."

Justice Department officials could not be reached for comment.

For more information, call Alan Glasser at the FCC: 202-632-6357.

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# Looking Back at AM Missives

by Mark Durenberger

**Minneapolis MN . . .** A reader suggested we look back at some early columns to see if any of them "still made sense." She was wondering if AM as a dying (or emerging?) medium was viewed differently today from the way we saw it just a few years ago.

## Engineering Views

In response, I quote from a February 1982 column:

"How come no one ever talks about the romance of long-distance AM at night? What a gas it is to be tooling down the Interstate at 2 AM listening to a French-Canadian jazz station slowly fade into a high-energy rocker from Tampa.

"The very sound of slow fading and sporadic E-skip adds a dimension you can only appreciate at night in the auto. FM is way too predictable and almost all music!"

"Go up and down an AM dial these nights and you'll find few music stations.

**Mark Durenberger** is a senior RW columnist and director of Technical Development for Hubbard Broadcasting, Inc. His phone number is 612-642-4257.

It's kind of interesting to hear the various sounds of news/talk stations which help the miles go by; but there's nothing as much fun as hearing Willie Nelson booming through the night, rolling over the countryside, 2000 miles from that mighty Clear. You feel a kinship with all the truckers on the road and even the sometimes-hIDEOUS processing doesn't seem to matter."

Not too much has changed since I wrote that, though many of you will agree AM audio has gotten a whole lot better, and there are some very nice-sounding AM stereo stations on the air.

"And hello FM!"

That same column steals a bit from Lloyd Hall's approach: "Early FM had romance, too. Remember the simulcast stations put up after WWII? 'Hello, and Hello FM!' A lot of AM stations finally returned their FM licenses to the FCC. Often those self-supporters made lousy AM radio but were great for FM support. A lot of AM stations destroyed their AM coverage area by installing super-tall self-supporters as AM towers with FM atop.

"I mentioned . . . some of the fun we had doing early AM/FM or AM/AM stereo. That was done one channel on each station!

"My 'Elmer' was Chief Engineer of KFAM/St. Cloud, Minn. Bob Witschen

designed his new studios for stereo, and when his station installed an FM transmitter, Bob did live AM/FM stereo from that studio!

"His was an early high-power FM station, and it was one of the few we could



*How come no one  
ever talks about  
the romance of  
long-distance AM  
at night?*

get with our yagis on rotors. There were few stations on the air in the late '40s, and a 100-mile reception report was a sought-after prize."

I said this in 1982 and still mean it: "As regards topics for this territory of Radio World, perhaps you've missed our cries for ideas. It may be we've given you all the technical telephone info you need for a while.

"There may be, however, an area we have missed. I hereby challenge you: if you can come up with a hot idea worth discussing, something that really appears

interesting, I'll gladly research it and discuss all over this column. Let me know."

So . . . let us know!

### Updates and miscellany

A quick note to update you on our Santa Fe AM Synchronous Booster project: We're awaiting FCC processing, just behind a Seattle, Wash. station.

As of mid-June, I understand a Hawaiian station has applied. Stay tuned to this column for the latest.

We'll all soon be reading about Bill Ruck's forays into the performance standards of the new telephone company and the very real problems encountered in trying to exact realistic distortion figures from equalized program channels funnelled through the new digital hierarchy. It's enough to make a mother (Ma Bell?) cry.

Bill's Bell findings and frustrations will fill a future column or two.

A quick reminder is in order in making your plans for the several fall technical shows. Michael Rau of NAB tells me the radio show in New Orleans is going to be an "all-stops-out" barnburner with a lot for engineers.

The SBE National Convention is slated for St. Louis, and the 32nd annual Broadcasters Clinic for Madison, Wisc. These, alongside the IBC in England, the IEEE Broadcast Symposium, and state and regional conferences, make this a helluva fall for convention choices. Hope you've made yours by now, and that you're attending as many shows as possible.

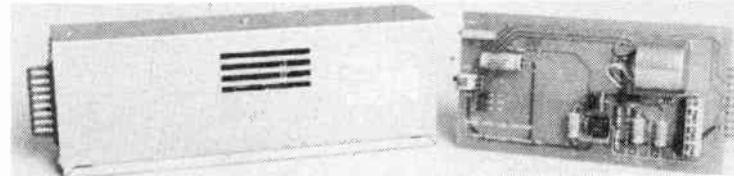
## New Problem Solvers Available from Northeast

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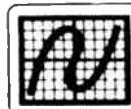


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# Harris Offers Hands-On Help

by Peter O. Swanson

**Boston MA . . .** If you heard of a low-cost option for your station's transmitter that could cut downtime, maximize operating efficiency and streamline the maintenance process while increasing your understanding of your rig, would you be interested?

Harris Corporation, makers of widely used broadcast transmitters and equipment, offers such an option for their customers. The Harris Broadcast Technology Learning Center, located at their Quincy, IL factory, offers intensive, high-quality courses that are custom tailored to each type of transmitter they offer.

The courses typically consist of a full week of classroom and hands-on instruction.

Included in the cost of the course is a full set of documentation (both operating manuals and prints) for your particular equipment that you can take notes on and mark up to your heart's content.

Supplemental materials may include papers explaining unique principles (such as pulse duration modulation or progressive series modulation) employed in the particular model you are studying, and extensive tips on extending tube life.

I have had the good fortune to attend two Harris courses. The first dealt with the Harris FM-25K transmitter and the MS/MX-15 FM excitors usually paired with it. Our group of eight students was divided equally between engineers already using FM-25s and those about to install them.

The quality of instruction was excel-

lent. Every single circuit in the exciter and transmitter was explained down to the component level.

Questions, both "real world" and theoretical, were addressed as they came up. If the instructor felt he might not have fully answered an inquiry, he'd arrange for another Harris staffer more familiar with that particular "wrinkle" to meet with the class. Having the full resources of the Harris factory people backing up this high level of instruction was invaluable.

What specifically can the school do for you? One of the 'Catch-22s' of having quality broadcast equipment that seldom fails is that, when it finally does need repair, you may lack the familiarity with the particular circuit or hardware that's in trouble. Precious time gets wasted when you can least afford it.

While studying the theoretical side of the Harris equipment, you also are given an opportunity for some practical hands-on experience without having to take your rig off the air to do it.

Example? At the session I attended, an FM-25K and dummy load were set up in an adjoining classroom for us to take apart and troubleshoot. Each member of the class got to tune right into the dummy and get a feel for how a properly running unit behaved.

Our instructor then had us leave the room while he booby trapped the rig. We then got to fix the bugs he'd planted in the transmitter. We repeated this process for several "failures."

We had opportunities few would be able to take using their own on-air rigs to pull things apart just to see how they work.

The MW-50 series course was conducted in a similar fashion, but with a "baby" MW-50. A 10 kW version of their

PDM series of transmitters that employ identical PC boards and setup procedures for the PDM stages served as our guinea pig.

Hands-on learning provided what reading and listening couldn't alone.

During a typical week at the school, several guest lecturers from Harris' Customer Service and Field Service departments offer insight into the day-to-day workings of the equipment. They know what's happening in the real world, and offer much support in handling preventive maintenance and repairs.

For instance, the various ways Harris Customer Service has of getting needed parts to a customer is discussed. Depending on the urgency with which you need a replacement part, options run from ordinary UPS shipment to having a chartered airplane run a part from Quincy to Chicago or St. Louis, or getting the part a "seat" on a commercial flight headed near your city/town.

They explained the relationship between timeliness versus cost in using various carriers, information which is useful

for future decision making.

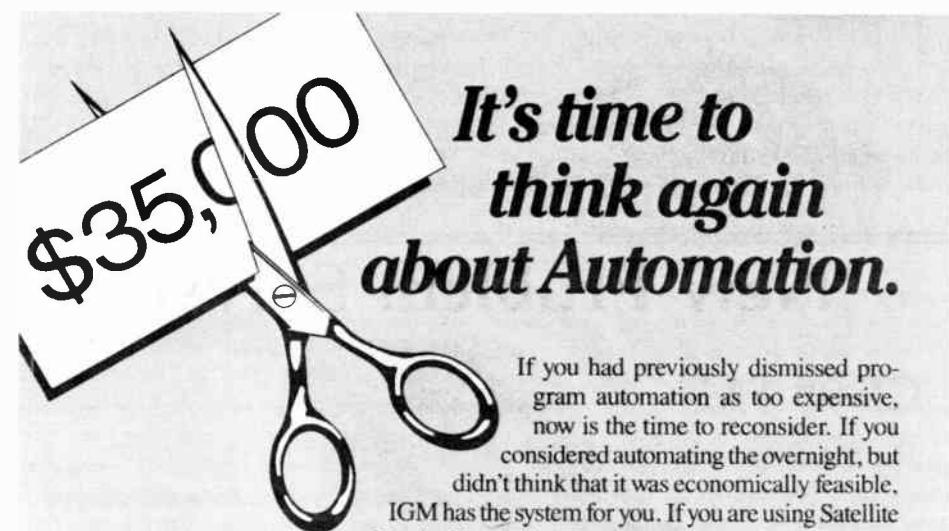
For further appreciation of the workings of your rig and of Harris' pride in its products comes with the factory tour that is part of your week in Quincy.

If you are working with a Harris transmitter (or other major broadcast system) and haven't taken the course covering that particular model, you should seriously consider doing so.

The courses are reasonably priced (\$450-\$650 for the week's instruction and materials). I suspect Harris runs the program more as a convenience to their customers than as a profit-making venture.

Discounted motel room rates are available in Quincy for participants in the programs. Connecting flights can be made between Quincy's own airport and both St. Louis and Chicago airports. Harris provides a package of maps and information covering local accommodations, car rentals, restaurants, etc.

Take the opportunity to broaden your knowledge of the gear your station's revenues depend on—it will be time and money well spent.



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**POTOMAC INSTRUMENTS**

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# EBS Messages Auto-Recorded

by Ronald F. Balonis

**Wilkes-Barre PA ...** The Emergency Broadcast System (EBS) remains one of the few FCC-regulated areas left that is still carefully defined in how it is to be done. Despite that, EBS works, as intended, most of the time.

Ron Balonis is CE at WILK, Wilkes-Barre and a frequent contributor to RW. He can be reached at 717-824-4666.

As a system, EBS is quite complex, with many, many equipment specs and procedures that have to work for it to function. Even when all the equipment works, the system can fail because of a non-EBS equipment fault elsewhere in a station, especially, it seems, in the confusing and tense *what-to-do?* moments after the EBS Alert sounds.

The EBS rules or procedures fail to account for one prime factor in radio today. The modern radio announcer/

operator has the task of juggling four or five tasks at the same time (it comes with the job), and waiting around for an EBS Alert is only one of them. Getting the EBS message taped or written down for rebroadcast, in a 'drop-everything-else' moment's notice, can be a weak link in the EBS message distribution daisy chain.

This is a problem that begs for a solution other than that of finding fault with the system, the procedures or the equipment; yet a solution is so obvious that it's a wonder the FCC didn't initially build it in.

The solution for the weak EBS message link is to set up the EBS equipment so that EBS DECODER'S ALERT will automatically record the EBS messages.

The diagram (Figure 1) shows my EBS message tape recorder control circuit. The circuit's relay electrically latches on

when the EBS decoder detects the two-tone Emergency Action Notification, and remains on until manually reset, even when the EBS decoder has been reset.

The cassette recorder's input connects to a 'live-all-the-time' audio point in the EBS receiver, so that the cassette will record when the decoder is reset and enable testing of the cassette recorder and the circuit.

Automatic EBS message recording adds another level of complexity to the station's EBS equipment because the tape recorder and the control unit must be checked and tested so that they don't also become a weak link.

In addition, there is another button for the announcer to press to reset the EBS equipment.

However, as insurance against the weak EBS message link, it's well worth it. It also provides a record of the routine EBS tests that are received, so that the reason for the ones that aren't logged can now be quickly determined.

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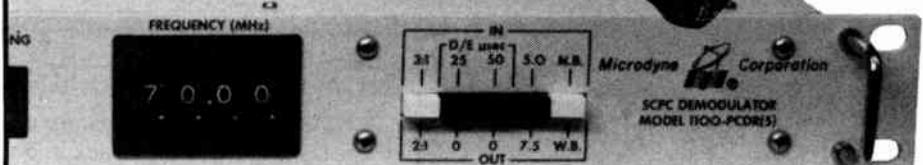
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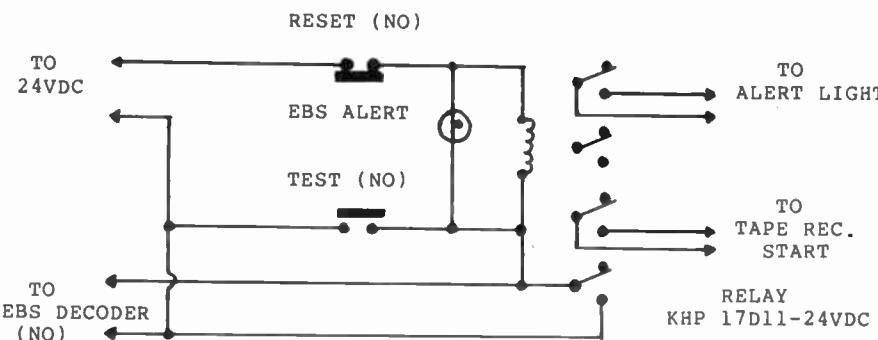
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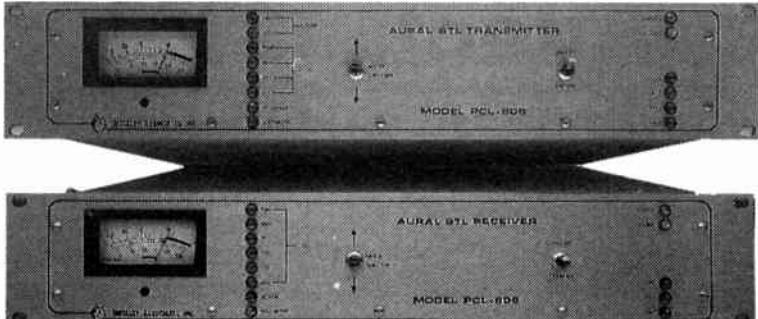


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Figure 1. EBS Message Tape Recorder Control Circuit.



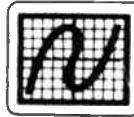
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# Cart, Time, Phase Links Vital

by John "Q" Shepler

**Rockford IL ...** This column is about time, frequency and cart machines.

Perhaps it may seem odd to discuss all three at the same time. Nevertheless, they do come together in all tape equipment. Understanding the relationship is the key to solving the problems of poor separation and stereo/mono incompatibility.

Let me begin with this statement: *Time is Frequency*. I'll illustrate the point with the simple sine wave in Figure 1.

**Q-**

**Tips**

A sine wave is only a sine wave because we choose to picture it that way. Say you have a center-zero voltmeter and you connect it to a sine wave generator with a frequency of 1 Hz. If you watch the meter, do you see a sine wave? No.

What you see is a meter with the pointer moving back and forth. That's because the generator output is a varying voltage level, not a wave of any sort.

Now, increase the frequency of the generator to 1 kHz and connect it to an oscilloscope. Do you see a sine wave? Well, it looks like a sine wave.

The point is that we are accustomed to picturing audio waveforms just like they would appear on a specialized instrument, the oscilloscope.

What is unique about a scope is that the picture we take for granted is a varying voltage displayed with respect to

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

time. We talk about cycles which are complete repetitions of the wave shape, but each cycle is also a definite unit of time.

If you use the familiar equation:  $t=1/f$ , it is easy to figure out that a cycle of 1 kHz is the same as 1 msec.

Now, let's look at two sine waves of the same frequency. Time is the same for each waveform.

If they are synchronized, they will be at the same voltage at any given instant of time.

If they are of the same amplitude, you can connect a voltmeter, one signal to each lead, and the voltmeter will read 0. Synchronized waveforms are said to be in phase.

Figure 2 shows a classic problem with stereo tape. Two signals which are in phase on the tape tracks become out of phase after pickup by the tape head.

The quick reply is that the skew is caused by head misalignment, specifically azimuth.

Now, azimuth is nothing more than a side-to-side rocking of the tape head in its mount. So why does that create a phase problem?

You have to look closely at the head to see the answer. The tape head is really two independent magnetic pickups mounted together for convenience. By definition, the head is aligned when the two pickups are exactly on top of each other. A line perpendicular to the deck of the cart machine would run through the center of the pickups.

That's how standard tapes are created. The head of the recorder is mechanically aligned so that it is perfectly square with the pickups on top of each other. A single sine wave is fed to the two chan-

Figure 1.

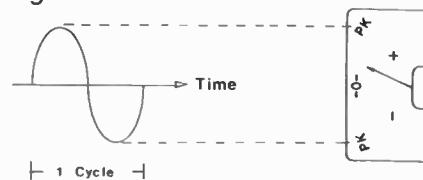


Figure 2.

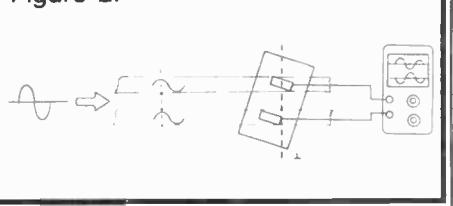
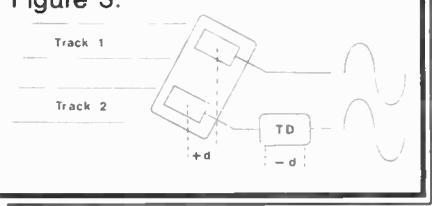


Figure 3.



nels of the head and recorded on a master tape.

If the playback head is also mechanically aligned, the reproduced sine waves should be exactly in phase.

The problem occurs when the head gets bumped or works its way into a different position. Now, the pickups are offset from each other so that one channel on the tape gets picked up before the other. The output of the cart preamps shows the waveforms out of phase.

This situation can be rectified easily enough. Get out your Allen wrench and tweak the head back into correct mechanical alignment. You'll know when you've succeeded because the output signals will show up in phase on the scope.

But what if the problem is in the record head? The cartridges may have been recorded on many machines, each with a slightly different head positioning. The tape itself may be slightly skewed. Is it really practical to re-align the playback head for each cartridge?

I'll digress for just a second to talk about a mechanical solution to this dilemma. What ITC has done is to assume the playback head is correctly aligned and then to adjust the record head azimuth until the output is in phase.

A microprocessor-controlled motorized head mount rocks the head back and forth until tones recorded on the cartridge are considered in-phase by phase

detection circuits connected to the playback amplifiers.

It works. In fact, it works great. However, once the alignment has been determined mechanically, there are no further compensations. If the tape jitters or if the playback heads get out of alignment, there is no automatic way to fix the problem with this scheme.

At this point, the relationship between time, frequency and phase suggests other ways to solve the alignment problem.

Consider again the out-of-alignment tape head in Figure 2. With the head tilted, you can see that the pickups are no longer on top of each other. If you measure horizontally, there is some distance ( $d$ ) between the pole gaps where the pickup occurs.

Remember the simple formula,  $t=1/f$ , that relates time and frequency. There is another simple formula  $t=d/r$ , that relates time and distance.

Let's assume the tape is moving past the head at 7.5 ips. Let's also assume two sine waves of 15 kHz were recorded on that tape exactly in phase. The time for a 15,000 cycle per second signal to complete one cycle is  $1/15000$  or 0.0666 msec. A half cycle takes 0.0333 msec.

This is where phase comes in. If frequency can be converted to time, so can portions of cycles. Usually, portions of cycles are measured in phase angles of  $0^\circ$  to  $360^\circ$ . You can talk of phase in degrees regardless of frequency, since phase is only valid on signals of the same frequency, or multiples of that frequency.

If the frequency is known, the time per cycle is also known. In this case, it is 0.0666 msec for  $360^\circ$  or 1 cycle. Half a cycle, or  $180^\circ$ , is 0.0333 msec. Thus, phase can also be described in terms of time.

Back to the tape head. The tape is moving 7.5 ips, so if the distance between the pole gaps is 0.00025 inches (250  $\mu$ in), the tape will cover that distance in 0.0333 msec, which represents  $180^\circ$  of a 15 kHz waveform.

Thus, the time elapsed between the taped signals getting to their respective head pickups causes the resulting outputs to be out of phase. This implies that if there were some way to adjust time, the two signals could be put back in phase.

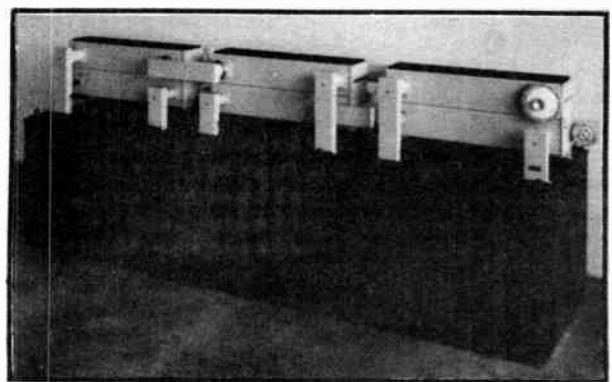
It isn't possible to speed up time to get the lagging waveform back in phase with the leading channel. However, it is possi-

(continued on page 14)

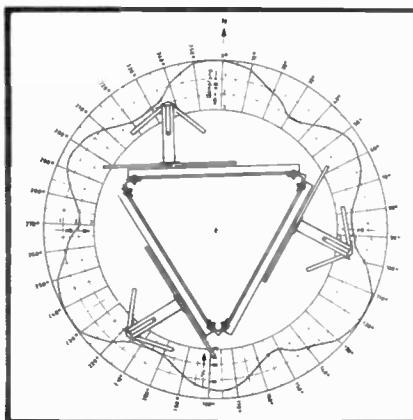
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# Cart, Time, Phase Links Vital

(continued from page 13)

ble to delay the leading channel until it matches the lagging channel. Figure 3 shows how this is done.

An electronic time delay, such as the type used in reverbs and talk show delays, is placed in series with the leading channel. The amount of delay is adjusted until track 1 and track 2 are in phase.

Adjustable-digital or bucket-brigade time delays are readily available. The trick is to know how much delay to add, and to which channel. To avoid guess-work, time delays can be added to both channels, with one TD set to a certain number of microseconds and the other varying from 0 to several thousand microseconds to correct early- or late-arriving signals.

The Howe Phase Chaser uses a circuit called a cross-correlator to determine whether the channels are in phase.

The cross correlator looks at the left and right channels like you would on a scope. It looks for a pattern of phase difference between channels over a wide frequency range.

If a time difference is caused by and

out-of-azimuth head, the phase difference will increase with frequency. (Normal stereo phase variations are more random, and will not show this pattern.) The Phase Chaser adjusts the time delays until the pattern disappears.

The Ramko PhaseMaster works differently. Part of the left channel audio is recorded on the cue track. The approach here is that, if the head is tilted, the cue track pickup will be out of alignment with the left and right channels, just as the latter are out of alignment with each other.

This system is more methodical, since it is comparing two supposedly in-phase signals to make the time delay adjustments. There is no correlation circuit that tries to decide if the phase problem is misalignment or normal stereo.

However, the PhaseMaster circuit must be incorporated in each cart machine. One Howe Phase Chaser may be installed downstream to correct the mix from many potentially out-of-phase machines.

A third approach is the Harris ATBC or Audio Time Base Corrector. Harris

superimposes a modulated high frequency tone on the left and right channels during the recording process. The alignment tone is at 19 kHz, so it is easy to filter out before transmission.

A single decoder and time delay adjustment circuit compares the phase of the 300 Hz modulation signals on the 19 kHz alignment tone and adjusts the channel time delays. Since the tones are part of the audio on the cart, any head misalignment or tape jitter will affect the alignment tones the same way as the audio.

While there are competing methodologies for determining how much of a phase problem exists, the three systems just described have a common goal. That goal is to correct a mechanical misalignment problem by electronic means.

Perhaps a sophisticated RC phase shift circuit could be designed in lieu of the digital time delay approach.

However, a RC filter also works in terms of time. Anyone who has built a neon relaxation oscillator or 555 timer circuit knows that time is a fundamental part of any physical process, be it the mechanics of tape movement or the electronics of charge flow. Understanding the involvement of time suggests new ways of solving old problems.

## Canadian Clear Status

(continued from page 1)

no need for the nontechnical (minority) criteria. We didn't abandon anything."

To prove the FCC's point, he said that since the seven Canadian clear channels were opened last fall, only one application has been filed for a new station. "There may not be room for the number of stations the NBMC argued," Silberman added.

He said that the court agreed that "fair notice" was not given regarding the elimination of the nontechnical criteria, but he added that the court did not address the "merits" of the FCC's clear channel order.

NBMC Counsel David Honig could

not be reached for comment.

The Commission will have to issue another report on the docket that would solicit comments on whether to include a procedure for minority and noncommercial applicants for new stations on the affected clear channels addressed by the docket, Umansky said.

"It would require another phase of the rulemaking," he said.

According to Silberman, a further rulemaking proposal will be issued on the docket in the next few months.

For more information, contact David Silberman at the FCC: 202-632-7112, or Barry Umansky at the NAB: 202-429-5430.

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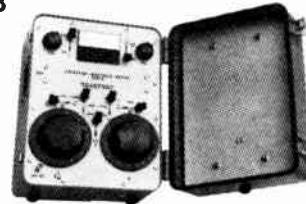


The RG-4 combines high level output (10 VRMS) capacity with a sensitive receiver (5 micro V) and more than 120 dB receiver/generator isolation.

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OIB-1

The Operating Impedance Bridge measures the impedance of networks, radiators, and the like while they operate under full power. VSWR as well as complex impedance of up to 400 ohms  $\pm j300$  ohms can be measured.

- Frequency Range: 500 kHz to 5 MHz
- Through Power Rating: 5 kW Modulated 10 kW Carrier only
- Accuracy: R and X, 2%,  $\pm 1$  ohm
- Direct Reading in R:

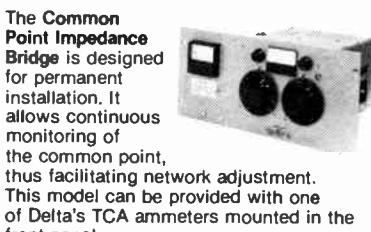
  - 400 to +400 ohms, standard
  - 1000 to +1000 ohms, optional

- Direct Reading in X:

  - 300 to +300 ohms, standard
  - 900 to +900 ohms, optional

- Measures VSWR:  $Z_0 = 0$  to 400 ohms

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- CPB-1A, 50 kW
- Resistance Measurements: 30 to 100 ohms Range  $\pm 2\%$ ,  $\pm 1$  ohm accuracy
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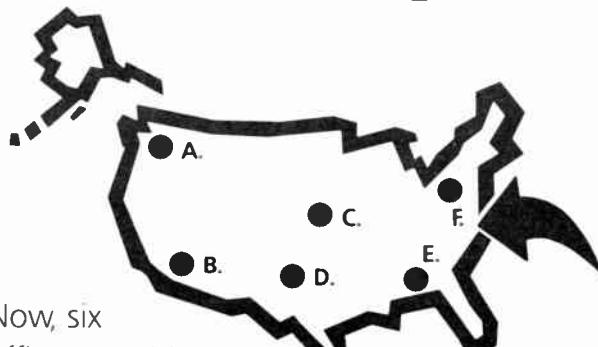
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# JOY Enjoys Continual Power

by Edgar F. Coudal

**Park Ridge IL . . .** When thunderstorms threatened, the data processing personnel at radio station WJQY-FM, Fort Lauderdale, Fla., used to come to work "sick to their stomachs," said James L. Sorenson, CE for the station. "They knew that there was a good chance of electric power problems and they knew from experience what that meant to their computer operations . . ."

"Since we installed an Uninterruptible Power Supply (UPS), there has not been a single complaint, despite almost 30 power failures."

WJQY-FM, which bills itself as "JOY 107," is #1 among women in the Miami area and #3 overall. It is part of the Amaturo Inc. group, which owns radio stations in Houston, St. Louis and Detroit, and television stations in the Midwest.

JOY's signal is sent by microwave link from the Fort Lauderdale studio to a transmitter at JOY's 1,000' tower in Hollywood, Fla. The signal blankets the Miami/Fort Lauderdale market. Sorenson has engineering responsibility for the Fort Lauderdale complex and Hollywood transmitter.

Fort Lauderdale is the administrative headquarters for all of Amaturo's properties.

All accounting and traffic (ad spot inventory, program scheduling, broadcast logs) are handled on an IBM Sys-

*Edgar F. Coudal is a freelance writer who regularly writes on high-tech subjects such as computer applications, electric power problems, radio, defense electronics and related subjects. He can be reached at 312-823-3834.*

tem 36 with 3 terminals, 256 Kbytes of main memory, 121 Mbytes of disk storage and 3 printers. The accounting and traffic software is Columbine Broadcast Information System's, tailored to JOY's needs.

In addition to the System 36, the complex employs three IBM PCs (the PC in the assistant controller's office has a terminal emulator board that allows it to access the System 36) and three stand-

alone CompuCorp word processing systems in the legal and administrative departments.

#### 12 seconds: an eternity

Sorenson, who joined JOY in 1984, said, "We had problems with the quality of electricity supplied by Florida Power and Light. The station was experiencing large voltage swings, outages and surges, almost all of which fell

within the boundaries the power industry considers 'acceptable.' For instance, FP&L does not recognize as an outage an interruption of power of less than 30 seconds. But any outage of *any* measurable duration can be disastrous when you're dealing with computers and audio broadcasts."

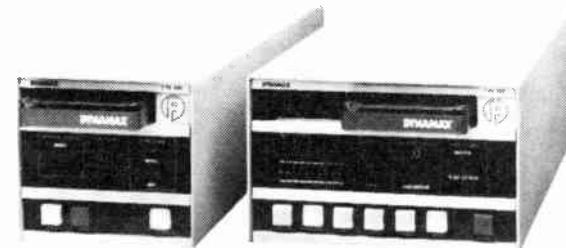
To remedy the outage problem, JOY had installed a 350 KVA diesel-powered

(continued on page 16)

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# FERRUPS Keeps WJQY On Line

(continued from page 15)

generator. "The generator can support the whole complex: microwave transmitter link, lights, typewriters, coffee pots, air conditioning, everything," Sorenson said. "The problem is that it takes about 12 seconds to run up and lock in before the automatic transfer from failed line to generator takes place.

"Twelve seconds is much too long," he said. "The computers crash. Vital data is lost off the System 36. Word processing goes down. We have 12 seconds of lost radio transmission. Dead air. Twelve seconds—an eternity in broadcasting."

"Even when there were no outages, surges and spikes were trashing data and directories on the computers' disks. In addition, there is about a 1/2 second switch transient when utility power comes back and the generator goes off," he added. "We had to fill that power hole as well."

The cost to JOY of the poor electric quality was many manhours spent in reconstructing data, rewriting documents, and meticulously checking records that may or may not have been affected.

"We needed a 12 1/2-second cure," Sorenson said, "for the problems affecting the System 36 and transmitter. And we wanted a cure that was economical, would use a minimum of space, and not demand any special facilities. In other

words, we wanted something that would stay out of the way, do its job, mind its own business and tell us what it's doing when asked."

#### First solution considered

Sorenson said their first thought was to replace the generator with a traditional uninterruptible power supply.

*We wanted a cure that was economical, would use a minimum of space, and not demand any special facilities.*

"It would have been possible," he said, "but the costs would have been enormous, both in installation and in continuous operation, because of the way a traditional UPS wastes power."

Sorenson instead selected a FERRUPS manufactured by Best Power Technology, Inc., of Necedah, Wis. "I was familiar with Best's units from a previous study I had done for a two-way communications system at American Motors. The Best units gave us instant power in the case of a blackout or brownout, as

well as line conditioning and filtering at all times to control surges, spikes, transients, frequency variations and overvoltage conditions."

He continued, "I've heard the old arguments that an UPS should run all the time, with an inverter and rectifier constantly on-line. I don't see why that has to be done. I want the backup power on-line in less than one-quarter of a cycle. More important, I want it coming on-line exactly in phase in the cycle where power was lost.

"The Best unit," he continued, "tracks the power coming in. If there is an outage, it picks up exactly where the power company's waveform left off, exactly in sync. In addition, the FERRUPS unit gives us a nice clean form, which is important in broadcasting."

The 5 KVA FERRUPS system was installed by JOY's contract electricians in August, 1985. The 5 KVA size was determined by "going around the office and totaling the load demanded by each component that would be backed up," Sorenson said.

Engineer John Farrell added, "We had a failure in the system's battery charger board two weeks after installation—an 'infant mortality' failure common to IC boards. We called Best. They sent a new board by overnight express. The unit was fully operational again the next day."

JOY put its data processing equip-

ment, along with the microwave transmitter, on the Best system.

In the first nine months after installation, Sorenson said there were two protracted power outages and "more than two dozen minor outages that the power company doesn't count, but which would have crashed the System 36." In each case, all systems protected by the FERRUPS functioned without interruption.

As to space requirements, the FERRUPS system was located in a closet used for the storage of audio and video tapes. Sorenson said, "It's as near the System 36 as possible to cut down the amount of wiring needed. In radio, you want as little AC power running around as you can get away with, just to reduce electrical noise."

"We also wanted it handy so that either John or I can check the diagnostics readouts regularly. We like the sealed batteries supplied because of our closed loop air conditioning system. The FERRUPS system needs no additional air conditioning or special facility of any kind."

The System cost JOY about \$14,000, with another \$4,000 for the special wiring runs that terminate in red outlet plugs signifying wall receptacles backed up by the FERRUPS system.

#### How FERRUPS works

The FERRUPS system provides two vital functions to its users:

- Instant backup power in case of

(continued on page 22)

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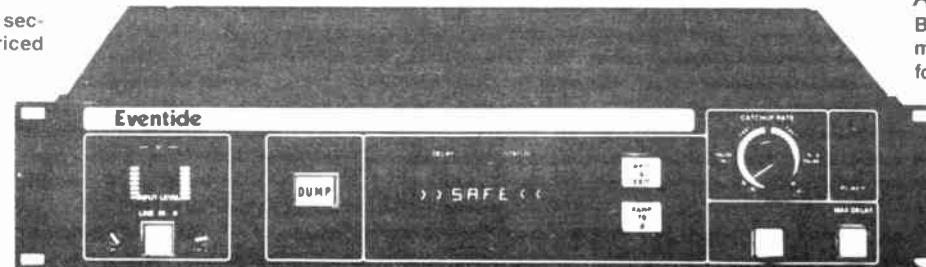
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# Circuit Affords Design Lesson

by Peter Burk

## Part III

**Harvard MA** . . . Jeff couldn't understand it. His latest digital project was spread out over three kludge boards with test leads sprouting like weeds. "It works some of the time," he said.

I asked him what it was supposed to do.

"It's the new contest telephone controller the PD wanted . . . yesterday."

I looked at the schematic. It was hard to tell which lines had been erased and which hadn't.

"I'll make a deal with you," I said. "I'll help you straighten out this rat's nest if you'll promise to spend an hour with me before you start your next project." Jeff readily agreed.

A week later he was in my office talking about a circuit to operate the transmitter filaments and plates on the same remote control channel. "You owe me an hour," I reminded him, "so here goes."

We spent a few minutes talking about what the circuit should do. Jeff explained that he wanted to be able to push Raise once to turn on the filaments, then push it again to turn on the plates. The lower button would work the same way for turning the plates and filaments off. "It's easier for the jocks," he pointed out, "and saves a channel on the remote control."

The circuit had to be smart enough to synchronize itself with the transmitter if someone made a change locally, and had to behave predictably following a power failure.

It not only was a simple enough task which could have been done any number of ways—but it also provided an ideal opportunity to show Jeff a design technique that he could apply to future projects.

We started by drawing a state diagram (see Figure 1). Each block is a desired state, with the connecting lines showing the condition necessary to cause a change of state.

Looking at the Raise diagram, one starts from power up in the Idle 1 state. Turning Raise on should naturally start the filaments, which is the next block.

When Raise is released, the Fil On output should be removed. This is indicated by the On-Not line between Fil On and Idle 2.

For the plates, pressing Raise moves one to the next block, labelled Plt On.

At this point, Jeff and I discussed the options. We could choose to return to Idle 1, expecting the need to turn on the fils again, or we could choose to wait at Idle 2, assuming the possibility that the plates would get knocked off and need to be turned back on without going through the first step.

We reasoned that having the filaments turn on each time the plates were turned

Peter Burk, with Advanced Micro-dynamics, is a frequent contributor to RW. He can be reached at 617-456-3570.

Figure 1.

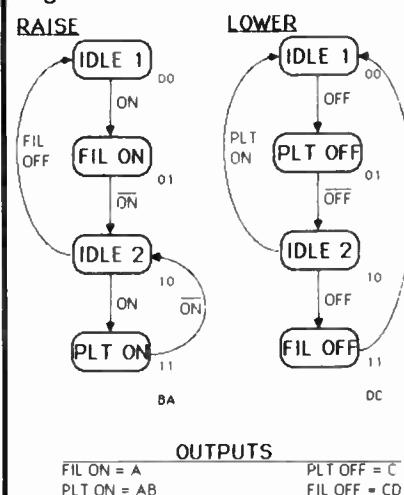


Figure 2a.



Figure 2b.

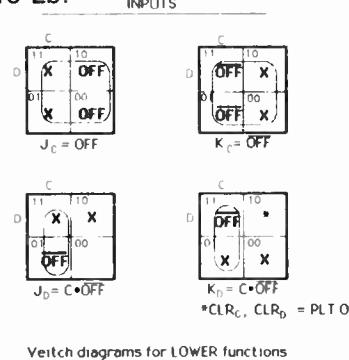


Figure 3a.



Figure 3b.

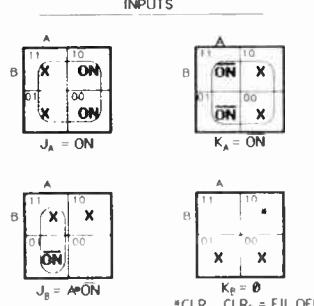
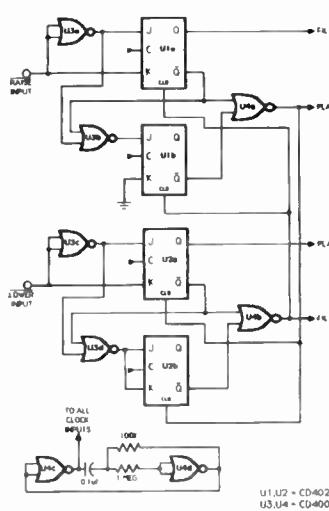


Figure 4.



on was acceptable, and it would also allow us to park in Idle 2, permitting immediate recovery of a plate overload. The short loop labelled On-Not would provide return to Idle 2 when Raise is released.

If the filaments were turned off intentionally, we wanted to be able to turn them back on without the plates coming on. The loop marked Fil Off prepares for this event every time the Lower circuit asserts the Fil Off output.

The Lower state diagram went together even more quickly. Walk through the logic and see if you can explain the loops back to Idle 1.

I started to explain how we'd assign the output states for each block, but Jeff beat me to it.

"We have four states, so we'll need two flip-flops, won't we?"

I nodded and started to pencil in two-digit binary numbers beside each state. Each digit would represent the output of one flip-flop.

The actual sequence of binary numbers can be anything you want, but careful assignment will reduce the number of gates needed to advance from one state to the next. Each transition should only change by one bit where possible.

I started with a Moebius code, trying to impress Jeff. That would have worked, but it made the output decoding more complicated; I ended up with the straight binary sequence shown next to each block in Figure 1.

Any binary combination could be decoded for the plate and filament outputs, but a look at those state assignments showed that output A will be on for either Plate On or Filament On, and off otherwise. Since we agreed to assert Filament On every time the plates are turned on, output A can directly control the filaments. An AND gate is necessary to control the plates since they must only come on during the Plt On state, which is A=1 and B=1.

"The creative part is done," I said. "We'll use JK flip-flops to keep it simple. All we have to do is crank through some Veitch diagrams to figure out what to put on each J and each K input."

Jeff didn't look thrilled at the thought, but I reminded him that he still owed me a half hour.

I sketched the state assignments we had made into a matrix (Figure 2a). Notice that the squares under the A have the LSB (least significant bit) equal to one. The right-hand column corresponds to A=0.

The MSB is represented by two rows, B=1 on top and B=0 on the bottom. The names of the states are taken straight from the state diagram we just finished.

Next, I drew four more boxes, one for each of the J and K inputs (Figure 2b). For each of the states in the top box, we'll determine what has to happen to get to the next state. Before we do, though, let's review the truth table for the JK flip-flops:

J	K	Q (after trigger)
0	0	no change
0	1	reset
1	0	set
1	1	toggle

If Q is at 0, we can make it 1 either by setting or toggling the flip-flop; thus J must be set to 1 and K doesn't matter. To go from 1 to 0, we can reset or toggle. K must be 1 but J doesn't matter. The rule is simple, then: 0 to 1, J=1; 1 to 0, K=1 (Jeff was hoping for a rhyme).

Half of the matrix turns out to be 'don't care' states, greatly simplifying our work. This is true for any function we care to implement this way. For the J matrices, mark  $\oplus$  in square with an X where the output is already 1. For the K matrices, mark the squares where the output is already 0.

Now we can get down to business. Look at the Idle 1 state on the Raise state diagram (Figure 1). We can only go to one state from here: Fil On. B doesn't change, so we do nothing with the B matrices, but A has to get set, so we'll need a 1 in the appropriate JA box. Since the Idle 1 state is the lower right square, that's where the 1 would go.

But wait! Instead of a 1 we've got C in that box. That's because the line from Idle 1 to Fil On is marked On. If there were no label on the line, we would expect the state to change immediately on receipt of the next clock pulse (more about the clock later).

As it is, the counter will stay in Idle 1 until Raise is pressed, then move to Fil On.

Moving down the state diagram, Fil On to Idle 2 requires A to be reset and B to be set. Fil On is the lower left box in each matrix, so On-Not (the name of the line) must be put in the lower left KA box and lower left JB box.

The remaining two states, Idle 2 and Plt On, get completed the same way. Normally, we'd have to fill in the square for the Fil Off path from Idle 2, as Jeff was quick to remind me, but I had a different approach in mind. It doesn't save much hardware here, but I wanted to show him anyway.

Since the Fil Off path creates the 00 state, we can use the direct clear input of the flip-flop to reset both A and B. Fil Off (from the lower circuit) can go straight to these inputs.

In Figure 3b, the shaded areas represent symmetrical areas with identical signals. For this operation, we can include the 'don't care' boxes whenever they are convenient. The object is to identify the largest possible area to simplify the final logic expression.

JA and KA are a dream; the Raise signal (On) and its complement (On-Not) are all we need.

JB is only slightly more involved. Since the shaded area lies exclusively in the A column, we'll have to And A with On-Not.

KB is all blank or 'don't care,' so that input can be tied to ground for a zero.

I completed the Raise Veitch diagram **(continued on page 26)**

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Circle Reader Service 15 on Page 28

World Radio History

# Dynamax Speed Options Easy

by Richard E. Douglas

Houston TX . . . KRBE, originator of the "Classic Rock" format, remains Houston's only true AOR station. As such, much of our playlist includes LP cuts which exceed 10 minutes.

Placing this music on carts involved using B-sized carts, which are expensive and not overly rugged, and which presented us with some storage problems.

We saw promise in the Fidelipac CTR-100 Dynamax cart machine, which offered a choice of speeds. For our purposes, the 3.75 ips would allow us to make use of the more economical A-sized phase-stabilized carts and still expect reasonable performance. The Dynamax™ system's typical sine-wave frequency response, 3.75 ips, extends to 11 kHz, which we considered satisfactory. Because of the exceptionally clean, fast response of its active-balanced input and output (transformerless) circuitry, the Dynamax' 3.75 ips quality rivals the 7.5 ips quality of other cart machines.

After much evaluation and consideration, KRBE purchased a half-dozen of the CTR100 Dynamax playback-only cart machines for the AM air studio, and one recorder-player for AM production.

Our workbench experimentation with the Dynamax optical Cart Scan™ features and other on-board options led to discovery of a way to alternate between electronic functions by inserting an optically-encoded cartridge.

Since the Auxiliary function is not normally used by the machine, it is therefore fair game for those wishing to expand their system capabilities.

Our Dynamax decks were modified with the addition of an optoisolator, two resistors and a diode, so the Auxiliary function activates the 3.75 ips speed option.

We found sufficient printed-circuit real estate on the Dynamax tone sensor board (including lands for the optoisolator DIP socket) to mount additional parts. Then, because the Dynamax Elevated Level electronics uses separate equalization, we adjusted that circuitry for optimum 3.75 ips response.

It is necessary to extend two speed-select lines from the tone sensor board to the play amp, where the Cart Scan logic circuitry (and our optoisolator) is located. This can easily be done with two very short jumpers on the bottom of the motherboard, is readily accessible.

As shown in Figure 1, the AUX Cart Scan transistor Q7 is not normally conducting. Current flows through the LED of W3's half of the optoisolator, placing

15 V on W3 to allow normal 7.5 ips operation.

Inserting a cart with the AUX cart scan label turns on Q7, shunting LED current through the added diode and holding the W3 optoisolator off. Q7 now provides a current path for the LED of the second half of our optoisolator, placing 15 V on W1 for 3.75 ips operation (or use W2 if

you're going for 15 ips operation).

With the speed control circuitry thus modified, the insertion of a cart with the AUX/ELEV LEVEL optical label will make the speed change and bring in 3.75 ips equalization, with the only evidence being a momentary servo error light as the speed change takes place.

KRBE has operated its machines con-

tinuously in this manner for the past six months with dependable speed change every time. We are now considering the replacement of other cart machines in our studios with Dynamax.

**Richard E. Douglas** is CE of KRBE-AM/FM. He can be reached at 713-266-1000.

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**Randy Orbaker**, WNYR, Rochester, NY

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**Marvin Fiedler**, KCOR, San Antonio, TX

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**Ed Anglin**, WGCR, Brevard, NC

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Circle Reader Service 33 on Page 28

# Choosing a Tech Consultant

by Ronald Chaffee

**Greenville SC . . .** Most broadcasters are familiar with programming consultants, media sales consultants, brokers and business consultants. However, many are not always familiar with the technical aspects of their stations, and thus do not fully understand the role of the engineering consultant or how to go about finding a good one. The new investor in broadcasting is probably even more prone to this confusion.

To understand the role of the technical consultant and to select a good one, it may be best to start with some of the things technical consultants are not.

Technical consultants are generally not a replacement for RF engineering/maintenance talent on staff. The staff engineer's main responsibility is to keep the equipment in top operating condition.

Next, the technical consultant is not normally an expert in programming, advertising, sales or the talent side of the enterprise.

Finally technical consultants are not a substitute for a capable communications attorney.

Ronald Chaffee is director, Client Services, with Lawrence Behr Associates, Inc., a technical consulting firm in Greenville, NC. He may be reached at 919-758-4509.

The technical consultant should be responsible for the basic engineering aspects of a station. These include selecting optimum frequency, facilities and location of the transmitter/antenna.

He can be involved in cost-effective station construction and equipment selection. The technical consulting firm may either counsel in these areas or assume complete construction-project management responsibility.

Working in concert with the communications attorney, the technical consultant assists in the development of winning application strategies for new or expanded facilities. He prepares technical statements in support of such applications and follows the application throughout the comparative hearing process.

The firm should also be proficient in the evaluation of station sales and purchasing opportunities, especially in the "value" of equipment.

Finally, it is one of the consultant's responsibilities to keep his clients continually advised on the changing FCC body of regulation and assist the client in taking advantage of the engineering and regulatory opportunities presented by rule changes.

Though the technical consultant should be an integral part of the broadcaster's team, unfortunately many broadcasters shop around for someone

to perform independent procedures each time they believe there may be a need for those services.

The relationship should be a lot like that of a CPA or family physician. If the consultant could keep abreast of current station engineering parameters and assist in the planning function, he would be in the best position to perform his services in the minimum time and at minimum expense.

## Finding a consultant

But, where do you start? How do you go about finding high quality, objective and technically proficient technical counsel—one that keeps up to date, keeps clients informed and is small enough to regard you as a valued client yet large enough to provide the varied talents required of this complex business?

This is a tall order, but one which is well worth the time needed to undertake a thorough investigation.

A good starting point might be to contact colleagues with broadcast facilities which seem to be about the same size as yours and which also seem to have it "all together" relative to sound, coverage and operation. Find out who they have retained and what their experience has been.

Another excellent reference is your communications attorney. These specialized attorneys deal with technical consultants frequently, and are in a position to recommend one or two firms for your consideration.

Once you have gathered a few candidates and checked some references, it's time to contact those firms which pass your initial screening. Tell them what you are looking for and get as much information as you consider relevant. Probably the least important item to be considered at this time is fees.

Things to focus on are experience, philosophy, size, reputation and "chemistry." In a business relationship, chemistry, mutual trust and respect are very important.

Specifically, your questions might be directed at:

- Staff background and resource availability: Does the consultant run a "one-man show" or is there adequate staff with the necessary talents and training to ensure timely completion of projects?

Does the consultant have adequate in-house resources to perform most activities quickly and efficiently, or must he rely on outside resources?

- Ability to communicate effectively: Ask for samples of the firm's work. Can they provide clear, professionally prepared and accurate presentations and reports? Do they maintain a newsletter to keep clients continually informed about the changing environment?

Does the firm employ individuals considered by the FCC to be expert witnesses? What positive experience does the firm have in the comparative hearing and litigation processes?

- Proven ability to keep up to date: Nothing is worse than a plan which is based on obsolete information. The consultant must maintain constant liaison with FCC staff, and subscribe to and read regulatory updates.

The firm should display its technical knowledge through its performance as well as through participation in conferences, seminars and published articles.

- Objectivity and a willingness to work with a client: The technical consultant is just what the name implies. He is a team member and counsels the client in technical matters. The decisions, however, are those of the client.

Thus, the consultant should have strong convictions relative to his recommendations, but still be willing to understand the "real world" limitations of budgets, business plans and corporate/partnership goals.

One way to gather information about a prospective consulting relationship is by requesting it directly from the firm involved. Be frank and let them know why you want the information. You may even let them know what fault you find with your present relationship (if one exists).

You might consider visiting the offices of the top contenders.

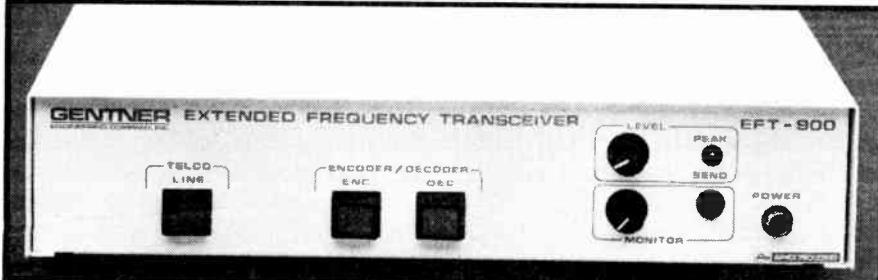
Finally, the true test would be to discuss retaining the most appealing firm for some specific project. Let the consulting firm present its approach in solving your problem. After all, problem solving is one of the main abilities for which the consultant is being hired, not just technical ability.

## Fees

Once the consultant has presented his approach and proposed solutions, it is time to examine fees.

In this regard, the only meaningful (continued on page 25)

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Circle Reader Service 14 on Page 28

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Circle Reader Service 29 on Page 28

# Test Tone Generator Ensures Reliability

by David Driessen

**Green Bay WI . . .** If you have a need for a basic tone generator for general-purpose level setting, this one may be for you.

The device produces digitally synthesized sine waves at a precise level and frequency that will remain stable over a long period of time. It also produces a multifrequency-stepped tone, which is handy for routine frequency response checks.

If you are looking for an ultralow distortion signal, look elsewhere, but for general level checking, this may be just what you need.

Two inverters in the 4069 are set up as a multivibrator running at 256 kHz. This is divided down by the 4040, which drives a four-stage ring counter using two

*David Driessen is a studio engineer at WGBA-TV, Green Bay WI. Call him at 414-864-7826.*

4013 flipflops.

The counter produces a stepped sine wave with the resistors, which is fed to a 741 for buffering.

The amplitude is so stable because it is essentially the power supply voltage provided by the GEVR108 switched through FET switches in the CMOS gate.

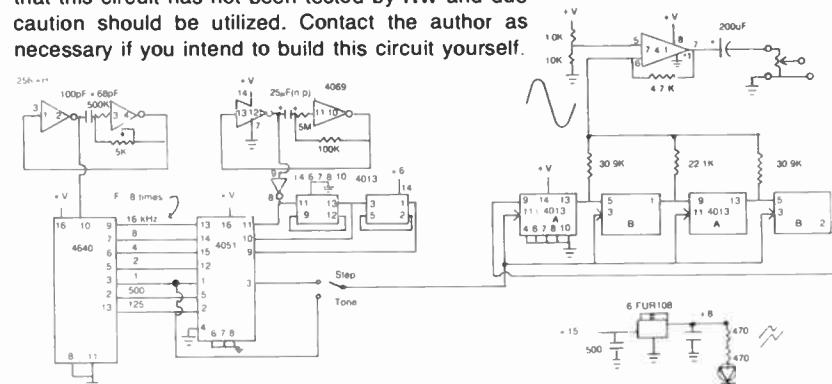
The tone step feature works by a 4051 SP8T CMOS switch selecting the various divided outputs of the 4040. One step stops the tone briefly.

The other two inverters of the 4069 are also connected as a multivibrator, running at 0.5 Hz, which is fed to another 4013 connected as a binary counter, which steps the 4051. A switch selects a steady tone or stepped operation.

When building the circuit, you may need to adjust the value of the capacitor in the 256 kHz multivibrator to get exactly 256 kHz. A better-quality capacitor used here will help maintain frequency stability.

The 25  $\mu$ F capacitor in the 0.5 Hz

Figure 1. Test tone generator. RW reminds its readers that this circuit has not been tested by RW and due caution should be utilized. Contact the author as necessary if you intend to build this circuit yourself.



multivibrator should be nonpolarized. The unregulated DC for the voltage regulator can come from a calculator-type wall plug supply.

If you are like me, you never build a project exactly as it appears in the publication. You could increase the number of stages in the ring counter to produce a smoother sine wave.

More information on this can be found in the *CMOS Cookbook* by Don Lancaster.

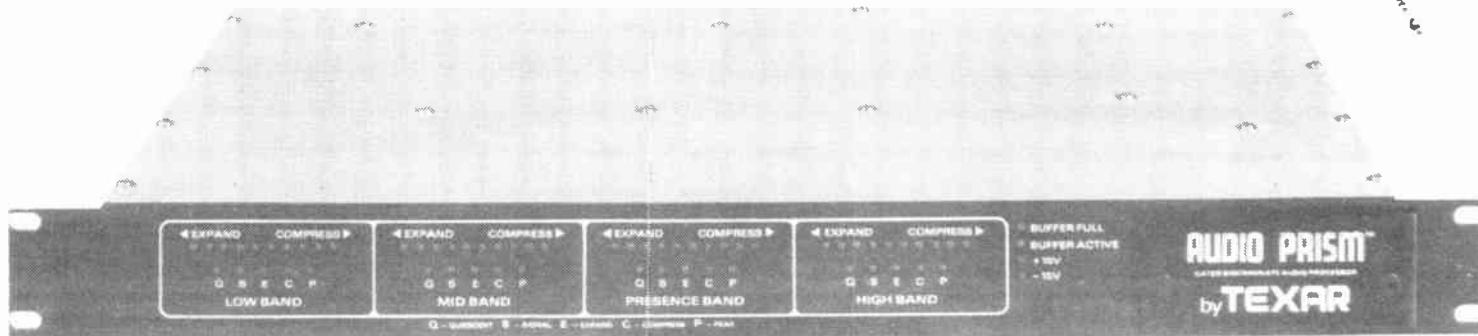
The 741 opamp could be replaced with a 5532, with the second opamp wired as an inverter for a balanced output.

For stereo operation, a second 5532 fed from a switch providing either a straight or inverted signal from the first 5532, which would be switched by another 4013 cascaded off the 4013 binary stepper so the circuit would step through the tones, reverse left channel polarity and step through them again.

Or, how about a switch to step through the tones rapidly instead of at 0.5 Hz, with a trigger pulse going to your scope from pin 9 of the 4051.

Or . . . (Editor's note: Advised that Dave could run on another 10 pages, we had to cut him off).

## THE TOP THREE STATIONS... THE NUMBER ONE MARKET... THREE ARBITRONS IN A ROW!\*



Climbing to number one is tough. Staying there is tougher. Any defending Super Bowl team can tell you that. Suddenly, you're the team to beat. Other teams are studying your game films more than anyone else's. They watch all your moves, they learn all your tricks. When game day comes, you better have new moves, because they know all your old ones. Very few Super Bowl winners have returned to win again the next year.

The same goes for being number one in the Arbitron. You are the guy to beat. You are the one with a bullseye drawn on your back. The competition monitors your modulation level, hooks up his scope to look for composite clipping on your baseband, and scrutinizes your stereo separation on an X-Y display. He'll look for any clue to tell him how your audio processing system works.

No one is watching game films of the NFL

team that finished dead last in their division last year. No one cares. And no one is huddled over an oscilloscope scrutinizing the composite of the station that finished last in the most recent Arbitron.

If you're number one, you are the one everyone is trying to unseat. It's suddenly no longer a game of one on one. It's five to one! It's everyone else out there trying to beat you. Returning as number one in the next Arbitron is harder than getting there in the first place.

It is with considerable pride then that TEXAR was the audio processing system of choice for the #1, #2 and #3 rated stations in the Super Bowl of radio, New York City . . . for three Arbitrons in a row.

What's the secret? DIGITAL CONTROL. Just as digital Compact Discs are replacing vinyl LPs

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\* Summer, Fall 1985 and Winter 1986 Arbitron Ratings. Total Persons 12+ Share, Mor-Sun, 6A-12M. (Used with permission.)

# JOY Enjoys Continual Power

(continued from page 16)

blackouts or deep, protracted brownouts; and

- Complete line conditioning and filtering, which protects against virtually all other line power problems, including minor brownouts, sags, spikes, surges, noise and frequency variation.

Terrance D. Paul, Best president, said that his company's products employ unique ferroresonant transformer technology. "The FERRUPS technology nor-

mally powers the critical load through the ferroresonant constant voltage transformer," Paul said, "which provides clean sine wave output with complete line conditioning and filtering."

"In the event of a total power failure, the inverter/battery section becomes activated, rather than running constantly, as with a traditional UPS. The changeover to battery/inverter power takes place with no interruption of load function. FERRUPS is a true on-line UPS

without the disadvantages of the old UPS technology."

Paul said the Best units are 40% smaller and 20% to 50% less costly than traditional UPS, which use a constantly functioning inverter and large rectifier/charger.

The units are also highly efficient because ferroresonant technology eliminates the AC-to-DC-to-AC conversion typical of other UPS. Thus, some 90% of the power is passed through to the

load by the FERRUPS, rather than 60-80% in older double conversions.

Paul said the units have a low decibel level, and are designed to fit into the decor of any office or computer room.

#### Second-generation FERRUPS

A new second-generation FERRUPS, introduced at the start of 1986, features microprocessor controls with software interrupt capabilities, high efficiency and further cost savings.

The new 2-15 KVA units have a keyboard to control the microprocessor and a LCD display. Immediately available to the user are 17 meter functions, 12 alarm messages and 13 set points to tailor a FERRUPS to a specific application.

Virtually all setup, calibration and other user-defined control of the unit is exercised from the keyboard. The microprocessor controls the inverter and coordinates input and output systems.

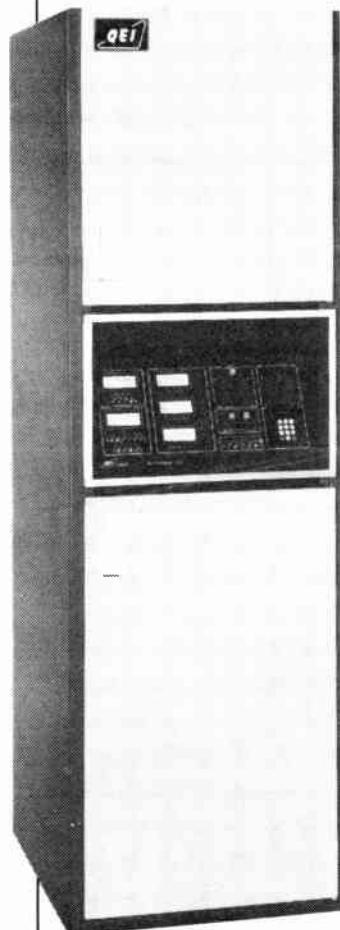
Off-the-shelf IBM-PC/XT/AT and compatibles and XENIX software for terminal emulation and interrupt capability are offered. Typical of the small size of the units is the 5 KVA unit, which, including batteries, is about the size of a two-drawer file cabinet.

At 3:30 PM on a recent busy workday afternoon, FP&L withdrew power for conductor repairs on JOY's incoming line. The overhead fluorescent lights went off, but the background music played on.

In exactly 12 seconds the lights came back on and the hum of the air conditioning was heard again. The diesel generator was on-line, the 12-second startup and transfer bridged unnoticeably by Best's FERRUPS.

Sorenson said, "Before installation of the FERRUPS, all the buttons on my phone now would be lit up and there would be frantic DP people running in here."

His phone buttons were dark. It was quiet in the hall.

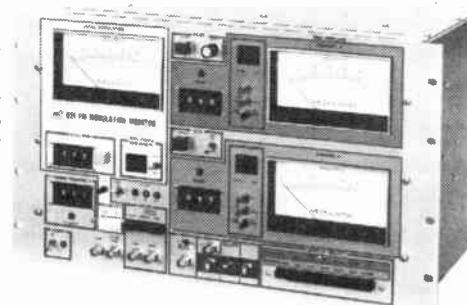


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# Telephone Interface 'Simplest'

by Frederick Baumgartner

Englewood CO ... There has never been a time when radio engineers haven't found themselves working with phone lines. In fact, most of our audio standards are based on telephone company practices.

I suspect I'm not the only engineer out there who got into broadcasting partly because the phone company wouldn't have me (color blind), but I still carry an interest in the earth's master communications system.

#### Simplest interface

Recently, RW has carried more than a few articles on the simplest or best telephone interfaces.

Figure 1 is, I believe, the simplest phone interface available. A ring pulse is rectified, then passed through the capacitor pulling in the relay.

The relay then acts as the holding coil, and remains in until either unplugged or until the central office provides battery break or reversal—hopefully at the end of the call.

The capacitor then blocks DC and passes audio to (or from) the transformer.

Construction involves a tiny plastic box with mod plug (we often tape on a

mod to a four-prong adapter, just in case) and another appropriate connector on cords coming from either end.

The relay is a 24 V "sugar cube," the capacitor a stock electrolytic and the transformer a transistor-radio-sized 600/600 ohm.

Options include an LED and resistor

**Applications include use for listen lines, computer interfaces and auto-answer devices for remotes.**

across the relay coil to indicate a "seized" condition.

In the case of an auto-answer cart machine or the like, running a DPDT relay's second set of contacts through a series capacitor to the cart machine start contacts does the trick. (We seldom avoided the urge to add more "bells and whistles" to the device.)

Some applications include use for listen lines, computer interfaces and auto-answer devices for remotes (it beats getting security to tell the announcer "the line is down, so hang up ... the station will call him back," or carrying a Ma Bell

"boat anchor" auto-answer interface; though, in truth, today's modern devices either listen to the line for a dial tone or force the announcer to, so that he might know his line went kaput).

Adding a small DTMF pad and dial from a "Princess" phone makes it larger, and allows it to call out.

#### Alternative net origination

One of the things radio stations do with piles of phone lines is to run sports or other (temporary) networks. The usual practice—now that dedicated lines are either too expensive or unavailable, and satellite costs are often more than a short-term, statewide user can afford—is to supply one line for each station, and a dial-up coupler on each. For our purposes, even that is a bit expensive.

One characteristic of our phone use is that we tend to set up networks outside of business hours, scheduling them for weekends and evenings. During this time, the business lines are essentially not used.

These lines could be used for network origination through the use of an internal coupler bank. Incoming calls on the business line are transferred to a bank that holds 12 slots (in 8" of rack space) capable of feeding 8 stations. The other four couplers are for IFB (interruptible feedback).

Should we ever need to feed more than eight, some restructuring and/or "stealing" of other lines could feed 14 stations or so. Beyond that, we would have to get serious.

It would be nice to use the simple little coupler described above, but the internal phone system (in this case a Horizon, though it really doesn't matter) does not provide battery break.

Furthermore, the ring pulse is provided on a separate pair (no big deal). This, of course, is getting to be more and more standard as electronic phone systems replace the old key systems.

The simple little coupler, then, would neither know to answer nor to hang up.

#### The talk pair

If you are unfamiliar with the electronics of your internal phone system, I suggest it is time to open up the phones and find out what makes them tick.

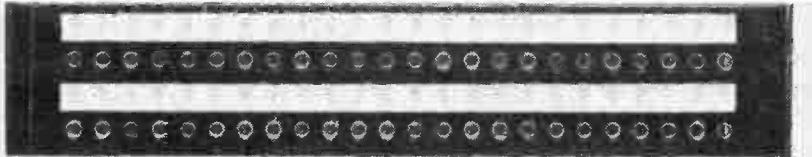
Most often, you will find a talk pair. This seldom has battery break, but may be sensitive to "hook flash" (a temporary break in the loop to tell the phone's "switch" to do something, like to go on hold).

Furthermore, the talk pair may or may not answer to DTMF commands—those commands and numbers sent by the touch-tone pad.

(continued on page 24)



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is supported in part by *Radio World* and *TV Technology*.

# Telephone Interface 'Simplest'

(continued from page 23)

Few systems allow dial pulses on the talk pair—or anywhere else, for that matter. Most phone switches deal only in touch tones.

Most often the talk pair has 24 to 48 VDC, with the two-way audio riding on top.

A separate pair generally carries the ring pulses from the switch to the telephone instrument. Because ring plants that generate something other than 60 Hz are expensive, most systems stick to a simple 60 Hz and keep it separate from everything else.

## The data pair

A glorified "electronic" instrument often needs one more pair; this is the data pair.

The data pair carries all the commands to illuminate lights, forward calls, camp on (monitors line that is busy, then rings both caller and line called when it is on hook) and all the other slick buttons you may have.

In some systems, the hook signal (on hook is "hung up," or off) and even ring commands are found on the data pair.

It is more often than not a difficult job to identify the structure of the data. People who know the data structure for your electronic phone system are few and far between, and will seldom pass along the information (job security).

Your basic phone installer does not need to understand the structure, only to replace the correct card when something isn't right.

In some systems, two data pairs exist, one going, one coming.

Generally, I don't think it is worth your time to become literate in your particular data structure, or to build devices that interface to it. History shows that systems get changed every 10 years or so,

which will leave you with a lot of slick gear that has nothing to talk to.

Likewise, the old key system, once the only standard and embarrassingly easy to interface to, should not be built around, as it is a dinosaur.

The long and short of all this is that you need to know how to interface to your phone system while building your special gear to service a systems change.

## Internal phone coupler

In Figure 2—the internal phone coupler built for internal systems—I gave only general guidelines, on parts selection, as everyone's junk box contains stuff that will work. I will, however, make comments on parts selection that I like.

The ring pulses from the real world enter the ring pulse detector first. The ring detector can be paralleled to the talk pair in systems that function that way. It can also be replaced by whatever is needed to read ring information from your system.

A 7400 or other device forms a flip-flop that is either on hook or off hook. The H command causes it to hang up.

The I command is to inhibit hang up. The 2N2222 and relay seize the line.

The talk pair from the real world passes through the on-hook relay; a hold

coil completes the DC path.

Some systems may need something else to perform the function of taking the line off hook (turning it on). In that case, you know where the relay contacts are to issue that command.

The hold coil I like is one half of a 15K/15K transistor-radio type. There are real "hold" coils that cost too much in space and money, and, given the limitations of a phone line, don't sound any different.

## 600/600 transformer

Two electrolytics form a bipolar capacitor that carries audio only to the 600/600 transformer, a tiny thing that runs about \$3.50 (I get them from Full Compass Systems in Madison, WI or Radio Shack).

These transformers do a credible job under three conditions: they must not have any notable DC current flow through them; they must be matched on both the load and source with 600 ohms; and they must not pass much beyond +10 dB through them.

Actually, under these conditions, they pass a proof (with sine waves) rather well.

The hybrid allows audio to go down the telephone line, but reduces the audio

level reaching the dial-tone decoder. The audio source is an 8-ohm amplifier that can drive a whole bunch of these.

I like a Radio Shack SA-10 because it is cheap, very reliable, available and disposable (that means, to fix it, you throw it out and get another).

Unfortunately, the newer SA-10s (the outsides of ICs all look alike) have a bit too much crosstalk to use both sides of the amp for dissimilar audio. The amp is no ultra-hi-fi device, but then again, neither is a phone line.

Adjustment of the hybrid amounts to hanging a scope at the input to the 567 (sometimes we use a hi-z amplifier-speaker) and, with audio or pink noise applied to the amplifier, adjusting the 5K pot for null. A result of 30 dB below the audio input is not out of the ordinary.

## Dial-tone detector

The 567 is the dial-tone detector. A dial tone is two tones: 440 and 80 Hz. Since it is difficult to optimize the hybrid, etc., to handle both tones, and since only one is necessary, we use the 440.

In truth, 567s get flakey at 80 Hz, even though the spec sheet doesn't let you know that. This really keeps the parts count down.

A test point on pin 6 of the 567 allows a frequency counter to be used to set the PLL (the 567). The values are chosen to provide a fairly narrow-detection band—

(continued on next page)

Figure 2.

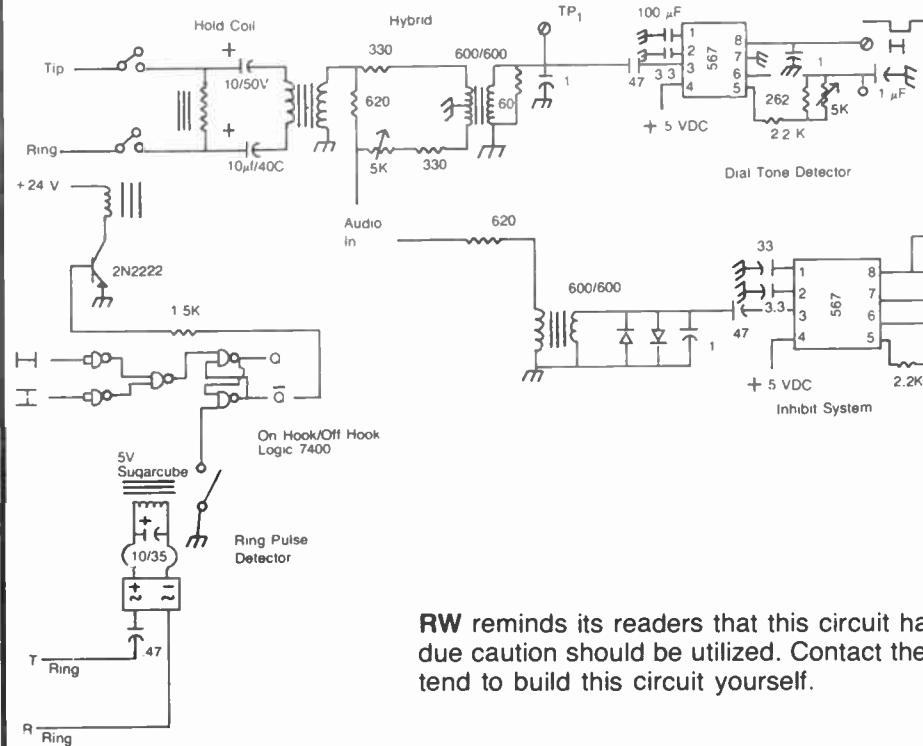
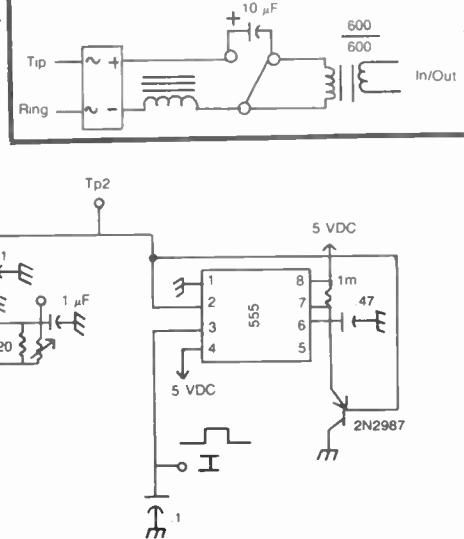


Figure 1.



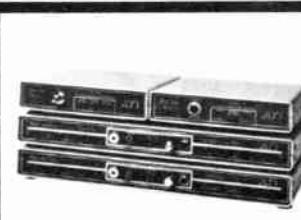
RW reminds its readers that this circuit has not been tested by RW and due caution should be utilized. Contact the author as necessary if you intend to build this circuit yourself.

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# Telephone Interface 'Simplest'

(continued from previous page)

width and long lock-up time.

Ideally, when the line is disconnected, the dial tone from central office will pass through the hybrid to the 567.

It, in turn, will tell logic to go on hook (hang up) to be ready for the next call.

#### Audio level considerations

The audio level heading down the phone line is determined by the feed amp. This should be about the same for all lines; thus, only the pot on the amp is required.

Too much audio will overload the dial-tone detector, consequently blinding it to the 440 Hz, and may cause clipping in the phone line. Too little audio causes the noise on the phone line to become a problem.

Long distance services, in particular the "dial 18 digits, go through lots of

economy lines and an extra switch or two" variety, are often used to save money.

These almost always have a noise suppression device that listens for consistent high-frequency components and then reduces gain on the circuit. This is supposed to happen between words in conversation, removing the "swish" during pauses.

Oddly enough, crowd noise looks like line noise and, unless the level is adequate, the noise reduction system will punch holes in your program.

I recommend a reasonably compressed audio source. That old "Audimax" (or similar) in the attic may do the trick.

An off-air feed isn't too bad, either. This is a phone line, and intelligibility, not fidelity, is the goal.

Now, what should happen if your program happens to have some 440 Hz in

it? It could come in the form of middle C on the stadium organ or a caller hanging up on the talk show portion of the program.

#### Inhibit circuit

The hybrid, not being perfect, allows the system to hang up.

That is why the inhibit circuit exists. It is also built around a 567, but its values are chosen to provide a somewhat wider bandwidth and much faster lock-up time. Should 440 Hz come along, the inhibit detector looking at the audio being fed tells the 555 reset-able (that's what the extra transistor does) pulse stretcher to put out an inhibit pulse to keep the dial-tone detector from terminating the call.

In real life, the inhibit comes on about a dozen times per minute and the inhibit itself lasts about 2 sec. This still provides plenty of time for the dial-tone detector to detect dial tone between inhibits.

Rather than have an inhibit system on each line, we can use one for every audio source. If your coupler bank has only one audio source and 20 phone lines, you still need only one inhibit system.

The transformer, diodes and capacitors provide signal conditioning, as the 567 is easily overloaded.

#### Master reset function

In practice, the device is assigned to internal lines in a hunt sequence. Calls from outside are screened and transferred to the bank.

Inside calls often get to the coupler bank accidentally. When this happens, the caller hangs up, but since there is no dial tone to detect, the device stays up.

A master reset button in master control allows us to dump the bank when we know there are no legitimate feeds

occurring.

Picking numbers that aren't the first two digits of local exchanges will cut down on the accidental access problem, but will also take the fun out of keeping track of how many folks forget to dial "9" first.

#### "Bells and whistles"

Of course, lots of "bells and whistles" are nice. We added LEDs to all the logic lines on both the board and the front panel. Leonard Charles of WIBA, Madison, WI, built these from a napkin drawing and hammered out the values and problems.

He managed to get two devices on each 6x6 plug-in card, including regulators, LEDs, 10-turn pots and transformers. This can be a bit dense, though it depends on what parts you select.

I am sure you can see some uses for the above devices in your plant. Few alternative off-the-shelf devices lend themselves easily to either task at prices below what you can build these for—including your time.

Don't forget the bookwork. Adjust the insurance list (with your time, these are worth about \$100 each) and document. I suggest a copy of the as-built drawing and the base article (this) be folded into a corner of the box housing each unit.

Having the devices created a case of "give them the toys and they will figure out how to use them." We removed the consultant's listen line, for one thing, and replaced it with these, thus saving the cost of the line month after month.

The device also serves a number of listener groups around the country who patronize the system during Big Ten season. The deal here is that, for \$50 or so, a bunch of alumni from some distant city dials into the game and puts it up on speakers in a hotel. Each throws in \$5 to enjoy the football game via phone line. Being an engineer, I can't imagine why they do that.

## Selecting a Consultant

(continued from page 20)

question regarding fees is this: "Is it a cost-effective approach?"

Do not confuse this with inexpensive. It may be.

However, a thorough look at all aspects of a problem is most often your best investment. You should realize that most consultants work on a time-charge basis. However, the per-hour or per-day charge is very seldom a true indicator of project cost. Very often a \$125-per-hour consultant can solve problems and obtain results much faster than the \$75-per-hour person.

In any case, the only true test is to make a business judgment and test that judgment under fire.

In conclusion, if you have selected a firm on the basis of all the above factors, there are three major considerations critical to the success of any long-term client/consultant relationship:

- Mutual respect for the professionalism and position of each party.

The consultant, attorney and client each have unique responsibilities. The consultant is an advisor in his area of expertise. Do not ask him to perform duties which are in the domain of other members of the team.

- Access to decisionmakers and staff.

There are times when questions must be answered and delay could be costly.

As a member of the "inner circle" from whom no secrets are hidden, the consultant can act in the client's best interest. The client, in return, has the right to expect strict confidentiality.

- Mutual understanding of goals, methods and the game plan. While this seems elementary, it is surprising how many relationships fail in the long run because clients may misunderstand the consultant's methods of performing his tasks, or the consultant may not understand the client's goals and aspirations.

It is imperative that, as team members, the consultant fully understand management's objectives in order to maximize the benefits the firm can provide.

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# Broadcast Computing

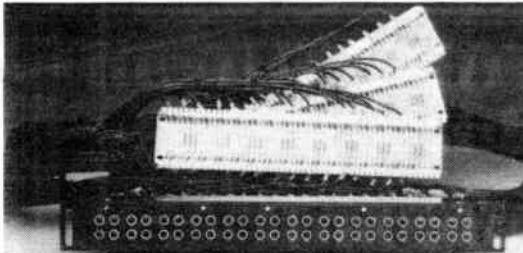
```

10 PRINT:REM      FMAFF BY SCOTT ROBERTS
20 INPUT "XMITTER POWER OUT = ";TP:PRINT
30 INPUT "COAX CABLE LENGTH = ";CL:PRINT
40 INPUT "COAX ATTEN/100 FT = ";CA:PRINT
50 INPUT "ANT POWER GAIN = ";AG:PRINT
60 A=(CA*(CL/100))/10:B=100/(10^A)
70 PRINT:PRINT" COAX LENGTH =";CL;"FT"
80 PRINT" COAX EFFICIENCY =";INT(B*10+.5)/10;"%"
90 PRINT"COAX ATEN/100 FT =";CA;"DB"
100 PRINT:PRINT"XMITTER POWER OUT =";TP;"WATTS"
110 PRINT" COAX LINE LOSS =";
120 PRINT TP-(INT(((B/100)*TP)+.5));"WATTS"
130 PRINT" ANT INPUT POWER =";
140 PRINT INT(((B/100)*TP)+.5);"WATTS"
150 PRINT" ANT POWER GAIN =";AG
160 PRINT" ERP =";
170 PRINT AG*(INT(((B/100)*TP)+.5));"WATTS"
180 PRINT:PRINT"CHANGE = <L>INE LENGTH"
190 PRINT TAB(10)<E>FFICIENCY *
200 PRINT TAB(10)<C>OAX ATTENUATION"
210 PRINT TAB(10)<T>TRANSMITTER POWER"
220 PRINT TAB(10)<A>NTENNA GAIN"
230 PRINT TAB(10)<R>ERUN PROGRAM":PRINT
240 GET C$:IF C$="" THEN240
250 IF C$="L" THEN INPUT"NEW LENGTH";CL:GOTO60
260 IF C$="E" THEN GOTO 320
270 IF C$="T" THEN INPUT"NEW TPO";TP:GOTO60
280 IF C$="C" THEN INPUT"NEW ATTEN/100";CA:GOTO60
290 IF C$="A" THEN INPUT"NEW GAIN ";AG:GOTO60
300 IF C$="R" THEN10
310 C$="":GOTO240
320 PRINT"ONE TIME CALCULATION ONLY":PRINT
330 PRINT:INPUT"NEW EFFICIENCY";B:GOT070
READY.

```

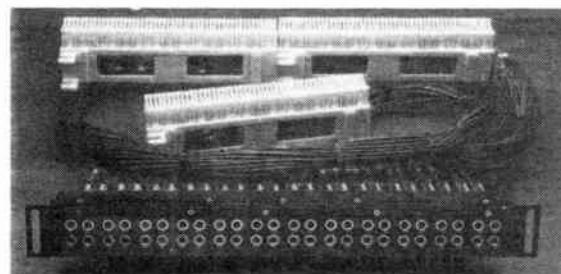
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Circle Reader Service 25 on Page 28

## Doldrums Banished

by Scott Roberts

Sunnyvale CA ... This is a very powerful program that can be used to take the doldrums out of FM broadcast facility change applications.

By entering in TPO, coax cable length, coax attenuation per 100' and antenna power gain, you can accurately compute coax line loss, coax efficiency, antenna input power and ERP.

What happens if the computed numbers just don't sit right with you? Do you tweak TPO, use another type of antenna feed line, or even change the gain of the antenna? Here's where the fun comes in!

You can change any of the four original input parameters, and this routine will quickly re-compute all the numbers—it's sort of like an electronic spreadsheet.

I have used it extensively to plan new installations and to check out the accuracy of applications filed by competitors.

Lines 20-50 input all the information needed. Line 60 computes the coax efficiency from information in lines 30 and 40. The formula used here is:

$$\text{EFFICIENCY} = \frac{10}{10^{(\text{dB}/10)}} \%$$

The dB figure is the total attenuation of the transmission line.

The information required in line 50 is antenna power, not decibel gain. The two are related, but not directly interchangeable. Most manufacturers will publish both figures.

To approximate one value from another, use:

$$\text{dB GAIN} = 10 \times \log_{10}(\text{POWER GAIN}) \text{ and,}$$

$$\text{POWER GAIN} = \text{INVERSE } \log_{10}(\text{dB/10})$$

Once the computed table of figures ap-

Scott Roberts is an SBE-certified senior broadcast engineer. He can be reached at 408-749-0113.

pears on the screen, you can change any of the original input data. You can also at this time make a one-time change to coax efficiency. This will affect all calculations accordingly, but will revert back to normal by entering a null impact on "L", "A", or "C".

This program is written for the C-64, but I have taken out all the special cursor control symbols that may confuse non C-64 users. The result is a universal BASIC listing that should be useful to most people.

The C-64 does not have a PRINT USING function, hence the need for the extra math in lines 80, 120, 140 and 170. Of course you should add screen-clear commands to aid in appearances, and include a printer driver section so you can save all the computed data.

## 'One Hour'

(continued from page 17)

while Jeff started on the schematic. He needed inverters in several places, so he used NOR gates for everything.

Need a refresher? DeMorgan's theorem lets us invert the inputs and outputs if we switch from AND or OR or vice-versa. Instead of A AND On-Not for JB, we use NOT(A-Not OR On).

The Lower circuit is not much different from the Raise circuit. Figure 4 shows the completed circuit, requiring four CMOS ICs. Two of the NOR gates (U4c and U4d) are connected as a multivibrator to drive the clock inputs.

Jeff looked at his watch. "Ten minutes to spare. If it's all the same to you, I'd like to get started building."

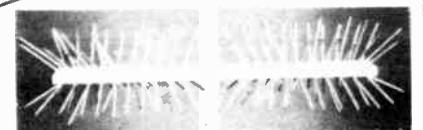
Since the purpose of the past hour was to discuss sequential logic design, we didn't go into interfacing, the power supply or the all-important Power-On-Reset. We'll leave these points for another hour.

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Circle Reader Service 45 on Page 28

## Broadcast Computing

# STL/TSL Hit Target

by Kenneth Hollan

**Austin TX** ... The following program was written to aid in long-distance aiming of the STL/TSL antennas and amateur radio beam antennas.

The program was written on and for a Radio Shack TRS-80 Model 4 or 4P. The TRS-80 returns, TAN, COS and ATN in radians, which must be converted to degrees. If your computer returns them in degrees you are ahead of the game and don't have to type in the conversion factors of 57.29577951000001 or 0.0174539252.

I have the completed program (seven pages long) on disks for Amateur Radio

beam headings. All you do is type in your latitude and longitude and the computer prints out six pages of beam headings to all countries and many cities of the world.

I won't go into the math involved with this program and explain what happens and how it works; the fact that it does work is all that really matters.

*Ken Hollan is president and owner of Hollan Electronics. He can be reached at 512-454-0229. Readers may call the author or to purchase a disk (TRS-80, Model 4 or 4P) at \$15. A hard copy printout of headings and range is \$5 and a hard copy of the program is \$10.*

```

10 CLS
20 PRINT "THIS PROGRAM WAS WRITTEN BY KEN HOLLAN (K5IQ) OF HOLLAN
ELECT., (BCST ENG)"
30 PRINT "AND IS DESIGNED TO AID IN AIMING STL, TSL AND AMATEUR
RADIO ANTENNAS"
40 PRINT "NOTE: NORTHERLY LATITUDES AND WESTERLY LONGITUDES ARE
TAKEN TO BE POSITIVE"
50 PRINT "SOUTHERLY LATITUDES AND EASTERLY LONGITUDES ARE TAKEN
TO BE NEGATIVE"
60 PRINT "PLEASE ENTER THEM AS SUCH. (56.98 OR -46.7, ETC)"
70 PRINT
80 PRINT
90 PRINT "PRESS ANY KEY TO ENTER THE PROGRAM"

```

```

100 IF INKEY$="" THEN 100 ELSE 110
110 CLS
120 INPUT "LATITUDE OF YOUR ANTENNA";A
130 INPUT "LONGITUDE OF YOUR ANTENNA";X
140 INPUT "LATITUDE OF OTHER ANTENNA";B
150 INPUT "LONGITUDE OF OTHER ANTENNA";Y
160 L=X-Y
170 IF L<0 THEN 190
180 IF L>0 THEN 200
190 IF L<-180 THEN 220 ELSE 230
200 L=L+360
210 GOTO 230
220 L=L+360
230 L=L
240 COTL=1/TAN(L*.0174532952)
250 COSL=COS(L*.0174532952)
260 COTB=1/TAN(B*.0174532952)
270 TANTHA=COSL*COTB
280 THA=ATN(TANTHA)*57.29577951000001
290 SINTHA=SIN(THA*.0174532952)
300 COTC=COTL*COS((A+THA)*.0174532952)/SINTHA
310 C=1/COTC
320 C=ATN(C)*57.29577951000001
330 IF L>0 THEN 340 ELSE 370
340 IF C>0 THEN 400 ELSE 350
350 IF C<0 THEN 360
360 IF L>0 THEN C=C+180: GOTO 410
370 IF L<0 THEN 380
380 IF C>0 THEN 390 ELSE 400
390 C=C+180: GOTO 410
400 IF C<0 THEN C=C+360
410 C=C
420 CLS
430 PRINT: PRINT
440 PRINT: PRINT
450 PRINT "THE DIRECTION TO AIM YOUR ANTENNA IS";C;"DEGREES"
460 PRINT
470 PRINT
480 INPUT "ANOTHER CALCULATION (Y OR N) THEN <ENTER>";E$
490 IF E$="Y" THEN 110 ELSE 500
500 CLS
510 PRINT "END OF PROGRAM"
520 END

```

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## New Products

### HAL WX-1000 Weather Box

HAL Communications recently introduced its WX-1000 Weather Box.

The WX-1000 monitors the National Weather Service wire 24 hours per day; stores the messages that you select; provides memory backup in case of power failure and automatically prints only the messages selected by the user.

The unit allows the user to use a radio system to access Weather Wire information from mobile units or remote sites.

The WX-1000 can trigger automatic alarms on bulletins or on user-defined priority messages.

Readers with a PC and 300 or 1200 baud modem may phone the company's WX-1000, which monitors the National Weather Wire Service in central Illinois. The number is 217-367-5547.

The WX-100 will respond with a listing of the products in memory. Type "H" for HELP and the unit will display a list of commands. To terminate the call, type "B".

Introductory price of the unit is \$1,995.

For more information, contact Kenneth Sartain, HAL Communications: 217-367-7373.

### DAC COM Portable Mixer

Dakota American Communications recently introduced its new DAC COM MX1, a three-channel, dual-line output

audio mixer unit.

The unit is compact and portable. It features two mic inputs and one tape (line level) source. Two line level outputs ("Tape" and "Line") and two jacks accommodate two headphone sets that can be individually adjusted.

The mixer amp was designed for multi-source news and sports interviews, voice-over field production work, as an add-on unit for additional inputs to an existing audio system, and for sports and commercial remotes (coupled to telephone interface gear, such as the DAC COM I or DAC COM II phone line interface units).

Front panel controls include level adjustments for each of the three inputs and each of the two headphones. LED indicators above each of the input level controls indicate which inputs are on line. Another LED display shows line and tape output level.

With plug-in power supply, the unit is \$187.50. The battery pack is \$7.95.

For more information, contact Darrell Williams at 701-222-4374 or write Dac Com, 3614 W. Regent Drive, Bismarck ND 58501.

### Fluke μP Troubleshooter

The John Fluke Manufacturing Company's new 9000 Series Micro-System Troubleshooters are a custom-made answer to the troubling presence of micro-

processors in every manner of new radio station equipment.

Compact and inexpensive, the 9000 Series includes a small microprocessor and test probe. A dedicated "Learn" key enables the Troubleshooter to memorize the address busses, data busses and control busses, and identifies I/O ports, RAM and ROM. The LEARN function makes a memory map from a good board.

The 8088 and Z80 units can test a "dead" computer, power supply and clockwork, even if the microprocessor is down.

Designed specifically for use at radio stations, the Fluke 9000 Series includes the 9010A, which troubleshoots for bus, RAM, ROM and I/O. One keystroke initiates all four tests.

The 900 Series Troubleshooters READ and WRITE functions can be used to program peripheral devices such as PIAs, CTCs, UARTs, PICs, etc.

The 9010A Language Compiler lets the customer write test and troubleshooting software off-line on a PC.

Once the operator has accessed and controlled the logic of the unit under test, the "Smart" Troubleshooting Probe can

track failure to the node level.

For devices not tied directly on the bus, 9010A Test Sequencing can be used to develop guided fault isolation routines.

The 9000 Series Mainframes use the universal connection of the unit under test's microprocessor socket as the point of interface. The Interface Pod gains direct control over all components which communicate with the microprocessor and uses the unit under test's clock for correct μP timing.

The 9020A allows custom testing using precision instrumentation. The unit gives a test system full control of the microprocessor bus.

The 9010A Micro-System Troubleshooter is \$3,995. The 9005A, which is nonprogrammable, is \$2,995. The 9020As (with either RS232-C Interface or IEEE-488 interface) are \$4,595.

The optional RS232 interface for the 9010A or 9005A is \$395.

Interface pods range from \$995 to \$2,695. Language Compiler models are \$495 each.

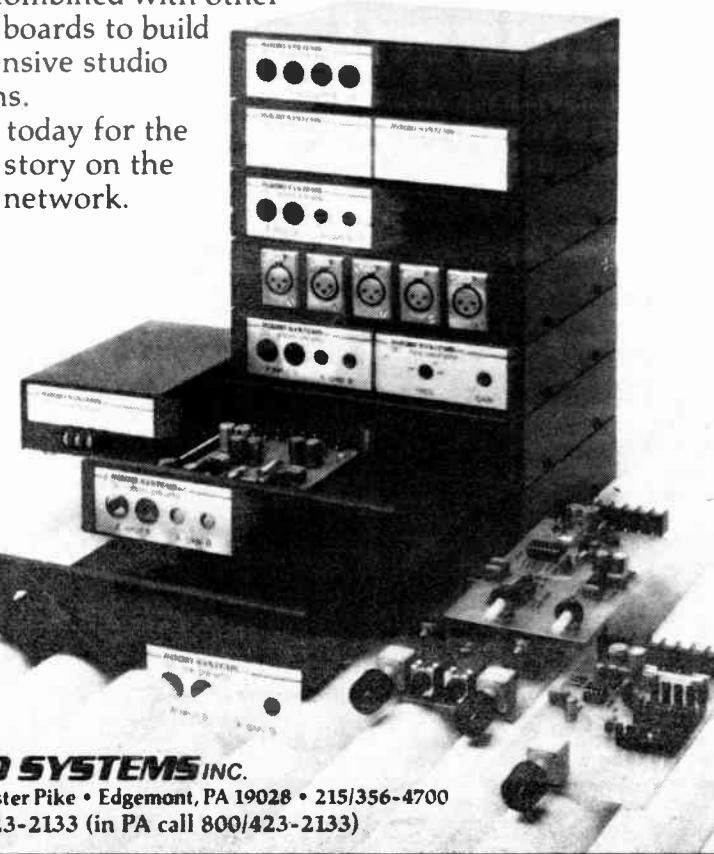
For more information, contact the John Fluke Co., PO Box C9090, Everett WA 98206, or call Larry Kay or Tom Allen at 800-426-0361 or 206-356-5112.

## A Stereo Phono Pre-Amp—\$690! That's DC-X from Radio Systems.

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Circle Reader Service 12 on Page 28

## Correction: Dolby Laboratories

Would RW lie to you? Never. At least not intentionally.

Frustrated readers who were interested in Dolby Spectral Recording (SR), as reported in RW 1 May, have fruitlessly been calling Dolby's facsimile machine.

The correct number to call for Spectral Recording information and updates is 415-863-1373. Ask for Bob Schein or Kevin Dauphinee for a full SR rundown.

The SR circuit employs a complementary signal processing algorithm that responds to the spectral diversity of audio signals, extending the utility

of the level-dependent gain functions utilized in Dolby noise reduction systems, according to the company.

The result is the largest usable dynamic range of any existing recording method, an extremely low noise level, effective elimination of modulation noise and a significant reduction in nonlinear components.

SR can be used in any professional analog recorder in any standard tape format and at any standard speed. The new system is available in the form of retrofit modules that will fit most existing Dolby A-type noise reduction mainframes.

## Subscription/Reader Service Forms

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# Broadcast Equipment Exchange

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Ampex SP-300 transports (2), same as AG-350 but includes tape counter, 7.5-15 ips, w/350 head rest, 1/4" FT, all \$700. J Krepel, 6147 Walker, Phila PA 19135. 215-331-1432.

Crown 800 series transports (3), one hyst sync, one DC servo & one hyst sync in parts w/3 sets of quad elec, 1/4" quad heads, spare heads & IC's, all \$1000. J Krepel, 6147 Walker, Phila PA 19135. 215-331-1432.

Magnecord 1048-4 1/4 trk, mld 1028-4 1/4 trk & mld 728 1/2 trk, all stereo w/cases, covers & hold down knobs, all for \$650. J Krepel, 6147 Walker, Phila PA 19135. 215-331-1432.

Audico manual cassette loaders (2), \$125 ea plus frt. Katherine, Linden Inc, 229 N Henry Alexandria VA 22314. 703-549-0429.

Tascam/Lanier 10-1/2", 4-chan logging recorder, excel cond, \$150; Scully 270. Ampex 350/355 maintenance manuals, \$20 ea; Teac 4010SL auto-reverse 7" 1/4 trk, vgc, \$85. W Laughlin, KDCV, 2636 N Lincoln NE 68504. 402-466-8670.

Telex 230 & 300 model duplicating equip inc: TDA's, cassette slaves, cassette master, R-R masters, relay racks, cassettes rewinders & more, call for details. R Kragen, Recdg for the Blind, 20 Rcsel, Princeton NJ 08540. 609-452-0606 X265.

Scully 280 R-R w/rack mnt w/19 percent hubs, FT mono, excel cond, \$400 plus frt. B Mountjoy, Custom AV, POB 1240, Elizabethan TN 37643. 615-543-5849.

Crown CX-822 2 trk prof recorder, mounted in portable case, vgc, low hrs on heads w/manual, \$650, neg. J Barton, Barton Recdg, 5611 N Delaware, Indianapolis IN 46220. 317-255-7752.

Revox A-77 (2) 1/4 trk, needs work, \$350; 1/2 trk, gd shape, \$500, both for \$800. B Borrelli, Mediagroup, 462 Merrimack, Methuen MA 01844. 617-688-5573.

Scully 270, PB machines 9/14" reel capability, new heads, 2 trk stereo, \$1000/both. B Bordeaux, KSLY, POB 1400, San Luis Obispo CA 93401. 805-543-9400.

Scully 280-B, 8 trk, low hrs & well maintained, excel cond, \$3800. W Sambati, Sqam Recdg, 84 Parkside, Suffern NY 10901. 914-368-0886.

Ampex 600 in gd cond w/manual, \$150. D Stebbins, KELK, POB 790, Elko NV 89801. 702-738-7118.

Ampex 440B 1/2", 4 trk/2 trk servo motor, 15/30 ips, vgc, \$3500. D Hewitt, Remote Recdg Svrs, 20 Kennedy Pkwy, Monsey NY 10592. 914-425-8569.

Ampex AT440 2 trk R-R in console w/manuals, mint cond, very low hrs, \$2000. D Bailey, Rock Shoppe Prod, 12869 Montfort St 250, Dallas TX 75230. 214-386-7783.

Ampex PR10 (4) transports, \$30. R Porter, Porter Recdg, POB 5452, San Mateo CA 94402. 415-349-0931.

Ampex 44A, full trk, self standing, BO, P Downes, Brandy Wine Prod, Box 2115, Wilmington DE 19899. 302-737-8273.

Ampex mono machine, BO, A Potheimus, Excalibur Snd, 750 8th Ave, NY NY 10036. 212-302-9010.

Kenwood cassette deck R/P w/Dolby, BO, P Downes, Brandy Wine Prod, Box 2115, Wilmington DE 19899. 302-737-8273.

Revox A77, gd cond w/manual, \$450; Magnacorder P75, works OK w/preamp, \$25, U-ship. S Bartkowski, WEDC, 4923 W 28th, Cicero IL 60650. 312-863-3090.

3M 56 16 trk 2" 15 & 30 ips, select tape & remote, spare cards & manual, \$9400. K Fox, Mercantile Recdg, POB 2271, Palm Springs CA 92263. 619-320-4848.

Ampex 354 modified & calibrated to current standards, \$1000. B Mattson, 904-383-1563 or 326-9231.

Ampex AG440B 8 trk, mint cond, comp w/remote, \$8000. Elsmere Music, Box 185, Bedford Hills NY 10506. 914-234-9201.

Otari MX5050, 3 yrs old, excel cond, \$1050. B Sam, Bogart Prod, 9 Twin Lakes Ct, Arlington TX 76016. 817-467-0158.

Technics RSM63 3 head cassette, \$100. David, Wave Sound Recdrs, 1956 Cahuenga, Hollywood CA 90068. 313-253-8562.

**Want to Buy**

Ampex 300 mono decks for parts or rebuild. R Robinson, c/o TNA, Box 57, Wallingford CT 06492. 203-269-4465.

Ampex 200 original head assy & manual. P McManus, McManus Interp, 4011 Orchard Ave, San Diego CA 92107. 619-223-1730.

ITC or Revox PBs, 1/2 trk stereo, for automation. R Miller, WRVI, 278 E Jackson, Virden IL 62690. 217-965-3388.

**CONSOLES**
**Want to Sell**

Tascam M-50, 20x8 mixing console w/stand, pwr supply, walnut side panels, excel cond, \$4300. S Cilurzo, KGMG, POB K, Oceanside CA 92054. 619-729-1000.

UREI Mod One, fair cond, working, w/manual, \$500. S Schneider, WBMX, 408 S Oak Park, Oak Park IL 60302. 312-524-3240.

Shure M67 (2) metered, gd cond, \$150 ea. J VonVelck, Aras Recdg, 2321 N Utah, Arlington VA 22207. 703-524-5067.

McMartin B80253 8 chan stereo, \$800; Collins 9 chan mono, \$300. B Van Prooyen, Van Prooyen Bdctg, 628 Mulford Dr SE, Grand Rapids MI 49507. 616-452-0133.

Collins 212F-2 console, like new, some preamps never unpacked, \$850. P Schneider, PKMJ, 1280 S Oxnard Blvd, Oxnard CA 93034. 805-486-2337.

Ramko DC38-8S 8 chan stereo, \$2900. D Smith, WFCB, 45 W Main, Chillicothe OH 45601. 614-773-3000.

Gates Executive 10 chan stereo, gd cond. G Williamson, WASK, POB 7880, Lafayette IN 47903. 317-447-2186.

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

Gates SA-40, spare tubes & manual, BO, L Ayer, KRPL, POB 8849, Moscow ID 83843. 208-882-2551.

Tascam 30, 8 in & 4 out, mint cond, w/manual, \$895. B Osborne, A-V Assoc, 4760 E 65th St, Indianapolis IN 46220. 313-253-8562.

Biampl 1282 stereo 12 input board, bal ins & outs, needs 2 plastic knobs, otherwise excel cond, \$375 ppd. G Finerman, Advanced Media, 17 Hillcrest Rd, Suffern NY 10901. 914-368-1143.

Teac AX-20 mixdown panels (2), \$20 ea. W Laughlin, KDCV, 2636 N 56th, Lincoln NE 68504. 402-466-8670.

Gates M6209B President (2) & M5236 Dualux tube type, 8 mixer w/2 output chan & 12 mixer w/2 outputs chan, BO, E Burger, 3403 Woodley Rd NW, Wash DC 20016. 202-966-3025.

Shure M67, (2) mic mixers (2). G Hyatt, 13318 Schwenger Pl, Herndon VA 22070. 703-471-5250.

Audiarts 8X 24 trk monitor, patch bay, new, \$13,500. D Kocher, 1901 Hanover, Allentown PA 18103.

Biampl 1283, 12x2x1 mixer, internal reverb, 2 sends, \$500. P Cibley, Cibley Music, 138 E 38th, NY NY 10016. 212-986-2219.

Getham 600/85 audio faders, balanced, (30), \$35 ea/B0. D Weinstein, Cinema Snd, 311 W 75th, NY NY 10023. 212-799-4800.

Ramko DC8MS 8 chan stereo, digitally controlled, \$1250. B Van Prooyen, Van Prooyen Bdctg, 628 Mulford Dr SE, Grand Rapids MI 49507. 616-452-0133.

Collins 212F-2 console, like new, some preamps never unpacked, \$850. P Schneider, PKMJ, 1280 S Oxnard Blvd, Oxnard CA 93034. 805-486-2337.

Ramko DC38-8S 8 chan stereo, \$2900. D Smith, WFCB, 45 W Main, Chillicothe OH 45601. 614-773-3000.

Gates Executive 10 chan stereo, gd cond. G Williamson, WASK, POB 7880, Lafayette IN 47903. 317-447-2186.

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

Gates SA-40, spare tubes & manual, BO, L Ayer, KRPL, POB 8849, Moscow ID 83843. 208-882-2551.

RCA BC-4A tube type mono, 4 chan, gd cond; RCA BC-6A, tube type mono, 8 chan, poor cond. WHPA, POB 464, Hollidaysburg PA 16648. 814-695-4441.

Tascam 5 8x4, gd cond, \$650 or \$950 w/cherry wood console. J Block, Prod Block Stds, 906 E Fifth, Austin TX 78702. 512-472-8975.

Sun SPL 2212 12 ch mixer, 2 main, 2 mon, 2 effect, 1 sum outputs, \$950. F McCall, Performance Srvs, 1521 W St Marys #229, Tucson AZ 85745. 602-623-2110.

Collins 212S stereo 6 chan, all solid state, very clean. J Runkle, 208-344-0947.

Shure M68 (2) mixers, new, \$100. J Ross, WTVN, 6263 Emberwood, Dublin OH 43017. 614-766-4292.

Bogen MXM mixer, fair cond; Bogen LOM mixer, fair cond. WHPA, POB 464, Hollidaysburg PA 16648. 814-695-4441.

Quantum QM8P stereo prod console, \$595; Tangent 802 prod console, \$400/B0. M Harrelson, Botwell Studios, 720 23rd St S, Birmingham AL 35233. 205-251-8889.

BE 8M100A 8 mixer mono, dual chan, vgc w/manual, \$1500. R Laine, United Cable Co, 4757 S Salida Ct, Aurora CO 80015. 303-690-9533.

Harris Medalist 12, new, 12 ch stereo w/slide faders, up/down timer & 12 hr time, \$7100/B0. A Soroka, WJRO, POB 159, Glen Burnie MD 21061. 301-761-1590.

Tascam Mdl 10, 8 in, 4 out, gd cond, \$1400. J Mulien, Audio Recorders, 3843 Richmond, San Diego CA 92103. 619-296-6355.

Attec Lansing 250SU 10 chan solid state mono or stereo, comp w/2 wired-in patch panels, \$800 plus ship. W DeLong, WMOV, POB 667, Ravenswood WV 26164. 304-273-2544.

Ramsa WR-130 8x2x1 stereo mixer, linear sliders, EQ, echo send/receive, pan-pots, +4 out, Q, mix or line in, LN, \$600/B0. B Dombrowski, Whirlwind Prod, 10356 W Warren, Dearborn MI 48126. 313-584-4038.

CCA Ultimate control boards (2), \$2500 ea; Cetec antenna, 92.5, 6 bay, 2 yrs old, L Daven, WYFI, Box 1818, Chesapeake VA 23320. 804-547-9421.

Ramko DC5M-S 5 chan stereo, \$1400. D Smith, WFCB, 45 W Main, Chillicothe OH 45601. 614-773-3000.

Tascam Mdl 10, 8 in, 4 out, OK shape, \$500. M Cogan, Bay Records, 1516 Oak St, Alameda CA 94501. 415-865-2046.

McMartin B502 5 chan stereo, gd cond, w/manual, \$1000. G Bishop, WOES, 8989 Colony Rd, Elsie MI 48831. 517-834-2271 X40.

Tascam 5 8x4, gd cond, \$650 or \$950 w/cherry wood console. J Block, Prod Block Stds, 906 E Fifth, Austin TX 78702. 512-472-8975.

Sun SPL 2212 12 ch mixer, 2 main, 2 mon, 2 effect, 1 sum outputs, \$950. F McCall, Performance Srvs, 1521 W St Marys #229, Tucson AZ 85745. 602-623-2110.

Collins 212S stereo 6 chan, all solid state, very clean. J Runkle, 208-344-0947.

Want to Buy

Inst book &/or schematic for RCA BC15BS 5 chan stereo SN 6130-004. C Smith, KREK, POB 1280, Bristow OK 74010. 918-367-5501.

Langevin AM-516-B tube type preamps. P McManus, McManus Interp, 4011 Orchard Ave, San Diego CA 92107. 619-223-1730.

DISCO & SOUND EQUIP.

**Want to Sell**

K&H UE-100 universal EQ, tube/mono, w/manual, \$100. D Weinstein, Cinema Snd, 311 W 75th, NY NY 10023. 212-799-4800.

Rec studio package inc Ampex MM1200 16 trk, 32x16 mixing console, digital reverb system, mics & other outboard gear, all equip in excel cond, real estate also avail, terms sale/lease. R Medlen, Creative Sound Studio, 602 Cree Dr, San Jose CA 95123. 408-225-6302.

E-V MC8A 8" speaker, new in box, never used. S. W Laughlin, KDCV, 2636 N 56th, Lincoln NE 68504. 402-466-8670.

Studio, 8 trk, mostly new equip, BO, W Preist, Classic Sound & Recd, 1515 County Rd 1, Dunedin FL 33528. 813-736-3131.

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# Broadcast Equipment Exchange

**LIMITERS ... WTS**

CBS Audimax 3, gd cond. \$145. J Hall. WCHV. 1140 Rose Hill Dr. Charlottesville VA 22901. 904-977-5566.

CRL AM4 mono system, complete. BO. K Jenkins, KAMA. 4150 Pinnacle #120. El Paso TX 79902. 915-544-7600.

Aphex Compellor, less than 1 yr old. \$800. T Parker, KXEW. 889 W El Puente Ln. Tucson AZ 85713. 602-623-6429.

Volumax 400 & 411; Dorough DAP-310 FM audio processor; Inovonics 215 processor; Orban 245 E stereo synthesizer. P. Wells, KLZZ. 8665 Gibbs #201. San Diego CA 92123. 619-565-6006.

Mosley TFL-2800 limiters (2), excel cond. \$850 ea; CRL SEP-400A, excel cond (2). \$550 ea; CRL CC-300A comp limiter, gd cond. \$400. S Schneider, WBMX. 408 S Oak Park, Oak Park IL 60302. 312-524-3240.

Orban Optimed 8000A, gd cond. \$1750 or trade for prod equip. R Sanson, WGUS. POB 1475. Augusta GA 30913. 803-279-1380.

dxs 162 rack mounted stereo comp/limiter. \$400. B Hawkins, WENS. 1099 N Meridian #1197. Indianapolis IN 46204. 317-266-9700.

Orban 8000A Optimed in excel cond. \$2000 or trade for stereo console. Larry O'Neal, KIXX. POB 1624. El Dorado AR 71731. 501-862-9696.

Optimod 8100/A compressor/limiter/stereo gen. excel cond. \$3700 firm. S Ciurzo. KGMG. POB K. Oceanside CA 92054. 619-729-1000.

Marti CLA-40H compressor/limiters (2). P Wicker, WOBR. POB 400. Wanchese NC 27981. 919-473-3434.

Collins 260-1 limiter. P Wicker, WOBR. POB 400. Wanchese NC 27981. 919-473-3434.

Gates Solid Statesman, FM limiters. \$500. K Magrill, KSLM. POB 631. Salem OR 97308. 503-364-8433.

Gates solid-state FM audio limiters. matched pair (2). \$400 ea. L Ayer, KRPL. POB 8849. Moscow ID 83843. 208-882-2551.

Optimed 9000A/1 AM, excel cond. \$1995. R Benson, KHOM. POB 728 Station 2. Houma LA 70360. 504-876-5466.

UREI BL40 recently recnd. \$250 or trade. B Ladd, WNRR. 108-1/2 E Main. Bellevue OH 44811. 419-483-2511.

Pacific Recorders Multi-Max & Multi-limiter triband AM system. \$1000. K Magrill, KSLM. POB 631. Salem OR 97308. 503-364-8433.

CCA AGC amp, AGC-10 tube type, fair cond. WHPA. POB 464. Hollidaysburg PA 16648. 814-695-4441.

Gates Level Devil, works. \$50 or trade. B Ladd, WNRR. 108-1/2 E Main. Bellevue OH 44811. 419-483-2511.

UREI LA4's, dual, blackface w/rack & manual, all aligned. \$600. B Hawkins. WEMS. 1099 N Maridian St. Indianapolis IN 46204. 317-266-9700.

UREI LA3A, LA2A, excel cond. work like new. BO. R Kaufman, Ricky The K Prod. POB 29804. Atlanta GA 30359. 404-636-9911.

CRL FM System inc: 1 SPP-800, 2 SEP-400A, 1 SMP-800. BO. B Vizza. WXUS. 711 N Earl Ave. Lafayette IN 47904. 317-448-1566.

CRL APP400/PNC 300A, only used 2 mons. \$1100 ea or \$2000/both. N Allebaugh. WICE. 100 John. Cumberland RI 02864. 401-725-9000.

Spectra-Sonics 610 (2) comp/limiter. check aligned & updated w/LED indicator. \$225 ea or \$450/both. D Johnson, KAWL. Box 544. York NE 68467. 402-362-4433.

Orban 8000A, perf cond. J Howell, Howells Audio. 521 Park. Kingman AZ 86401. 602-753-3054.

Inovonics 201. D Nebenzal, Tamara Prod. 8143 Morse Ave. N Hollywood CA 91605. 818-780-3099.

MSP-100FM Tri-band AGC. must be reasonable & in gd shape. D Payne. WZPL. 1440 N Meridian. Indianapolis IN 46202. 317-637-8000.

AM processor, up to \$500. A Caswell. C&G Bdcg. POB 171. Linden MI 48451. 313-735-4545.

**MICROPHONES****Want to Sell**

Neumann U-64 w/power supply (2). \$600 ea. A Varner, Penny Lane Stds. 1350 Ave of the Americas. NY NY 10019. 212-687-4800.

Neumann U-67, factory recnd w/new capsule. \$1200. J Hoffman, Daybreak Ent. 12318 Hardesty Rd. Ft Wayne IN 46825. 219-627-5990.

Altec Coke Bottle. 21B tube omni condenser mic w/new cable & power supply. R Robinson, TNA Records. 10 George St. Wallingford CT 06492. 203-269-4465.

EV D056 (2) omni directional mic. \$70 ea. A Simon. 305 Spring St. NY NY 10013. 212-924-2276.

EV CS15 condensor, cardioid. \$150. Beyer 101NC omni dynamic, small dent in shell. freq response still exc. \$50. Audio-Technica ATM63 supercardio dynamic. \$75. 813 condensor. \$75. 813R phantom powered condensor w/stands. higher SPL. \$100. R McMillen, RM Audio Prod. 13515 SW 72nd. Tigard OR 97223. 503-684-1973.

Neumann U87 (2) mics w/power supplies. L Thompson, WCLT. POB 880. Newark OH 43055. 614-345-4004.

EV RE15, \$90. Sony C500. \$600; AKG N66 pwr supply. \$150. D Kocher. 1901 Hanover. Allentown PA 18103. 215-776-1455.

Sennheiser MKH805 w/pwr supply & boom shock mount, excel cond. \$850. S Rosenthal, Rosenthal Prod. 4419 Irving St. San Fran CA 94122. 415-665-1035.

EV 665 (2), dynamic mics. gd cond. \$220/both. J Sunier, Audiofile Auditions. Box 1621. Ross CA 94957. 415-457-2741.

Sennheiser MD421U, brand new. \$190. A Soroka, WJRO. POB 159. Glen Burnie MD 21061. 301-761-1590.

**Want to Buy**

Altec 21B tube condenser mic. Coke bottle. R Robinson, c/o TNA. POB 57. Wallingford CT 06492. 203-269-4465.

RCA 77DX, must be in excel cond. need two. M Brenner, Cal State Long Bch Music Dept. 1250 Bellflower. Long Bch CA 90840. 213-498-4796.

**MISCELLANEOUS****Want to Sell**

Weston illuminated VU meters. \$25 ea. D Weinstein, Cinema Snd. 311 W 75th. NY NY 10023. 212-799-4800.

Phase Master T-10000, rotary phase converter. used 2 mon. ran 25 kW xmtrs until install 3 phase power. avail now. \$3950. K Dolly, WQCB. POB 273. Brewer ME 04412. 207-989-5631.

Telephone, (4) rotary dial, individual hold. 5 lines. E/C. \$35 ea. H Jernegan, WHRO. 5200 Hampton Blvd. Norfolk VA 23508. 804-489-9476.

Bird 8891, 5 kW coax load resistor w/blower. \$750. R Renner, WCLT. POB 880. Newark OH 43055. 614-345-4004.

Rack cabinets, 6' by 15" deep & 4' by 24" deep. P Wicker, WOBR. POB 400. Wanche NC 27981. 919-473-3434.

T-12A vacuum crystals, 1250 kHz (2); T-12A vacuum crystal, 1380 kHz. WHPA. POB 464. Hollidaysburg PA 16648. 814-695-4441.

Telodyne Telan-2 series, thermal gen. complete w/meters. propane fueled w/regulators. 24 VDC 70 W. new. BO. D Barton, KMTL. POB 1590. Manti UT 84642. 801-835-7301.

# Employment

**POSITIONS WANTED**

Bdct Tech seeks FT/PT work in studio, can announce. 10 yrs FM/TV exper. Hank. 408-246-5563.

Radio CE, former CE Boston, Houston, Miami. Ham genrl, non-drinker, now! ASEE. M Gottesman. 3377 Solano #312. Napa CA 94558. 415-550-8506.

Eng, exper & qualified to handle studio. STL's & xmtrs. an immediate opening for CO at WKGR in the Ft Pierce FL area & plenty of opportunities for addtl work in the area. send complete resume to Francis Sherwood. WKGR. 600 Atlantic Ave. Ft Pierce FL 33450.

Versatile announcer, 9-1/2 yrs exp. OH area pref. Ken Baker, 33 Richmond Pl. Akron OH 44303. 216-253-2679.

Assist. Radio CE, 2 yrs exper.. general class license, audio, radio freq & digital electronics knowledge. KGBT/KELT. Box 711. Harlingen, TX 78550. EOE.

Prof actor w/equip looking for people to form film co. call or write: H Deans. 170 Grand St. White Plains NY 10601. 914-949-5920 or 203-866-5050 X3243.

Tech oriented person seeks bdct related job as xmitter maint tech. elect exper. Write: M Rakoff. 114-41 Queens Blvd Ste 148. Forest Hills NY 11375.

CE/Ops Dir, 10 yrs exper. great prod if needed. prefer Colorado-Rockies. AM/FM/TV. GB. 1312 Left Hand Dr. Longmont CO 80501. 303-72-3916.

CE, hard working, looking for FT position would like to take care of single or group owned stations. MO. NE. OK. avail imm. Larry Timmons. 913-425-6509.

CE for quality station in midwest or west. 30 yrs hands-on exp in radio-TV bdct maint. Rick. 509-332-6310.

Bright, ambitious. 32 yr old, seeks station for eng work to break into bdct. general/ham. CET plus more!. Mitchell Rakoff. 114-41 Queens Blvd. Forest Hills NY 11375. 718-591-0002.

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Want To Sell It?



# Broadcast Equipment Exchange

**MISC ... WTS**

Plate transformer FM, high voltage, 3 phase 220/4000 V, never used. \$500. D Smith, WFCB, 45 W Main, Chillicothe OH 45601. 614-773-3000.

**Want to Buy**

Transformers, 1 doz Hi Z, 10-100 Kohms, to 600 ohms; (10) 600-600 ohms. J Kobrock, WEOS, Geneva NY 14456. 315-789-8970.

Jingles & air check tapes to swap w/stations in Northern MI incl the UP. J Linthicum, Linthicum Prods, 1409 Brook St, Piqua OH 45356. 513-773-7284.

**MONITORS**
**Want to Sell**

McMartin TBM-4500A gd cond. \$1000; McMartin TBM-2000 SCA mon, 67 kHz. fact cond. \$1200. S Schneider, WBMX, 408 S Oak Park, Oak Park IL 60302. 312-524-3240.

RCA(Belair) BW 75 & BW 85, FM & stereo mod monitors, tuned to 92.9 as set only. \$1600. R Dietterich, WLTJ, 1051 Brinton, Pittsburgh PA 15221. 412-244-7600.

TFT 753 AM mono mod monitor, excel cond. \$900. M Persons, KKIN, POB 930, Aitkin MN 56431. 218-829-1326.

Collins 900F1 SCA monitor, gd shape. \$200. J Schloss, KICD, 2600 Hwy Blvd, Spencer IA 51301. 712-262-1240.

McMartin TBM-3000 FM freq mon. w/manual. \$100. G Bishop, WOES, 8989 Colony Rd, Elsie MI 48831. 517-834-2271 X40.

HP 335B FM monitor & mod meter (mono), needs minor repair w/manual. \$100. G Bishop, WOES, 8989 Colony Rd, Elsie MI 48831. 517-834-2271 X40.

Collins 900C-3 FM mod mon; Metron 506B-1 AM mod mon. P Wicker, WOBR, POB 400, Wanchese NC 27981. 919-473-3434.

**Want to Buy**

Tower type accepted directional antenna monitors, 3 or more. D Davis, KMIN, POB 980, Grants NM 87020. 505-287-2989.

RCA BW 73-A mod monitor sub-carrier filter or monitor for parts. J Schloss, KICD, 2600 Hwy Blvd, Spencer IA 51301. 712-262-1240.

**MOVIE PRODUCTION EQUIP.**
**Want to Sell**

Bolex 816 16mm movie camera, zoom lens, sync motor for snd recdg, battery pack & attachment for 400' magazine, BO, H Beans, Beans Prod, 170 Grand, White Plains NY 10607. 914-949-5920.

RCA FR-35 35mm projector, new cond w/manuals. T Smith, CCI Prod, 192 Lancaster Ave, Frazer PA 19355. 215-289-1725.

Bolex H16, 16mm w/zoom lens, sync sound motor, battery pack, pistol grip, 400' magazine on camera. \$1650. H Deans, Deans Prod, 170 Grand St, White Plains NY 10601. 914-949-5920.

**RECEIVERS & TRANSCEIVERS**
**Want to Sell**

Yaesu FRG 7 comm rec, excel cond. \$185. M Goodman, Interport Group, 6621 Gettysburg Dr, Madison WI 53705. 608-833-6948.

GE MSTR VHF base station w/Regency TR200 VHF mobile 2-way on 161.64 MHz, \$200 ea/\$1500 for both. F Morton, KMGZ, POB 7953, Lawton OK 73504. 405-536-9530.

Drake R7 comm rec w/all 5 bandwidth filters & noise blinder, excel cond. \$745. M Goodman, Interport Group, 6621 Gettysburg Dr, Madison WI 53705. 608-833-6948.

Motorola UHF ENG system w/HT's, mobiles, voting system & more, wide audio bandwidth. \$35000. P Wells, KLZZ, 8665 Gibbs #201, San Diego CA 92123. 619-565-6006.

Bogen TP160 solid state AM/FM mono receiver, may need some work, \$75. M Persons, KKIN, POB 930, Aitkin MN 56431. 218-829-1326.

RCA Pac Tech Series, 2 W transceivers, port, exc cond (8). \$250 ea; Johnson 547 UHF port, 4 W/rapid chargers. \$175 ea; RCA 700 series UHF base station 25 W. \$450; Standard 703 UHF repeater w/60 W amp, \$850. R McGrath, Spanner Dup Svcs, 320 William Circle, Alliance NE 69301. 308-762-7640.

**Want to Buy**

McMartin EBS-2 EBS monitor. K Smith, WJBQ, 583 Warren, Portland ME 04103. 207-775-3439.

**REMOTE & MICROWAVE EQUIP.**
**Want to Sell**

QEI 7775 automated xmt system \$2000 or trade for quality R.R. D Doughty, WTLB, Utica NY 13503. 315-797-1330.

Microwave Assoc MA6-G, comp xmit & receive stations in racks, 1 video & 2 audio chan, 6987.5 MHz, new cond, BO. T Smith, CCI Prod, 192 Lancaster Ave, Frazer PA 19355. 215-289-1729.

Marti RMC-20, vgc, w/2 chan ext relay panels total 10 ch. \$1000. J Meyers KVPR, 754 D St, Fresno CA 93721. 209-486-7710.

Marti M30BT, VHF RPU transmitter w/tube type receiver on 161.64 MHz, avail 7/30/86, \$1200/BO. F Morton, KMGZ, POB 7953, Lawton OK 73504. 405-536-9530.

Microwave Assoc MA66 complete transmit & receive stations in rack's 6987.5 MHz, new cond. T Smith, CCI Prod, 192 Lancaster, Frazer PA 19355. 215-289-1725.

Micro-Controls RCR-9 & RCT-9 analog remote control system, currently on phone line, but adaptable to STL/SCA. \$1500 & will pay ship, avail 6/86. R Miller, WRVI, 278 E Jackson, Virden IL 62690. 217-965-3388.

Tri State 10' wire dish & button hook, \$375 or trade. B Ladd, WNRR, 108-1/2 E Main, Bellevue OH 44811. 419-483-2511.

**Want to Buy**

STL antennas, 950 MHz. D Davis, KMIN, POB 980, Grants NM 87020. 505-287-2989.

NBC sat receiving system, inside elec. SA 2375 digital audio processor & SA 7300 wide band DPSK rcvr. K Brooks, KREI, POB 461, Farmington MO 63640. 314-756-6476.

Moseley TRC15A, need xmt end, will buy system for backup. D Barton, KMTI, POB 1590, Manti UT 84642. 801-835-7301.

RPU xmt & receiver on 450 MHz, low power, must work. R Miller, WRVI, 278 E Jackson, Virden IL 62690. 217-965-3388.

**STEREO GENERATORS**
**Want to Sell**

CCA SG-10 stereo gen, gd cond. \$200; Moseley SCG-4T SCA gen, 67 kHz, vgc, \$400. S Schneider, WBMX, 408 S Oak Park, Oak Park IL 60302. 312-524-3240.

Mod Sciences Sidekick, excel cond w/manuals. 67 kHz changable to 92 kHz. \$2000 firm. C Peterson, Show Sound, 4601 W Kennedy Ste 301, Tampa FL 32609. 813-884-1461.

RCA BTS 101 stereo gen, \$250. A Bater, WPIX, 220 E 42nd, NY NY 10017. 212-210-2773.

**SWITCHERS (VIDEO)**
**Want to Sell**

JVC KM2000 switcher, like new, \$2295. D Brennan, Custom Video, POB 26126, Birmingham AL 35226. 205-823-0088.

**TAPES, CARTS REELS**
**Want to Sell**

Ampex 406, 1" audio tape, never used. (9) total reels. \$35 ea/\$300 for all. M Friend, J-Mark Prod, 8706 Doss Rd, Moseley VA 16915. 814-274-8085.

Non-profit station needs 6076 & high voltage rectifier 857B, 6894, 6895 or 673 & parts for RCA 50 kW BTA xmt, also 833 tube, S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

Harris Criterion Compacts, religious station has donated Harris Criterion Compact 3 cart deck, need the record amp. T Cochran, Alaska Radio Mission, Box 988, Nome AK 99762. 907-443-5221.

Seven sec delay carts & 7 sec delay cart machine, donation would be appreciated. S Davidoff, WAIF, 2525 Victory Pkwy, Cincinnati OH 45206. 513-961-8900.

Self-supporting tower, stereo gen, & solid state stereo board sought by non-comm FM college station, leave message or write. R Shegrer, KNBU FM, Baker Univ, 7th & Dearborn, Baldwin City KS 66006. 913-594-6451.

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## 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.

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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.

Check as appropriate:  Help Wanted  With Box Number  Positions Wanted  Without Box Number

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**BROADCAST EQUIPMENT EXCHANGE  
PO BOX 1214  
FALLS CHURCH VA 22041**



# Broadcast Equipment Exchange

## TEST EQUIPMENT

### Want to Sell

IFR-1200 comm mon/RF spectrum analyzer w/all options. 250 kHz to 1 GHz, excel cond. \$6500 firm. S Cilurzo, KGMC, POB K. Oceanside CA 92054. 619-729-1000.

Barker & Williamson 200 audio osc. \$150. M Persons, KKIN, POB 930, Aitkin MN 56431. 218-829-1326.

Hickot 800 tube & transistor tester. \$150. M Persons, KKIN, POB 930, Aitkin MN 56431. 218-829-1326.

Tek 7L18 spectrum analyser. 1.5 to 18 GHz. 60.5 GHz w/ext wave guide mixer, digital storage, perf for sat system measurement, fits Tek 7000 mainframe. excel cond. \$10,000. J Somich, KSCI, 1954 Cotner Ave., LA CA 90025. 213-479-8081.

Nems-Clark FIM-135 field strength meter, solid state, excel cond. \$550. C Anderson, 1519 Euclid Ave., Bowling Green KY 42101. 502-781-2067.

Tek 520A vectorscope, perf cond. T Smith, CCI Prod. 192 Lancaster Ave., Frazer PA 19355. 215-289-1725.

Elec Devle Corp 4100 sine wave amplitude & freq standard, excel cond. 2 yrs old. \$2000/B0. S Jordan, WUSO, Rt 50 West, Winchester VA 22601. 703-662-5101.

Tek 526 vectorscope, gd cond. \$400; Tek 181S time mark gen, fair cond. \$75; HP 8558B & 853A spectrum analyzer, excel cond. \$10,000. W Grossman, 1555 Astor St. Chicago IL 60610. 312-944-6248.

Fluke 8020, digital handheld multimeter, very gd shape. \$150. R McMillen, RM Audio, 13515 SW 72, Tigard OR 97223. 503 684-1973.

Tek 1420, RM-529, 528, 520A, 1440, 1460, 146, 147, all units in gd cond: GVG 900 main frame, sync gen, proc amp & color lock module, gd cond. T Smith, CCI Prod. 192 Lancaster, Frazer PA 19355. 215-289-1725.

Sound Tech 1510A, tape & audio test system, inc reel & cart test tapes, excel cond. \$7500/B0. S Urban, KKUS, 396 Buckley Rd, San Luis Obispo CA 93401. 805-541-8798.

SSI-Wavetek mdi 2000 synthesized signal gen. 400 kHz to 999 MHz, excel attenuator & low RF leakage. \$2750. W Arnett, WBAT, 120 N Miller, Marion IN 46952. 317-664-2411 vdes.

HP 1415A time domain reflectometer w/140B scope, new cond. \$1100. R Evans, 216 N Green Bay Rd, Thiensville WI 53812. 414-242-6000.

McMartin TBM-3005 freq counter, may be used for direct measurement of 19 kHz pilot, w/manual. \$100. G Bishop, WOES, 8989 Colony Rd, Elsie MI 48831. 517-834-2271 X40.

GR 722-D precision condenser, 110-1100  $\mu$ F, in wood case. \$25; GR 1800A VTVM, \$15; Amprobe cable tracer, \$20; Heathkit vectorscope for TV service. \$25, plus ship. C Brennan, 661 Horseshoe Curve, Pike Road AL 36064. 205-277-0139.

### Want to Buy

Manual & schematics for GR 1613A capacitance bridge or military version, TTU-24E. T Adams, WI Public Radio, 3319 W Beltline Hwy, Madison WI 53713. 608-246-2052.

CMC 616 freq counter, any cond. for replacement parts & boards. T Adams, WI Public Radio, 3319 W Beltline Hwy, Madison WI 53713. 608-246-2052.

## TRANSMITTERS

### Want to Sell

Collins 820-D-2 AM, 1kW, compatible tower also for sale, excel cond, avail immmed. BO. C Thornton, WAGE, Box 1290, Leesburg VA 22075. 703-777-1200.

Gates DC-5E, 5 kW AM, on 1260, new P Dahl pwr xformers, vgc, some spare parts. \$2950 neg. J Hall, WCHV, 1140 Rose Hill Dr., Charlottesville VA 22901. 804-977-5566.

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Dallas, TX 75248

R.E. (Dick) Witkovski  
Owner. 214-630-3600

**Bird 8922** dummy load. 5 kW. \$1700. E Muscovitch, WHLM, 107 W Main, Bloomsburg PA 17815. 717-784-4900.

**Collins 22.5 kW** xmtr. 945' of 3-1/8" coax w/connectors. 12 bay antenna & 1000' tower. BO for lot. L Dupree, KWID, 1115 Texas Ave, Alexandria LA 318-445-1234.

**QEI 675**, 20 W exciter, mint. \$2000. S Lawson, KAK, POB 91, Villa Grande CA 95486. 707-865-1516.

**RCA BTF20E1** 20 kW FM xmtr w/BTE15A exciter. BB1B stereo gen. BTX1B SCA gen. no finger stock in PA socket recently & some spares. \$10,000. G Morrill, WITL, 3200 Pinetree Rd, Lansing MI 48910. 517-393-1010.

**RCA BTA50F1**, 50 kW AM, gd cond w/spares. BO. B Sowell, WMAZ, POB 5008, Macon GA 31213. 912-741-9494.

**RCA BTA 5F**, 5 kW xmtr. 620 freq. \$5000. B Hale, WINF, POB K, Leesburg FL 32749. 904-787-1410.

**RCA BTE-15AFM** exciter. 107.7 MHz. w/SCA module & wide band input module. manual, gd cond, in operation. \$1000. R Roiseland, KSXK, 5315 W 7th, Topeka KS 66602. 913-272-2122.

**RCA BTA-1R** 1000 W on 1320 kHz. BO. T BonDurant, WOJY, POB 2808, High Point NC 27261. 919-869-0101.

**Gates BC-1F**, AM 1 kW xmtr in aux use. BO. R Benson, KHOM, POB 728 Station 2, Houma LA 70360. 504-876-5466.

**Collins 8200-2** AM, tuned to 1290, power set to 1K/500 W, inc spare parts. \$8000 plus ship. P Draisey, WAGE, Box 1290, Leesburg VA 22075. 703-777-1200.

**Collins 830-1**, 10 kW power amp. \$5000. R Renner, WLCT, POB 880, Newark OH 43055. 614-345-4004.

**QEI Mdl 77751** ATS interface panel, never used. \$150. J Robillard, KLVU, 1803 N First East St, Haynesville LA 71038. 318-624-0105.

**LPB carrier current, inc** (3) 2-20 systems w/TX-20 xmtr & T-8 interface: (2) T-1A-X pwr splitters: (1) T-1A-X pwr splitter; (9) T-8 interfaces: (4) RC 5A 5 W xmtrs: RF patch cables for all but RC-5A units, various manuals & install instructions. J Kobrock, WEOS, Geneva NY 14456. 315-789-8970.

**Harris FM-10K**, like new. 3 yrs old. in operation, w/exciter. \$25,000. J Zimmer, Zimmerman, POB 1610, Cape Girardeau MO 63701. 314-651-3003.

**Gates FM5B** 5 kW FM xmtr on 92.9, final cabinet needs minor work w/manual & spare final. \$500 & buyer ships. B Croghan, KWFM, 2100 N Silverbell Rd, Tuscon AZ 85745. 602-623-7556.

**Gates BC-500T** 500 W AM xmtr, gd cond, sitting idle, ready for use. \$1700. R Christiansen, KDAK, 859 Main, Carrington ND. 701-652-3151.

**Collins 830D-1A** 1 kW FM xmtr, clean, very reliable, now on 103.1 MHz. D Matthews, KASK, 120 First Natl Tower, Las Cruces NM 88001. 505-524-2103.

**RCA BTA 250L w/BTA1K** 1000 W AM xmtr, spare parts. BO. H Jenkins, KFMM, POB 549, Pima AZ 85543. 602-485-2228.

**RCA BTE 115**, direct FM exciter w/manual, fully synthesized, 17 W. 3-1/2" tall. 7 yrs old, tuned to your freq. \$900 plus ship. B Hawkins, WENS, 1099 N Meridian, Indianapolis IN 46204. 317-266-9700.

### Want to Buy

**FM xmtr**, 20 kW, mid 70's or newer in gd cond, single phase if possible. G Durham, WYGO, 400 E Center, Corbin KY 40701. 606-528-6618.

**BTA-IR-1** or IR-2 xmtr, call or write: R Eugene, 610 W 141st #5A, NY NY 10031. 212-926-2511 or 212-862-1298.

**Rust FMT15A-HV** FM xmtr instruction manual, \$50 reward. D Swanson, KTCF, RR 2, Sioux City IA 57106. 712-252-4621.

**FM xmtr**, 20 kW, w/o exciter, for full donation or part donation or part cash, non-comm licensed to public school district. J Mangan, KVTL, 4500 Steilacon Blvd SW, Tacoma WA 98499. 206-756-5889.

**FM xmtr**, 2.5 or 3.5 kW, w/exciter, 240 V single phase, S Mueller, KQLX, Box 1008, Lisbon ND 58054. 218-681-4554.

**UHF xmtr**, chan 16 or 14-40, any cond, incl junkers & translators from 1-20 kW visual, need immed. J Kautz, KJKL, 402 E 4th, McCook NE 69001. 402-534-2071.

## TUBES

### Want to Sell

**Tubes**, high power transmitter, new & used, all guaranteed & verified. BO. T Smith, CCI Prod. 192 Lancaster Ave., Fraizer PA 19355. 215-289-1725.

**High-Power UHF-VHF tubes**: VA891; VA891H; 6166A/7007; 892R; 8890; 8916; 8984; 9007, many others. Varian, EIMAC, RCA etc. Your source for tubes-transmitting, camera, etc. Call Temtron Electronics, 15 Main St, East Rockaway NY 11518. 800-645-2300/516-599-6400.

**Varian, Macheletta, RCA** xmtr pwr tubes, various types, all guaranteed & verified. T Smith, CCI Prod. 192 Lancaster, Frazer PA 19355. 215-289-1725.

### Want to Buy

**RCA TTU1B**, need (2) 6181 tubes & (2) 6161 tubes for 1 kW UHF xmtr. L Nixon, WTKV, 601 N Lee, Valdosta GA. 912-247-3333.

**Surplus inventories**, power, industrial, receiving, etc. C Dripps, Kurluff Ent, 4331 Maxson, El Monte CA 91732. 818-444-7079.

**Tubes**, 4-100A & 5CX1500A, like new. C Frodsham or M Hoffman, KVSV, POB 7, Beloit KS 67420. 913-738-2206.

## TURNTABLES

### Want to Sell

**Shure M44-7** (3), brand new. Shure SG39EJ (6), brand new. B Major, KJNO, 3161 Channel Dr #2, Juneau AK 99801. 907-586-3630.

**BE Spotmaster Studio Pro TT**, w/Micro-Trak tonearm, low hrs. \$200. L Wagner, ARN Prod. POB 1788, Orlando FL 32802. 305-299-1299.

**Stanton 681E**, (2) brand new. \$30 ea. J Glass, WLBN, 711 N 1st, DeKalb IL 60115. 815-758-8686.

**QRK 12C** w/onearm & cartridge in gd cond. \$180/bot. D Cody, Cody Prod. 6431 Inkster, Garden City MI 48135. 313-425-8794.

**Micro-Trak 306**, 16" tonearms (2), new. \$100 ea. K Harnack, Harnack Eng. 895 Mt Rushmore, Richmond KY 40475. 606-624-2181.

**Rusco MK V** (2), w/Harris EQ's pre-amps. Micro-Trak 303 arms & Stanton 500 cartridges. \$400 ea. M Ripley, 4K Radio, Box 936, Lewiston ID 83501. 208-743-2502.

**Dual 1229** (2), \$60 ea; (2) Kenwood direct drives, \$75 ea; Bic 960 (2), \$50 ea, all mint cond. F McCall, Performance Svrs. 1521 W St Marys #229, Tucson AZ 85745. 602-623-2110.

## Want to Buy

**Sony TTS 3000** 2 speed belt drive, pay any price, collect calls accepted. M Glaser, C&G Ent, 2 Floyd Ln, Massapequa NY 11762. 516-489-1071.

**EMT 927, 928, 930ST** complete. Gerrard 301, C Dripps, Kurluff Ent, 4331 Maxson, El Monte CA 91732. 818-444-7079.

## VIDEO PRODUCTION EQUIP.

### Want to Sell

**Alden 9271 D/H/AEC** facsimile recorder for NWS map repro via sat or landline, 4 yrs old, 24 hr clock stand, 30 rolls paper, spare blade. \$4000. KLMS, 1540 S 70th Ste 200, Lincoln NE 68506. 402-489-6500.

**VDS/Compuvid System**, teletext, char gen, includes all equip for full screen data & stock disp from sat, inc keyboard. F Campenni, Madison Cable Network, POB 8056, Madison WI 53708. 608-252-6000.

**Harris 516** digital TBC, 16 lines, excel cond. \$2595; Dynascience hor/vert image enhancer, gd cond. \$495. D Brennan, Custom Video Labs, POB 26126, Birmingham AL 35226. 205-823-0088.

**FMS 1000**, 2 speed belt drive, pay any price, collect calls accepted. M Glaser, C&G Ent, 2 Floyd Ln, Massapequa NY 11762. 516-489-1071.

**Time Code Editor** for RCA TR600A's, must handle 4+ machines & in gd working cond. H Henson, Henson Prod. 4569 Havencrest, Winston-Salem NC 27106. 919-924-8717.

**Microtime 2020**, buy for parts w/service manual, \$500/less. J Scheppers, Scheppers Design, 4740 Charlotte, Kansas City MO 64110. 816-561-6622.

**Cleaner/evaluator**, 3/4" & 1-66 Angenieux tele-extender. E Hillman, TK Video, 301-762-2786.

&lt;p

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October 6, 1983

Mr. Eric Small  
Modulation Sciences Incorporated  
99 Myrtle Avenue  
Brooklyn, N.Y. 11201

Dear Eric:

As I was connecting back up my new Sidekick to our Harris 20 K. 1 was thinking about all the electronic marvels that Eric Small has contributed to the radio business. From early development work on the Optimod, to that clever Upstart unit, your contributions have been many.

And now, I'm happy to report that I can add another unit to the long list of developments and place it in its own very unique category.

When the local paging company inquired about usage of the SCA, my first thought was of the new sidekick SCA generator. You promptly shipped it to us. I didn't realize however that the paging company was going to make available a McMartin generator for our usage as well. Well, it gave us the opportunity to audition both units on the air. The comparison was like night and day. I was expecting the typical "background music" sound. However, much to my delight, the Sidekick was bright, clean, and loud. Almost resembling the sound of the main program channel! The McMartin sounded pale, by comparison.

Once again, I don't know how you did it...all I know is that it works! and it works very well!

Best regards:  
*Jim Davis*

Jim Davis  
General Manager  
Radio Station WVAF

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Watch for our new ad for SIDEKICK next month!

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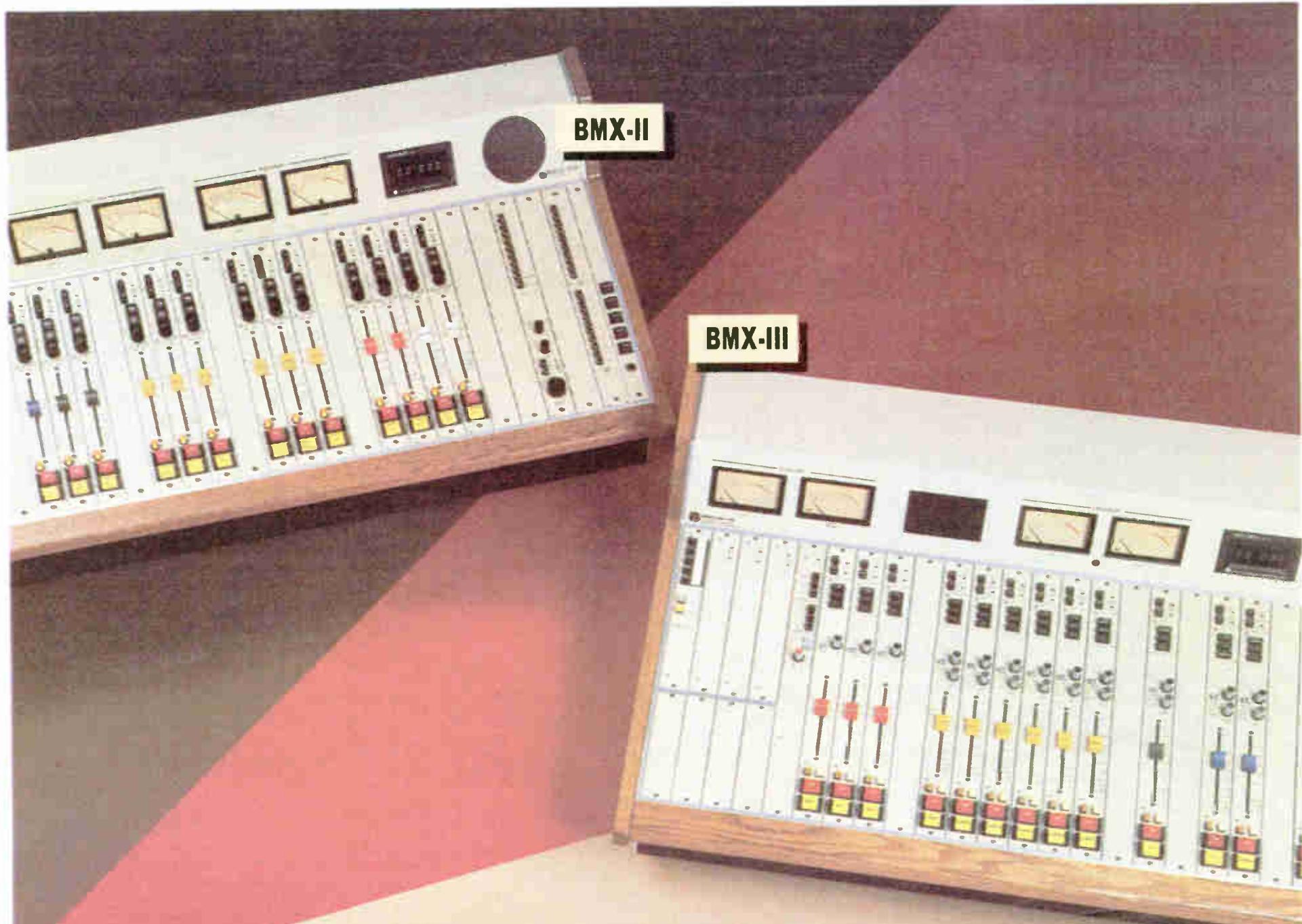
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