

FCC OKs User Fees for 1987

by Edward Wytkind

Washington DC ... Broadcasters will begin paying user fees by April 1987 that are designed to cover FCC application processing expenses, Commission officials announced in early April.

The new user fees were adopted by Congress in its budget reconciliation bill, which was passed 20 March. President Reagan signed the reconciliation bill on 7 April, which marks its enactment into law.

The new fees that affect radio broadcasters include \$2,000 for a major CP by AM stations, \$1,800 for a major CP by FM stations, \$6,000 for all FCC public

hearings, \$500 for minor facility modifications, \$325 for AM licenses, as well as additional fees for equipment certification and type acceptance, according to the bill.

In addition, stations using satellite transmissions will have to pay \$3,000 to apply for transmit/receive earth stations, \$1,350 for transmit-only earth stations and \$200 for initial authorization to operate a receive-only earth station.

Small-to-medium market broadcasters said they were concerned about the reconciliation bill's lack of consideration

for market size regarding fees. In essence, a radio station in a small market will pay the same fees as a major market broadcaster.

However, FCC Managing Operations Director Marilyn McDermott said that if Congress had chosen to differentiate fee levels based on market size, then the fees would be viewed as a tax, rather than as a charge intended solely to cover the FCC's expenses associated with application processing.

According to the bill, the Commission must implement the fee schedule within

360 days of the bill's enactment.

The FCC will then release the fee schedule as a proposed rulemaking, and will seek industry comment regarding implementation, McDermott said.

McDermott added that the Commission will probably need the entire 360 days to install the proper automation equipment and to hire the new personnel necessary to administratively implement the new fee schedule. The projected date of implementation is mid-April 1987.

Dangerous precedent

Thomas Shattenfield of the Washington, DC communications law firm Arent, Fox, Kinter, Plotkin and Kahn, and legal counsel for NRBA, said he was "conceptually against such fees," and that user fees "play with danger."

The NRBA, he explained, has lobbied the FCC to adopt the "contract theory," which essentially would treat broadcasters' spectrum usage on a longterm lease basis. The contract theory would protect broadcasters from increased fees, Shattenfield said.

"In theory, these new fees are supposed to cover application processing expenses, but in reality, granting the power to charge such fees is a dangerous thing," he added.

Small market radio victimized

Also voicing strong opposition to the new fees, Dennis Hudson, president/GM of WKOR-AM, Starksville, MS, said the fees will "kill small market radio."

"Common sense tells you how unfair it is not to differentiate between market (continued on page 4)

MBI: FCC Sets Plan

by David Hughes

Washington DC ... The FCC has proposed allowing FM noncommercial translators to be fed by satellite or microwave link.

The proposal, unveiled 3 April, was issued in response to a series of requests from the Chicago-based Moody Bible Institute (MBI) to feed by satellite or microwave its FM translators, each of which currently rebroadcasts a MBI-owned local FM noncommercial station. Current rules require an off-air link from the parent station.

In a related matter, the NAB, claiming that the FCC's current FM translator rules are being abused and "do not clearly reflect the Commission's intent," has asked for the development of "clearer, more strict technical standards."

The "expanded authority" to feed FM noncommercial translators via satellite or microwave would apply only to translators located on Channels 200-220 (88.1 to 91.9 MHz), which are reserved for noncommercial use.

The FCC said that even though a satellite or microwave link could be used, the translators would be limited to rebroadcasting the parent station. The proposal only applies to translators which are owned and operated by the parent station.

"Noncommercial FM translators (will) continue to be authorized only on a secondary basis as a fill-in service in areas that cannot support full-service noncommercial stations and only when they would cause no interference to other authorized broadcast stations," the FCC said.

(continued on page 6)

C-QUAM Violations Alleged

Washington DC ... Kahn Communications, Inc. (KCI), in a complaint to the FCC, has alleged that Motorola Corporation's C-QUAM™ AM stereo system, manufactured by Motorola and three authorized licensees, violates type acceptance requirements mandated by FCC rule 73.44 covering spectrum occupancy and adjacent channel interference.

According to the complaint, KCI, which, with Hazeltine, jointly manufactures the only competing AM stereo system, received technical measurements from a radio station engineer (who Kahn refused to identify) demonstrating the C-QUAM system's alleged type acceptance violations.

A Motorola spokesperson said, "We feel that the complaint is without foundation." No other comments were issued.

At press time, in a letter dated 10 April 1986, the FCC denied KCI's allegations and said that further action against Motorola and its licensees is not "warranted at this time." See the 15 May Radio World for an update on the matter.

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Regulatory News

AM Improvement Report Issued

by David Hughes

Washington DC . . . The FCC approved on 3 April a long-awaited AM improvement report, developed by the Commission's Mass Media Bureau.

The 103-page document, which was scheduled to be released to the public in April, lays the groundwork for future Commission action in revamping regulations—some of which have been in place for 60 years—that many in the industry claim burden AM broadcasters.

"This will keep us busy for the next few years," Mass Media Bureau Chief James McKinney told the four FCC commissioners when he officially presented the report, which has been in the works since last September.

Surprises announced

While McKinney has, in repeated talks, divulged some issues the report would cover—including the future of clear channel operations, synchronous transmitters, duopoly rules and RF noise, he announced a few surprises.

The report explores the possibility of allowing AM broadcasters to sell or lease their interference rights, he told the commissioners. It also examines placing low powered local stations on regional channels. The document even raises the issue of allowing an entity to own more than one AM station in a market.

Commissioner Mark Fowler pointed out that a licensee is now permitted to own an AM and an FM facility within one market. "Why not two AMs, instead," he said, pointing out that this practice might be limited to larger markets, where diversity would not be a pro-

blem on one band.

McKinney said the report questions whether the FCC's definition of "a community," of which a station is licensed to serve, should be broadened. It also questions whether AM broadcasters should be allowed to transmit nonaural program material, such as computer data, over the main channel during hours when they would otherwise be off the air.

“While McKinney had divulged some issues the report would cover, he announced a few surprises.**”**

The Commission's future use of more accurate computerized projections of skywave propagation calculations are also covered in the report, which is divided into 11 sections.

One section of the report looks at "assignment principles," including plans to restructure the station classifications, interference limits, protection ratios, power limits and antenna systems. A section on "engineering standards" examines receiver standards, AM stereo, propagation characteristics and "trade-offs."

Nontechnical operating requirements, station ownership and "new concepts" are also covered. A subsection is titled, "The need to unshackle entrepreneurial ingenuity."

McKinney said the Commission will establish a three-month public comment period on the report, predicted to run through July. After the comments are studied, the commissioners will then set priorities on the individual issues.

"I have no desire to have one broad rulemaking," McKinney said. "There is no need to open all the issues (for rule-making) at once."

Individual rulemaking proposals would be released on what the commissioners deem to be the most pressing issues by fall, he added.

Report praised

The commissioners praised the report. "I was a strong clear channel man," said Commissioner James Quello, "but the situation has changed." He said the number of people "unserved, except by skywave" has dropped significantly.

Commissioner Mimi Dawson, in praising the report, jested that she wondered how East Coast residents would be able to hear St. Louis Cardinals games on KMOX if the FCC's clear channel policy is changed.

Commissioner Fowler said the report was an important step in the eventual goal of regulating broadcasting "in the narrowest sense of the word."

The report, due to be released to the public in early April, is available for purchase from International Transcription Services, 2100 M Street, NW, Washington DC 20036. Call 202-296-7322. It can also be examined in the FCC's public reference room at its Washington headquarters.

FCC contacts are either Wilson LaFollette (202-632-5414) or Jonathan David (202-632-7792).

Editor's Note: Due to the diverse nature of the AM improvement report, RW will cover the issues in greater detail in a series of articles appearing in upcoming editions.

FCC Clips

Program Duplication

The FCC has eliminated its rules which limit the amount of program duplication or simulcasting allowed on co-owned AM/FM combination stations.

The rules had required that in instances of an AM/FM combo licensed to a community of more than 25,000 people, the FM station could devote more than 25% of its average weekly airtime to duplicated programming.

However, on 26 March, the Commission struck down the requirement. Licensees of AM/FM combos now have "full discretion to make decisions concerning program duplication in accordance with market conditions," the FCC said.

The Commission said the rule removal would "foster expanded radio hours of operation and, thereby, promote improved service to the public."

The FCC order deletes rule section 73.242. For more information, contact Alan Stillwell at the FCC: 202-632-6302.

"Birth Control" Update

The NAB said it opposes a petition for reconsideration filed against the FCC's recent repeal of the so-called AM "birth control" rules.

The National Black Media Coalition (NBMC) said the AM birth control rules, enacted two decades ago to place restrictions on the filing of certain AM applications to foster FM band development, should have been retained in order to aid the development of both minority owned and public radio stations.

The FCC voided the rules in October 1985, saying that the FM band does not need to be bolstered at the expense of the AM band.

According to comments filed by the NAB, minority opportunities for station ownership would actually be enhanced by the removal of the birth control rules, which would increase the overall AM broadcast service without hindering FM growth.

For more information, contact Bob Hallahan at the NAB: 202-429-5350, or Jonathan David at the FCC: 202-632-7792.

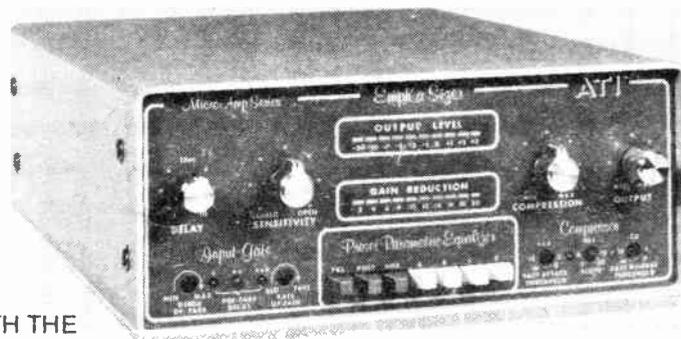
Fowler Advisors Resign

Daniel Brenner, senior advisor to FCC Chairman Mark Fowler, has been named director of the Communications Law Program at the UCLA School of Law.

Brenner joined the Commission in 1979. In 1985, he was appointed Fowler's senior advisor. His resignation takes effect 6 July.

Fowler's legal assistant, Thomas Herwitz, resigned 28 March to accept a position with Fox Television Stations.

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Regulatory News

Class III Power Increase Sought

by David Hughes

Washington DC . . . The NAB and the Association for Broadcast Engineering Standards (ABES) have asked the FCC to raise the maximum power limit for Class III AMs from 5 kW to 50 kW, in addition to allowing Class III daytimers to operate at night.

In line with the overall FCC/industry campaign to improve the state of AM radio, the two organizations asked for the rule change in order that Class III facilities "may improve and expand their existing service to the public," according to the joint petition for rulemaking filed 20 March.

While the NAB and ABES maintained that a 50 kW power limit would not be feasible for all Class IIIs, they said stations should be allowed to operate above the current 5 kW ceiling that now applies to Class IIIs in the continental US.

Because of increasing interference from foreign broadcasters, the Commission has already instituted a 50 kW power limit for Class IIIs in Puerto Rico and the Virgin Islands, along with Alaska and Hawaii.

Even though Class IIIs in the lower 48 states would be able to increase their powers according to the NAB-ABES proposal, they would still be required to comply fully with current interference protection standards, the two organizations maintained.

In the same petition, the NAB and ABES also asked the Commission to release a rulemaking proposal to allow Class III daytimers "full nighttime authority at reduced power."

"Daytime-only broadcasters face serious limitations which can only be alleviated by the authorization of full nighttime operation," they said.

Specifically, Class III daytimers should be given night power levels equal to their "second hour after sunset" postsunset authorization (PSS) levels, the petition maintained.

“*The Commission has already instituted a 50 kW power limit for Class IIIs in Puerto Rico, Virgin Islands, Alaska and Hawaii.***”**

Class III daytimers would be able to "continue to operate beyond the second hour after local sunset at the same power as they are now authorized to employ during that second hour and to continue to operate at that power through the night," the NAB and ABES said.

For example, the petition indicated, a typical Class III daytimer operation could be licensed to run 5 kW during the day, with authorizations for 150 W during the first half hour after local sunset, 100 W for the second half hour, and 73 W from the end of the second half hour to the end of the second hour after sunset.

The proposed plan would permit the station to keep operating all night at the 73 W level.

The NAB and ABES added that even though the daytimers would be allowed

to operate at night, most of their night power levels would be below 250 W. Therefore, the stations should technically continue to be considered daytimers, thereby able to receive FCC daytimer preferences if they, for example, plan to apply for foreign clear-channel operations.

If the increased power and night operations proposals are not accepted, NAB and ABES said Class III service "limitations" that have been in effect for three decades would be "perpetuate(d)."

While Class IIIs operate according to allocations criteria developed in the 1950s, the petitioners pointed out that there has been an increased number of stations, in addition to new international agreements.

Because of recent treaty agreements, Class III operations could find high powered cochannel foreign operations on their frequencies, the NAB and ABES said.

However, the two organizations said an "across-the-board" power in-

crease for all Class IIIs would not be feasible, owing to the complex system of fulltime and daytime stations operating with directional and omnidirectional antennas, with powers of 500 W to 5 kW.

"To authorize each station to increase power by a specific power (such as 100% or 500%) would result in unequal interference level increases because of the various parameters with which stations operate," the joint petition added.

The NAB and ABES also maintained that "adoption of expedited processing procedures, such as those developed in the FM field, can speed delivery of new AM service to the public, and Commission mediation between mutually exclusive applicants can resolve many interference problems without the need of a hearing."

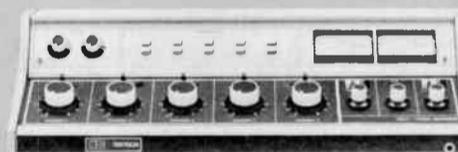
For more information on the NAB/ABES proposal, contact the NAB General Counsel Office at 202-429-5430.

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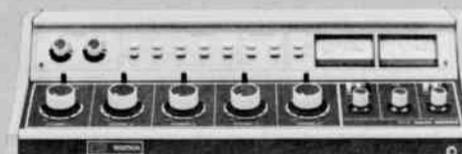
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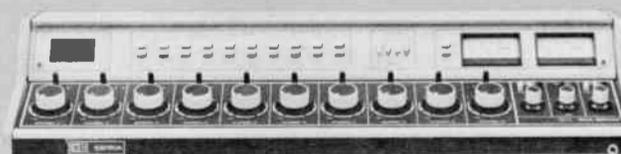
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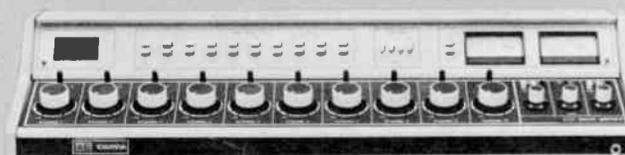


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Circle Reader Service 33 on Page 24

Regulatory News

RFR Complications Close KERG

by Edward Wytkind

Garberville CA . . . A California Class-C FM went off the air in March because of what it claimed to be an inability to comply with the federally recognized American National Standard Institute (ANSI) radio frequency radiation (RFR) human exposure limit.

Located in the rural northern California town of Garberville, KERG-FM's RFR dispute with state officials surfaced

“

In cases such as this, you're never sure (of compliance) until after the fact.

”

last August after state authorities discovered that RFR levels at a firetower located only 66' from the station's tower exceeded the ANSI exposure limit, thereby posing a health risk to forest rangers working atop the lookout platform.

Following months of effort to resolve the problem, KERG owner Daniel Healy, in a letter sent to the FCC in March, said the station's present antenna site was unable to "qualify for compliance with the ANSI radiation limitation standards and, due to available space and adjacent radio installation equipment, correction of (the) current site is prohibitively difficult and expensive."

Healy could not be reached by RW for

comment.

Healy also pointed out in the letter that the "extreme roughness of local terrain mandates equivalently high antenna vantage for proper coverage." He added that "KERG cannot properly and adequately serve a viably large enough population to make the operation financially possible from other site options."

Severe power reduction

After receiving complaints last August from the California Department of Forestry, which mans the firetower, the FCC reduced KERG's power level from 51 kW to 2 kW and granted the station a program test authority.

In addition, KERG was given until California's next fire season, which starts in late April, to resolve the problem. However, instead of pursuing a resolution of the conflict, station owners decided to go off the air.

KERG engineering consultant Kevin Fisher of Smith and Powstenko, Washington, DC, said compliance would have been a "calculated risk" because, even if station owners had invested the money to institute tower modifications, there could still have been some unavoidable "hot spots."

Fisher added, "In cases such as this, you're never sure (of compliance) until after the fact." Therefore, he said, the station decided not to take the risk.

Fisher also said California's RFR measurement criteria, although based on the ANSI exposure limit, are more "rigid" than the FCC's standard.

Most parties involved in the KERG case, including the FCC, said the incident

was unique, and that while the station could probably have solved the problem with certain engineering modifications, KERG's owners decided against making the investment.

"It sounds like it was a judgment call (by the station)," said a NAB official.

Throughout attempts to resolve the conflict, KERG consultant Neil Smith, of Smith and Powstenko, had reported progress in efforts to remedy the problem. Possible remedies included vertical separation or repositioning the antenna.

While recognizing that a problem existed, Smith said he was concerned that this could be a "lead case" on how the FCC plans to handle RFR conflicts that pit broadcasters with state authorities.

At press time, the NAB was waiting for action on a petition it filed with the FCC in late March urging the Commis-

sion to issue a policy statement preempting all nonfederal RFR standards that inhibit the operation of federally authorized communications facilities.

KERG's engineering questioned

Supervising Engineer Larry Mertens of the Telecommunications Division of the California Department of General Services maintained that if "KERG would have been properly engineered from the beginning, the problem probably would not have occurred."

"Our intent was not to kick a broadcaster off the air," he said.

Mertens, who led the RFR site measurement at the station, said increased "vertical separation" between the transmitter and the lookout tower would have been the "logical engineering approach."

However, in the letter to the Commission, KERG's Healy said that on-site facility modification attempts would have been too costly because of the station's dependence on a large coverage area.

FCC to Implement User Fee Schedule in 1987

(continued from page 1)

size," Hudson said. "This won't hurt the corporate owners; it will extend financially the small market owner that also runs the station."

KTWO-AM, Casper, WY VP and GM Bob Price said that, in the past, user fees were "nominal and didn't impose a great hardship on broadcasters."

"I don't see the rationale behind these new fees . . . To a small market radio station owner, this could make the difference between making and losing money," he added.

David Underhill, president of WKVT-AM/FM, Brattleboro, VT said that "one way or another it had to get paid for." Although WKVT is in a small, unrated market, Underhill said the fee levels were not "inordinant," but that the \$6,000 hearing charges were "questionable."

"I do have a problem with a citizen having to pay for his day in court," he added.

Amid broadcasters' oppositions to the new fees, Underhill and other broadcasters acknowledged that the user fees might help reduce the number of "nuisance" applicants or "spectrum speculators" filing questionable applications with the FCC.

NAB opposes fees

The NAB "opposes any sort of user fees, but we believe that the fees (in the bill) only reflect the FCC's costs for application processing," NAB Executive VP John Summers said.

Commenting on the \$6,000 fee for hearings, Summers maintained that the NAB wants assurance that only those parties "initiating" the hearing will have to pay the fee, unless the hearing is held for an open frequency.

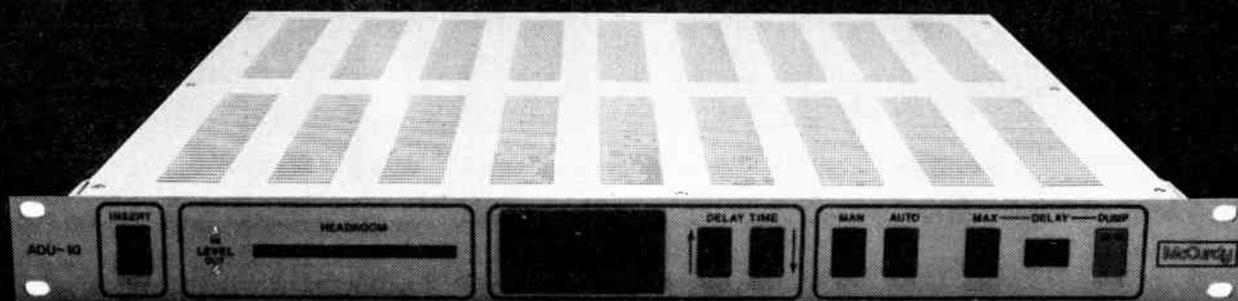
"However, the greatest significance of the bill," he added, is that Congress "opted for user fees, rather than spectrum fees . . . which are essentially taxes."

Summers also explained that the user fee issue dates back to the mid-1970s, when the NAB filed suit against the FCC over its user fees. The suit alleged that the old user fees exceeded the amount needed by the FCC to cover its application processing costs.

The US Supreme Court ruled in the NAB's favor, Summers said. As a result of that litigation, the FCC has operated without user fees since 1 January 1977.

For more information, contact Marilyn McDermott at the FCC: 202-632-5316.

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GMs and gender

Dear RW:

I want to make a comment to Floyd Hall, who writes your "Old Timer" column.

I am one of the younger engineers, and enjoy the column very much. However, in the 15 February 1986 edition, when talking about GMs, he addressed them as "he" or "him" . . . Hall *must* be an "Old Timer" . . . my GM is a female!

Kyle Dickson, CE
WCRJ, Jacksonville, FL

RW's Floyd Hall replies: I'm glad you enjoy my "Old Timer" column; thanks for the letter.

In reply to your reference as to your GM being a "female," I get the impression you might be afraid of her!

I have known several female GMs, and dealt with them on the same basis that I do with men. I'm not afraid of a female GM, and I would tell her the same things I do the others.

The term "General Manager" to me has no gender; and I believe that one of the feminine gender can be just as good, or as bad, as anyone else!

Decent AM receivers

Dear RW:

I have an AM wish list. Just one wish that I've had for years . . . a decent AM receiver.

Development of AM radio as a high-fidelity medium stopped somewhere in

the 1930s as far as the receiver is concerned. In broadcasting, we've watched the continual improvement of our transmitters, to the point that many of us are putting out a signal that is equal to FM, both in frequency response and absence of distortion. But no one hears that signal. Worse, the public doesn't believe that it exists.

How bad are today's AM radios? Ask any Chief Engineer who has ever performed an EPM. One of the most difficult parts of any proof has always been the act of demodulating the air signal to get a truly representative sample of the quality of your audio, transmitter and antenna.

In recent years, better modulation monitors have lessened this burden.

But a radio? Never.

I've run excellent proofs with a selected 1N34A and a coil, but never yet have I found a receiver that doesn't add substantial distortion or have a dismal frequency response.

A cursory glance at the schematics of any of today's hifi tuners or receivers will show an elaborate, well-engineered FM section, while the AM section is hardly better than that of a \$5 pocket radio.

This, I think, is AM radio's biggest problem. The fact is that we are putting out a good, high-fidelity product and few know or care about it. The FCC (advocating a *reduction* of bandwidth?) the RAC and the NAB all seem to ignore this simple fact.

We have the technology to build better receivers, but not the motivation. Perhaps AM stereo is the best hope we have, not so much for the stereo aspect, but because to receive stereo at all it is necessary to build a better receiver than we have heretofore seen.

What do you think?

John Gaboury, CE
KEZC/KJOK
Yuma, AZ

RW replies: We have heard a number of readers and news sources express the same thoughts, including several in "Readers' Forum." Unfortunately, as long as it's feasible to build and sell poor AM receivers, they will be built and sold. Nothing will change this, even AM stereo.

Dangerous procedures

Dear RW:

I'd like to second William Ellis' comments about safety in the 15 March RW.

Too many of us endanger ourselves and others while trying to save a few minutes of time, whether in the middle of the night or when trying to finish a construction project under pressure.

Several years ago, I took over a station where the former engineer had

Thank you, FCC, for coming through with the long-awaited and eagerly anticipated AM improvement report, first announced last September by Mass Media Bureau Chief Jim McKinney.

The contents of the report were previewed often by the Commission to let the industry in on the AM issues under scrutiny. The report, therefore, was anticipated less so for its contents than for its public release, which would signal the beginning of the rulemaking process.

The AM improvement report released by the Commission in April was anything but routine, and contained several refreshing surprises. The Commission even suggested some revolutionary ideas that would drastically alter the environment in which AM radio operates.

Report on AM Bodes New Era

Notwithstanding the merits and demerits of each issue raised in the report, the Commission's creative thinking is welcomed. This boldness and imagination indicates a tremendous step toward a new and exciting era in AM broadcasting.

Aside from the expected look at duopoly rules, synchronous transmitters, RF noise, the status

of clear channel operations and other issues, the Commission suggested examining the possibility of allowing broadcasters to sell or lease their interference rights to other stations.

The FCC's expected ability to better determine skywave propagation via computer may lead to a reclassification of stations, power levels and protection limits.

Another novel idea that could be immediately implemented and that would bring much-needed financial gain to AM stations is the proposal to allow daytimers to transmit monaural data via the main channel when it is not in use. The report also examines the possibility of permitting AM broadcasters to use FM translators.

The only action that will give the Commission's report meaning, however, is a follow-through free of bureaucratic delays. A Notice of Proposed Rulemaking on each issue should be prepared and scheduled for comment as soon as it is ready. Delays can only hurt AM radio and hinder private enterprise efforts to develop new and better AM technologies.

—RW

bypassed every safety interlock in the transmitter, with a single jumper in an inconspicuous place, and of course left no record of doing so. Fortunately, I discovered this by means of a minor, rather than a major, accident.

There's another, in my mind, less excusable side to this, which, I think station personnel have to stop tolerating. This is the practice by-all-too-many equipment manufacturers of requiring highly dangerous procedures to adjust or maintain their equipment in the field.

The transmitter mentioned above, with all the interlocks bypassed, has several crucial operating adjustments, including driver tuning and PA filament voltage, located *inside* an interlocked front door, only inches from the high voltage rectifier stack. Of course, these adjustments can only be made accurately with the transmitter operating at full power.

The manufacturer of this transmitter is blessedly out of business, but a lot of his products are still around.

At present I am responsible for a current model transmitter by a major manufacturer who is very much in business.

In order to adjust bias on the driver or PA of this transmitter, it is necessary to open a narrow front door, then attempt to hold this door open while the drag of the wiring harness tries to pull it closed against your arm (with dangerous voltages exposed at numerous term-

inals on the back of the door), and reach in with a meter and probes to measure the bias voltage at the terminals of a barrier strip (to which it is virtually impossible to attach any clips that I've ever seen; handheld probes are the only workable method).

To adjust bias, one must then reach (with his third or fourth hand) *past* this barrier strip to reach the bias adjust pot. With an extra foot or so of lead length, the manufacturer could have located these controls and proper test points (or a meter) on the front panel.

The same transmitter requires one to adjust driver loading (which is touchy on this model) by opening up the cavity and bending a small strap, then closing everything up and firing up the transmitter to see what you've just done, then shutting down and opening everything up again to bend a little more, and so on, until you finally get it right. This is a very tedious procedure, which only invites dangerous shortcuts.

When I spoke to the manufacturer's service people about this, they seemed to feel it was no problem, because this adjustment "only had to be made at the factory." I beg to differ: on our particular transmitter, it has to be made any time driver or PA tubes are changed.

In the future, I plan to follow a procedure which, if enough of us do it, could have an impact on manufacturers.

(continued on page 6)

Radio World

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Free subscriptions are available to professional broadcasting and audiovisual equipment users. For address changes, send current and new address to RW a month in advance at the above address. Unsolicited manuscripts are welcomed for review; send to the attention of the appropriate editor.

FCC FM Translator Plan Issued

(continued from page 1)

The Commission also maintained that the new rule would not permit the development of a satellite-fed network of FM translators located large distances from the parent station.

The plan does not deal with satellite and microwave feeds for FM commercial translators because the Commission chose to limit the proceeding to the specifics requested by MBI, which dealt only with noncommercial translators, according to FCC Policy and Rules Statistician Marcia Glauber.

"No one asked the Commission to address commercial translators," she said.

In October 1985, MBI asked the FCC to allow it to feed its noncommercial FM translators with satellite or microwave links.

MBI cited as an example its WMBW, Chattanooga, Tenn. station, which has a translator located on a mountain with a "hostile winter environment" that makes it difficult to receive an off-air signal from the parent station.

Instead of being forced to install a "large, cumbersome antenna," MBI said it could have relied on a less expensive, more dependable satellite feed.

MBI also pointed to TV translator regulations, which permit some instances of satellite feeds.

In 1984, the Commission turned down a similar MBI request, saying it wanted

to wait until a number of issues were settled, including the development of the Docket 80-90 plan to create 700 new FM stations, before deciding the FM translator issue.

In related news, the NAB filed a petition for rulemaking on 31 March asking the Commission to revamp its FM translator rules.

It specifically asked the FCC to prohibit commercial stations from making additional profits by expanding their service areas with translators located in areas already well served by other primary stations.

Only "community sponsored" translators should be allowed to broadcast commercial advertising, the NAB said. "Such a rule could serve to eliminate the use of translators as competitive devices."

It also asked the FCC to "further restrict primary station support of FM translators outside of the primary station's 1 mV/m contour" and to "more strictly enforce Commission policy against the use of translators as relay stations."

For example, the NAB said that in some cases the translator licensee is not the broadcast licensee, thereby creating a "dummy" situation in which the translator owner leases the translator to the primary station, and "does not actually take part" in the translator's operation.

"The proliferation of FM translators has resulted in market distortion through excessive and unfair competition to full service radio stations in many areas of the country," the NAB said.

"Introduction of a translator into an area already served by radio stations interferes with the proper functioning of the market forces. Often translators transport signals from large, major markets into medium or small markets."

Because of the relatively low cost of construction, the NAB said translators can come into markets with "relative ease" and "drain critical revenues from

the full power stations which serve that community." It added that a translator has no community service obligation.

"Frequently, a single, small station owner will be forced to challenge numerous translator applicant attempts to invade the market," the NAB added.

Additionally, the NAB said there is a need to allow FM translators to rebroadcast AM stations, in line with the FCC/industry campaign to improve the state of AM radio.

For more information on the FCC's plan, contact Marcia Glauber at 202-632-6302. Comments on the plan are due 1 July, with replies due 1 August. For more information on the NAB's proposal, contact the NAB's Office of General Counsel at 202-429-5430.

More Readers' Forum

(continued from page 5)

Whenever I am involved in a new equipment purchase, I plan to look very carefully at all maintenance procedures which are likely to be necessary (including those the manufacturer seems to think only have to be done once, at the factory).

If any of them require dangerous procedures, I will ask the manufacturer to modify the equipment to make them safe; if he's unwilling to do so, he's just lost a sale.

This applies to studio as well as transmitting equipment; I've often noticed audio equipment which required one to

work rather closely to exposed 117 VAC terminals while troubleshooting or adjusting the equipment.

Generally these problems can be corrected very easily by the manufacturer, but sometimes not so easily by the user.

David L. Molvik, CE
WIAA-FM
Interlochen, MI

RW replies: Thanks for your observations. Let us know what response you get from your efforts. In the meantime, RW would like to hear from readers who have had similar problems and/or solutions to risky service procedures.

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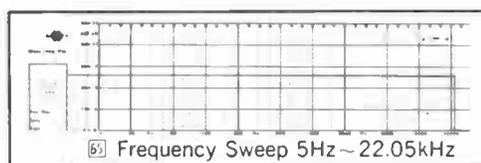
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OET to Update OST Functions

by David Hughes

Washington DC . . . The FCC has officially announced the formation of its new Office of Engineering and Technology (OET), following approval by Congress.

The OET was created in an effort to better define the responsibilities of the Office of Science and Technology (OST). In December 1985, the FCC approved a plan to reorganize the OST. Since then both houses of Congress have approved the plan, paving the way for the formation of the OET by mid-February.

The OET will concentrate on increas-

“*The OET was created in an effort to better define the responsibilities of the Office of Science and Technology.*”

ing workloads in spectrum engineering and technical analysis (including an equipment authorization program), in contrast to the OST's areas of responsibility in "more general technological and scientific matters," the FCC said.

With a constant amount of spectrum, and a rapid increase in new technologies and new uses for that spectrum (particularly broadcast auxiliary bands), the FCC has been devoting increasing effort to balancing various interests for spectrum space.

The new OET will also "provide technical aid" in support of Commission licensing activities and "evaluate evolving

technology for interference potential," the Commission said.

The OST reorganization entails replacement of the "chief scientist" position with that of "chief engineer." Additionally, the former OST divisions of Authorization and Standards, Spectrum Management, and Technical Analysis have been replaced by two new OET divi-

sions: Authorization and Evaluation, and Spectrum Engineering.

Thomas P. Stanley, former OST chief scientist, has been named OET chief engineer. "Essentially, the OET has a tighter management structure than OST (and) can handle spectrum analysis issues more efficiently," he said.

He added that the OET staff, number-

ing around 100, is "slightly smaller" than the OST staff.

Stanley can be reached at 202-632-7060. Will A. McGibbon, head of the OET Spectrum Engineering Division can be reached at 202-632-7025. Robert L. Cutts, chief of the Authorization and Evaluation Division in Columbia, MD, is available at 301-725-1585.

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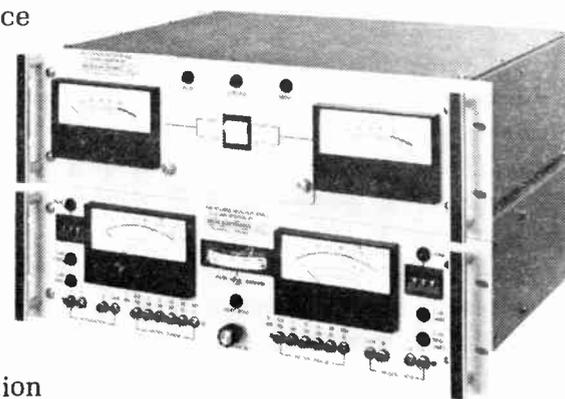
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Circle Reader Service 13 on Page 24

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* 50% single channel, closed loop exciter monitor

DELTA ELECTRONICS



Circle Reader Service 19 on Page 24

NRBA Survey Results Released

by Edward Wytkind

Washington DC ... Three percent of AM radio stations in the US broadcast in stereo with the Kahn system, while 9% use Motorola's C-QUAM™ system, according to a 1985 radio programming survey conducted by the National Radio Broadcasters Association (NRBA).

Though it covered some technical issues, the survey concentrated on programming matters. Questionnaires were

mailed last November to a random sample of 1,180 commercial radio stations, then a follow-up mailing of the same questionnaire was conducted in January 1986.

According to the survey, another 1% of the AM stations said they plan to use the Kahn system, and 5% indicated plans to use C-QUAM, if and when they convert to stereo. Another 20% of the AMs were undecided on a system, while 63% had no plans to convert to stereo.

The NRBA said that 591 "usable" questionnaires were returned at a response rate of 50%. Among the respondents were 382 FM stations and 465 AM stations, of which 256 were AM/FM combinations. Questionnaire returns were received from representatives from all regions, and most market sizes.

In comparison, the 1984 NRBA radio survey, mailed to about 7,600 stations nationwide, with a response rate of 46%,

showed that 13% of the AM stations (with no mention of the system used) said they broadcast in stereo, with another 11% planning to convert to stereo.

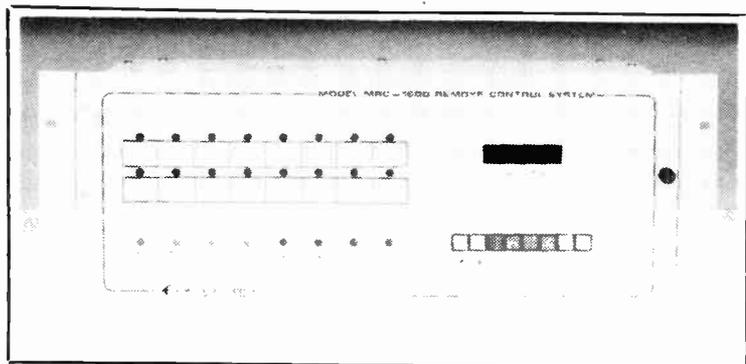
The survey revealed that 40% of the FM respondents utilize SCAs, with 17% of the stations leasing, and 23% retaining their SCAs for station use.

Of SCA functions reported in the survey, 29% of the FMs said they use it for data transmission, 39% for background music, 10% for paging, 26% for telemetry and 1% for news.

For a copy of the survey, contact the NRBA: 202-466-2030.

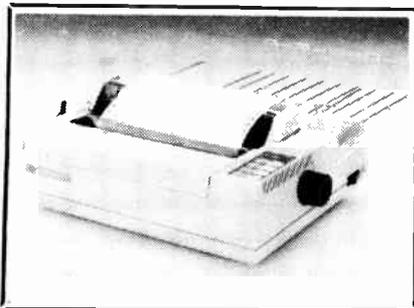
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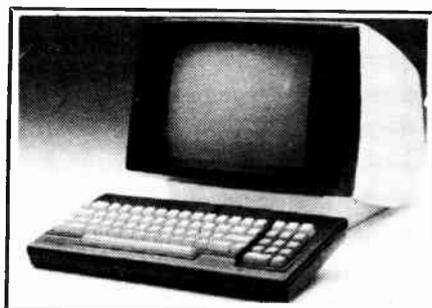


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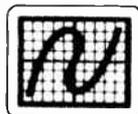
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JBL Division Formed

Northridge CA ... London, England-based Soundcraft Electronics Ltd., a manufacturer of mixing consoles, tape machines and power amplifiers, has sold its US assets to professional audio equipment manufacturer JBL Professional, a subsidiary of Harman International. Terms of the agreement were not disclosed.

The new JBL Professional division, called Soundcraft USA, will be the exclusive distributor of Soundcraft products in the US and Mexico, according to officials from both companies.

JBL's handling of Soundcraft product distribution will strengthen Soundcraft's position in the US and Mexican markets, JBL President Ron Means said.

Soundcraft equipment will comple-

ment both JBL products and the UREI Electronics (another Harman company) equipment line, which includes a wide range of audio gear, he added.

"JBL views broadcasting as a strong and growing market, and the purchase of Soundcraft assets will help the company expand its product lines into new markets—from pro audio to postproduction," Means said.

Although Soundcraft sold its US assets to JBL, the London based company did not sell any manufacturing rights. Soundcraft sold its assets only as an effort to establish an exclusive US and Mexican distributor, and to increase its sales abroad, officials said.

For more information, contact Ron Means at JBL Professional: 818-893-8411.

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Tape Change Requires Caution

by Richard Jolls

Braintree MA . . . At two radio stations that I service, I have recently noticed some heavily distorted commercials coming from cart machines.

Carts have been running through cues. None of the typical problems, such as a lack of attention to levels, dirty heads, or broken cart machines, existed. The culprit, it turns out, is cartridge tape.

Over the past 10 years, the cartridge tape business has been, at best, fickle. For those who wind their own carts, you

“

None of the typical problems, such as a lack of attention to levels, dirty heads, or broken cart machines, existed.

”

may remember when it became nearly impossible to obtain 1-mil-thick back lubricated tape and suffering through the agonies of stretched tape and commercials failing on-air because the 3/4 mil tape was all that was available. Even new pre-loaded carts would not stand up.

After the industry discovered that 3/4 mil tape was unsuccessful, 1 mil tape again became available. Cart tape problems disappeared for a while.

Richard W. Jolls is president/owner of Broadcast Systems Service Co., Braintree, MA. Call him at 617-848-4671.

Now a new problem exists. The tape industry for the past few years has been offering a new "high performance" or "high output" back lubricated 1 mil tape. However, technical problems can arise when you change over, or, even worse, mix it with "standard" cart tape already in use.

There are two areas of concern involving carts, tape and cart machines you should know about.

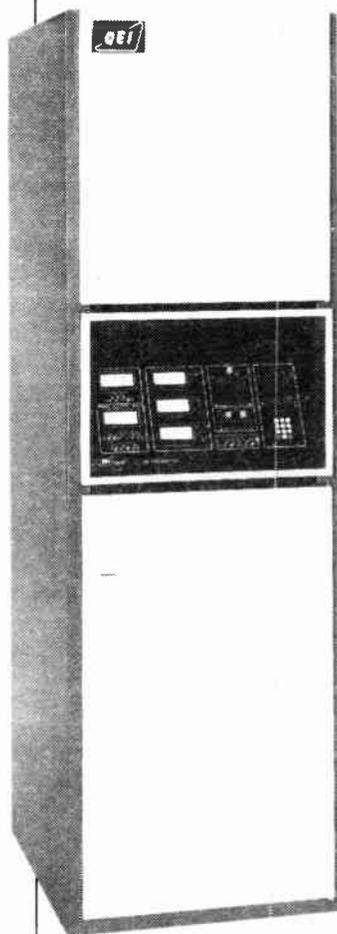
The first is mechanical. It concerns the reproducibility of the path over which the tape travels as it moves in a machine from one cartridge type to another.

This path must be exactly perpendicu-

lar to the vertical gap in the head for crisp highs and accurate phase relationships in stereo material. This path reproducibility is especially important for stereo machines in music on cart formats.

For this reason it is not advisable to mix cartridge types. Pick your cartridge **(continued on page 10)**

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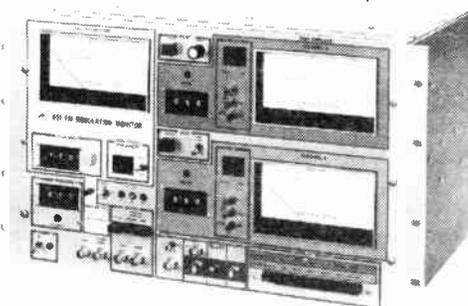
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Changeover Requires Caution

(continued from page 9)

and stay with it. Your library will sound more consistent as it grows.

Before you start a stereo cart library, you may want to give consideration to the matrix recording format, which allows the use of less exotic, and therefore less expensive, cartridge types (such as you now probably have in mono service), yet gives superb stereo performance.

The second area is electronic. Vendors

of high performance cart tape (or any other "high performance" reel-to-reel tape, for that matter) do not volunteer the information that your cart machine electronics need readjusting to successfully use this tape.

This is most important for the recording machines.

Most smaller stations will not want to undergo the engineering expense of this readjustment.

Machines adjusted for high perform-

ance cart tape will produce an acceptable recording on a standard tape cartridge, but not the other way around.

High performance tape is more brilliant on playback. This is one of the reasons for its popularity. This nonlinearity, or brilliance, is considered a plus by some in attracting younger listeners by brightening up the sound of the station.

However, this tape "sheds" or leaves

behind its coating more easily than standard cart tape, and thus fouls tape heads more quickly. Note that dirty tape heads kill brilliance.

Keeping tape heads swabbed down is an added staff chore and cuts a station's efficiency.

As you can see, these technical problems present many concerns. You should ask questions when you consider changing over.

Roger Underwood at Lauderdale Labs (800-327-3793) confirmed my field observations.

Dolby Develops 'SR'

San Francisco CA ... In early March, Dolby Laboratories introduced Dolby "spectral recording" (SR), a professional master recording process that the company has been developing for six years.

The new system can be used in any recording process, according to Dolby's Kevin Dauphinee, including those used in radio stations. "It can be used with any analog recorder," he said.

The SR process, according to Dolby, "combine(s) the most important advantages of digital and analog recording."

The system employs a "new coding algorithm sensitive to variations in signal spectrum as well as to level changes, in contrast to noise reduction systems, which respond primarily to level variations," Dolby said.

SR gives professional analog tape re-

orders a useful dynamic range equal or greater to that of 16-bit digital recording systems while, at the same time, suppressing modulation noise, the company added.

Dolby will produce single channel plug-in modules at its San Francisco plant to fit existing and new Dolby mainframes. First product deliveries are expected this month, the company said.

SR was first demonstrated at the Audio Engineering Society (AES) Convention, held in early March in Montreux, Switzerland. At press time, the firm planned to show the system at the April NAB Convention.

For more information, contact Kevin Dauphinee or Bob Schein at 415-863-1373.

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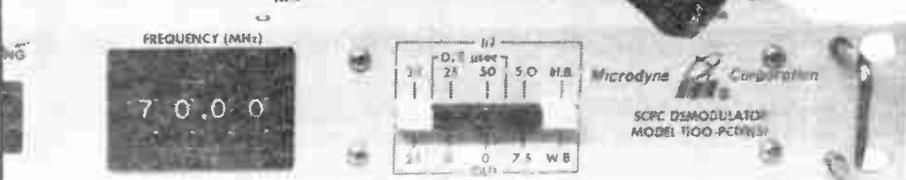
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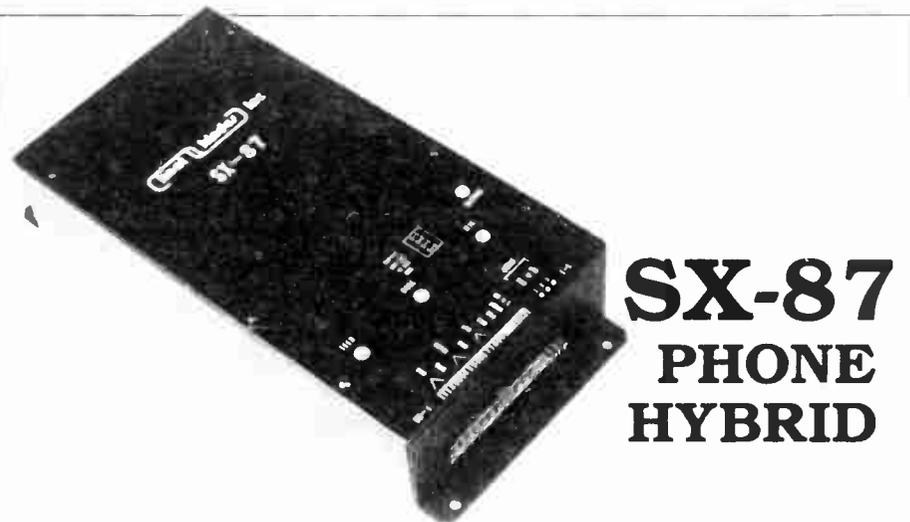
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New Telco Products Pleasing

by Mark Durenberger

Minneapolis MN . . . This month we review some recently introduced telco products. While it may be a quick review for you folks on top of the technology, it may also include an idea or two for the guy who needs to add a new dimension to his telecommunications facilities.

Engineering Views

At the top of my list are the new Gentner products from a young company which has already acquired a solid reputation. These include the VRC-1000 remote-control system, with brain by John Leonard; the EFT-1000, a dial-up frequency extender with built-in decoder, which finally makes it possible to use a single telephone line for two-way transmission with send encoding; and the Telemix IX, the third generation of that telco trendsetter first introduced several years ago.

Talk-show interfaces

Two more talk-show telephone systems have appeared in the past couple of years. They include Steve Church's Telos 10 (known for its super hybrid performance) and a new multiline system by Symetrix.

If you intend to "roll your own" interface, you can choose from several new or redesigned hybrids (2W/4W converters). While some passive or active "static" (one-time-adjust) hybrids perform well under most line conditions and are still a "best buy," the trend is toward the newer, more effective auto-nulling hybrids.

The digital adaptive filter is at the heart of this technology. Telos 10 is a pioneer example.

The recently introduced Gentner DPH-5 is a two-trunk active conferencing device which will combine a dual auto-nulling hybrid with its necessary audio periphery. There are other products by such folks as well-established Comrex, and products from several other significant contributors.

It's a buyer's market. Look to RW's Buyers Guide, which provides a complete review of these systems, in the 15 October issue.

Other neat telco stuff

From AT&T Consumer Products comes a tiny interference filter with mod plug architecture designed to eliminate RFI. This should be available at your local AT&T Phone Center. Insert it between the phone and the line.

R-Columbia Products offers a miniature tone/pulser/memory-dialer and transmit-receive package—a complete telephone which uses a headset/boom mike, and can be clipped to your belt.

It's difficult to find a good plug-in

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

phone-ring relay which will sink AC gear like flashing 300 W light bulbs. Wheelock, Inc. has one such; I suspect you'll see AT&T's version in more and more of their stores. It's a box which plugs into a wall outlet, has an AC outlet on the side for a lamp or somesuch and a mod jack which intercepts the phone line.

You should be aware that the telco industry is embracing a new type of mod jack, with internal 66-type terminations! Several versions are available. This is going to be a hot product.

The cellular scene

Cellular telephone sizes will be cut in half this year by folks like Walker Mobile Communications Division. You'll also start to see the hip technologists/manufacturers offering four-wire interface systems for the cellular phone in use at those stations doing a lot of remotes.

Engineers are working to improve the quality, and the cellular phone will enjoy increasing acceptance for high-quality remote broadcasts.

Auto-answer

See what you can learn about ComDev's Voice Saver! It plays a prerecorded announcement (great for talk show/contest lines?) and is in a tiny box which is inserted in series with the telephone handset.

Another device which is so inserted obtains my award for "Most Innovative": American Phone Products is selling a tiny telco-line-powered light which lights whenever the phone's off the hook. No more dial-groping in the dark!

Ya'll were asking recently about IC manufacturers' telecommunications products catalogs. There are dozens.

The handiest may be TI's since several of their products appear in blister-pack

form in electronics stores. The Texas Instruments "Telecom Circuits Selection Guide" is available through your TI rep.

Another company that offers technology a bit more appropriate to a telephone design engineer is Mostek, and they also publish an easily available data book.

If you're interested in further conquering the "black box" mythology of telephones, I suggest TI Learning Center's "Understanding Telephone Electronics." Look for pocket textbooks, such as the Hayden issue called "Telephone Accessories You Can Build."

There are many other similar publications appearing in increasing variety in

“ “

You should be aware that the telco industry is embracing a new type of mod jack.

” ”
the book display at your favorite electronics store. You may be able to scrounge free Telecom Products data books from your IC distributors.

I'd like to see them make . . .

Remember the old *Popular Science* column in which readers presented ideas for products to make their lives easier? That feature was fun in the '50s, but might be impossible today with our logarithmic technological expansion. Your idea might be obsolete before it's published!

Are you interested in the idea of a "suggestions" column? Do you have an

idea for an electronic product? Do you have a special application no one's been able to fill? An urgent (electronic) need?

We'd like to hear about it. Please take the time to type a note with your hot ideas or needs to "I Wish They'd Build," c/o Radio World, PO Box 1214, Falls Church VA 22041. The manufacturers who read *Radio World* may pick up on your idea and provide you with your product!

I wish they'd build!

I'll prime the pump: "I Wish They'd Build" a hands-free speakerphone which has no switching action! The mike and speaker are both on at all times. No more upcutting conversations and asking for repeats. Sidetone-reduction would be performed by the telephone set's hybrid, as in the Gentner Microtel.

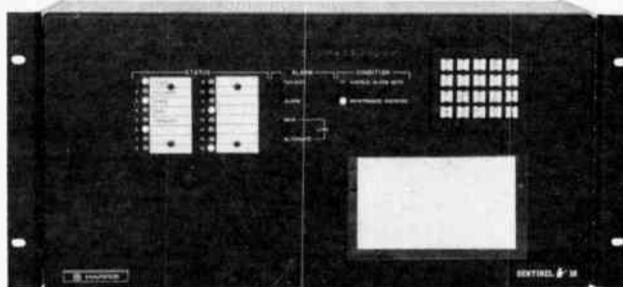
This device would have a built-in mike and speaker and only one user adjustment (speaker volume). It would also have a call-recording output. Its primary application would be in the mass market i.e., the small office.

It would also work as a high-quality mini-telephone interface for the talk studio, offering one or two lines, no equipment budget and comfort for guests who don't like headphones.

It would be inserted in the line between handset and phone, and would function as a self-powered, limited-volume speakerphone with no ducking. When it isn't used as a two-way system, it could function as a one-way telephone receive amplifier only, for those cases when one person in the room does the talking, but the entire room must hear the caller.

"I Wish They'd Build" it. I'd buy the first 20! What do you think? Good idea? Can you say "Good Idea?" Please share one with us!

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External Antenna for AM Easy Project

by Ronald F. Balonis

Wilkes Barre PA . . . It is an engineering fact of life that both AM and FM radio signals suffer reception problems in parts of their coverage areas.

Some of the causes of poor reception are unique to the band or its modulation scheme, such as multipath distortion on FM and receiver susceptibility to man-made and atmospheric noise on AM.

In recent years, however, a relatively new, manmade problem causing reception difficulties for both AM and FM has become more and more prevalent. This new obstacle to reception is caused by modern construction techniques and materials being used to construct today's buildings and houses.

These techniques largely consist of the use of metallic studs and metallic paneling, along with reinforced concrete slab walls, roofs and ceilings. Together, these

Ron Balonis is CE of WILK, Wilkes-Barre, PA and a frequent contributor to RW. He can be reached at 717-824-4666. RW reminds its readers that this device has not been tested by RW and due caution should be utilized, with contact with the author when necessary if you intend to build the device yourself.

materials combine to make many a new building relatively impervious to radio waves.

External antenna essential

These modern construction techniques mean that, for good inside radio reception, some sort of outside antenna is necessary.

For FM, that's no problem, since there are many external antenna systems available.

For AM, however, there are very few such systems available, partly because of band characteristics and partly because most of today's AM radio designs lack provisions for an external AM antenna.

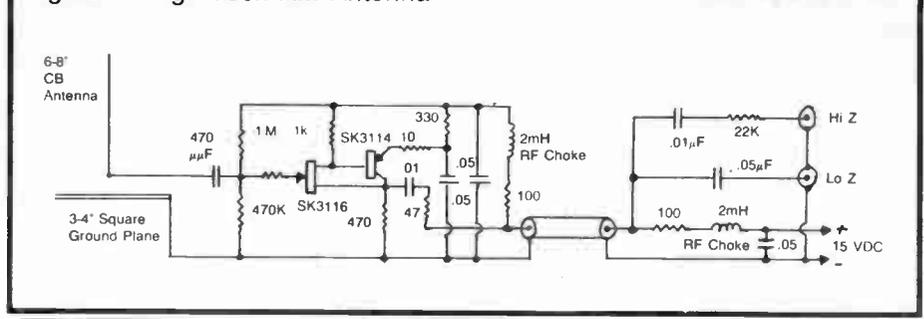
For AM, then, you've got to make your own antenna system if you want good reception inside a modern building.

It was for this reason that I built an external high-tech AM antenna.

The original design was for a remote antenna for field strength measurements, taken from the "Engineer's Notebook" section of the 6 February 1975 issue of *Electronics*. Figure 1 shows the modified version for use as an external AM antenna.

Basically, the external high-tech AM antenna is a FET input (near unity gain)

Figure 1. High-Tech AM Antenna



buffer amplifier that transforms the infinite impedance of the 6-8' antenna to a low impedance of about 50 ohms.

Antenna materials

The antenna consists of a CB whip antenna mounted on the cover of a weatherproof AC junction box. The impedance transforming amplifier circuit, wired on a small printed circuit board, is mounted on the cover for a short connection to the antenna.

To complete the antenna, the junction box mounts on a piece of sheet metal (3-4 sq. ft.) that serves as the antenna's ground plane and support.

Power to the amplifier is fed on the coax, and runs to a small mini-box where the DC power is applied and the receiver connections are made to it.

The high impedance output is for a radio with a high impedance antenna requirement, such as a car radio. To connect to a radio with a ferrite loop antenna, wind a link consisting of a couple of turns around the ferrite loop and

connect it to a low impedance output.

Though the external high-tech AM antenna gives reception where before there was none, or very little, it does so only at some cost.

The signal level it gives will be slightly less (3-6 dB) than the actual field at the antenna's location.

Being a vertical antenna, it is also prone to manmade noise.

In strong signal areas, weak IM products can be heard on a radio connected to it.

But because it's fed with coax, none of these factors is too serious. The antenna's location can be changed; it is only limited by the length of coax.

Editor's note: Due to the fact that WILK's studio location is "noisy," Ron hooked up his antenna to a radio so that the news department could effectively monitor area AM stations. He pointed out that the antenna would be a great AM radio sales tool for stores that can't effectively demonstrate AM radio.

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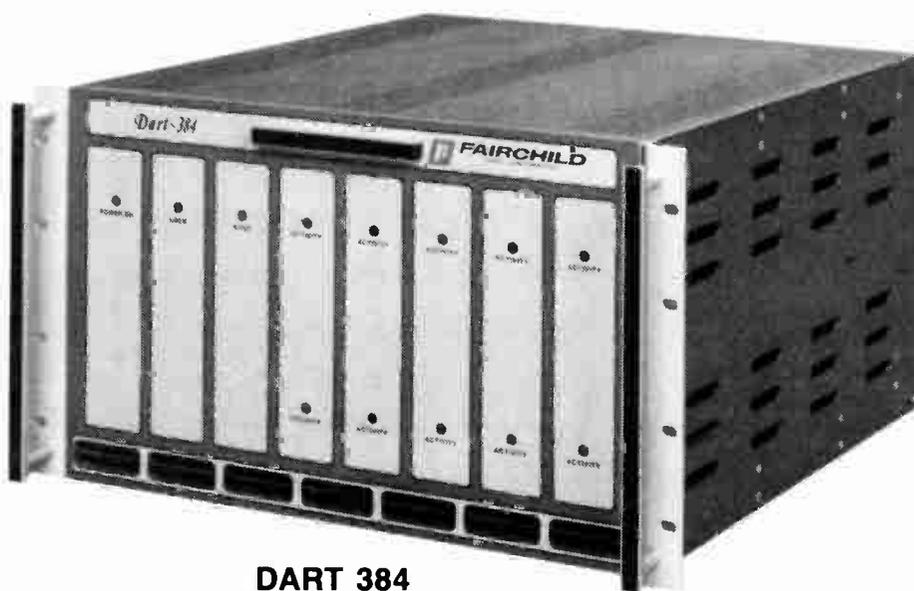
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KIIS 'Copter Poses Challenge

by Jeremy Burnham

Part 1

Los Angeles CA . . . It all started with a naked lady.

One morning during Rick Dees' morning drive time show, a yellow Hughes model 300B helicopter appeared and hovered just outside the control room, 19 floors up. The female passenger proceeded to disrobe and wiggle for the benefit of those lucky enough to be near the window.

To make a long story short, the incident got the intended attention of management and, after some negotiations, KIIS-AM/FM agreed to receive traffic reports from "Commander" Chuck Street in "Yellow Thunder."

The next step was up to the Engineering Department. A two-way radio had to be acquired and installed in the aircraft and studio. After several manufacturers came by and presented their wares, we chose Sideband Technology's Amplitude Compandered Sideband (ACSB) system.

One of the main selling points of this system was that we could get a license to use one of the new ACSB channels and have it all to ourselves. Several new channels designated for ACSB operation may be dropped in between many of the existing FM two-way channels.

In the Los Angeles area, all the standard FM channels are licensed to at least one other party, and finding another station holding a license and willing to share the channel for six hours every day during drive time would not have been easy.

Installation

We assumed that installing the system would be simple; after all, the engineering staff consisted of five ham radio operators who were familiar with simplex operations on the VHF bands.

The fact that the ACSB system was compandered audio single sideband with a pilot tone at 3,100 Hz did not bother anyone.

The radio was set into place in the cockpit of the helicopter, a 150-170 MHz antenna was mounted on the tail and the 12 VDC power was hooked up.

Other necessary wiring included: the connection of the transceiver input to the helicopter intercom circuit; connection of the speaker output to the headphone circuit; the mounting of a carrier key switch on the cyclic control stick; and a carrier-present light driven by a squelch circuit to alert the pilot when being called.

The aircraft already had a headphone monitor switch panel to select the aircraft radio, a conventional car radio, a Bearcat scanner and the new two-way.

Back at the studio, we made a 161.6875 MHz "J" antenna from 3/4" solid electrical conduit, which we then tuned and installed on the roof of our 22-story building.

RG-8 coax was run down to the small

Jeremy Burnham is special projects engineer at KIIS-AM/FM, Los Angeles. His phone number is 213-466-8381.

room where the station's base transceiver was located. The studios were wired to the transceiver for the easiest possible operation by the air talent.

I designed and built an interface to connect the lines coming from the studios to the ACSB unit. The transceiver had no provision for a customer remote control or audio interface, so a few circuit modifications were necessary.

Soon after the FCC license arrived for the radio, the system was tested on the air. What a disappointment!

The audio quality was bad enough, but the strange echoic feedback, whine, popping and general "grunge"—combined with the incredible roar of the helicopter engine—made our radio link unusable. It became obvious that there were many unrelated problems to solve to make the radio work.

Noise-cancelling gear

The first and most obvious component needing change was the pilot's microphone. The din created by the engine is literally at the threshold of pain.

The only way the pilot and passenger can communicate is through the use of an intercom consisting of big, padded headphones and noise-cancelling microphones. The original intercom microphone was not of broadcast quality.

Since there are several airborne traffic reporters in the greater Los Angeles area, we had local people to ask about available equipment. Everyone we talked to was helpful and wished us the best of luck (the traffic reporters all know each other and freely exchange information).

Unfortunately, none of the microphones they loaned us were any better than the ones we already had. The other reporters get by because they either use fixed-wing aircraft or larger helicopters with enclosed cockpits.

We finally found the solution within our own company. KUSA/KSD, St. Louis used a Racal "Slimgard" noise cancelling headset for their traffic reporters. We ordered one and were amazed at how well it performed.

This solved the problem of getting good audio from the pilot above the engine noise, but now the electrical noise problems became more glaring.

The whine from the alternator was at an unacceptably high level; filtering the power on the aircraft did not eliminate it. For a while we switched the alternator

off while doing traffic reports (this merely charges the battery for starting and running accessories; the engine ignition is powered by a separate magneto).

We solved the problem by replacing the alternator with one which puts out cleaner DC, and which incorporates a super filter like the one used in the local police department helicopter.

RF-audio loop

We thought the final quality flaw to overcome was the elimination of the feedback, popping and general distortion

“*That the ACSB system was compandered audio single sideband with a pilot tone at 3,100 Hz did not bother anyone.*”

heard on the signal while transmitting. However, the diagnosis was far more easy than the cure.

RF from our two-way radio output was getting into everything, including the chopper's aircraft band transceiver. Since that unit incorporates the intercom circuit which we were using to feed the input of our two-way transceiver, it created a not-so-nice RF audio loop.

All the leads to our transceiver, both audio and power, were shortened as much as possible, but that did not help much. We next tried moving the antenna to different points on the helicopter, which made little or no difference.

The final solution to breaking the feedback loop was to place a call to Television Equipment Associates and purchasing a second Racal microphone for the pilot's headset, which would then be used exclusively for and connected only to our transceiver.

ACSB system abandoned

Things were looking pretty good at this point. The entire system was working as it was supposed to work. It was working so well that we began to feel restricted by the inherent poor audio frequency response of the ACSB radio.

An equalizer at the studio end did not help because, due to the pilot tone, there is no audio to equalize above 3 kHz.

The only way to improve the quality of the sound was to abandon the ACSB system and go to a conventional FM system.

Another frequency search found a channel in the 450 MHz band which is used by a local television station. Some polite coordination revealed that they use it around noon and in the evening for news cuing, while KIIS only needed it for drive time.

Rumor has it that the US Forest Service tested UHF radios by placing several brands on a shake table. The last one to stop working was the Aerotron/Mega.

KIIS bought one, installed it in the helicopter, and changed the tail antenna to a Max-Rad 450 MHz half-wave. Nothing else in the chopper was changed.

Studio configuration

At the studio, we pressed an old Marti RPU system into service, put a Hustler G6-440 450 MHz colinear antenna on the roof of the building, and slipped a couple of tuned cavities on the bottom end of the coax.

The same studio interface worked with the Marti. We kept the equalizer and added a UREI LA-4 limiter into the audio chain. Low-end audio response still left much to be desired.

Since we knew the Marti had good low-end characteristics, we pondered the schematic of the Aerotron radio and decided to make a change in the internal audio filter circuit. Changing the input capacitor from 0.0047 μ F to 0.1 μ F made all the difference we desired.

RPU replaced

Now the entire system worked as well as could be expected. The only weak link in the chain was the old RPU base, which needed frequent attention.

The last piece of equipment purchased for this project was an ICOM 435 transceiver to replace the RPU. This transceiver is essentially the same as the one sold as ham gear, except that it is programmed for the commercial 450 MHz band. It is small, inexpensive (approx. \$600), is FCC type approved for commercial use and sounds great.

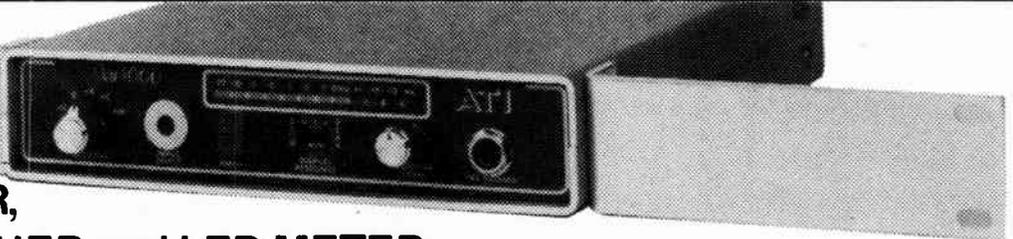
We eliminated the RF cavities, the equalizer and the LA-4 limiter from the chain.

The system was finished!

In part two, I will discuss the interconnect systems used at the studio, redundancy and day-to-day operations.

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FDM Used in FM SCA

by Ed Montgomery

Lesson 5

Annandale VA . . . Frequency modulation (FM) is a method of transmission that results in distributing power throughout an assigned channel width.

As mentioned in previous lessons, the loudness level of the modulating signal determines how far the sideband energy will be distributed from the center frequency, or carrier.

When Major Edwin Armstrong developed broadcast FM, he created a broadband modulation system to accommodate the high-fidelity frequency response and signal-to-noise ratio necessary to accurately reproduce sound.

The channel width for the FM broadcast station is 200 kHz wide. A station using 100% modulation is allotted a frequency deviation of 150 kHz, or ± 75 kHz off the center frequency (see Figure 1). The extra 50 kHz were designated as guard bands to protect adjacent stations from instances of overmodulation due to overall loudness of the audio, and from instances when the signal is louder than expected.

FM subcarriers

The broadband transmission of FM permitted the use of subchannel transmission. This latter transmission method, known as frequency division multiplexing (FDM), allows subcarriers to be incorporated into the total transmission, and then extracted using a special receiver.

Ed Montgomery is a professor of Broadcast Engineering Technology at Northern Virginia Community College. He can be reached at 703-323-3248.

Subcarrier transmission is not limited to FM, however. It is also used in AM and color television transmission. Subcarrier transmission must not interfere with the baseband signal (the primary signal generated) and may not add extra bandwidth to the broadcast channel.

This limitation prohibits subcarrier transmission on AM broadcasting stations. Since most subcarriers are super-audible, their transmission on AM would broaden the AM channel's bandwidth beyond levels acceptable for limiting adjacent channel interference.

A form of AM subcarrier transmission, which involves phase-modulating the carrier while transmitting conventional sidebands, is relatively new and employs technology not available to broadcasters until very recently.

Subcarrier reception

FM subcarrier reception uses two receivers to access the subchannel information. The first receiver is a conventional FM receiver. Within it is another receiver tuned to the subcarrier frequency (see Figure 2).

The subcarrier receiver is connected to the baseband output of the FM receiver. It is tuned to the superaudible signal of the subcarrier.

A frequently used subcarrier channel is 67 kHz. This signal is frequency modulated within limits prescribed by the FCC. The subcarrier receiver detects this information and discards the main channel signal.

Figure 3 illustrates the distribution of sideband energy for such a subcarrier. It is necessary to reduce the amount of energy in the subcarrier transmission to a level that will reduce the sideband energy beyond the ± 75 kHz broadcast channel deviation to an insignificant level. Usual-

Figure 1. Power distribution within an FM broadcast channel when a 5 kHz signal is applied to the modulating oscillator. Sidebands are distributed 5 kHz apart above and below the center frequency. Modulating signals of other frequencies will produce sidebands spaced in accordance with the specific frequency.

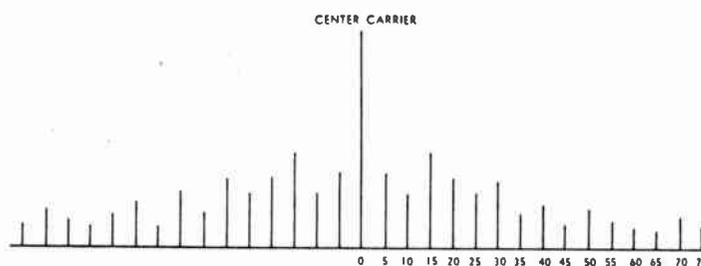


Figure 2. Sub-Channel Reception

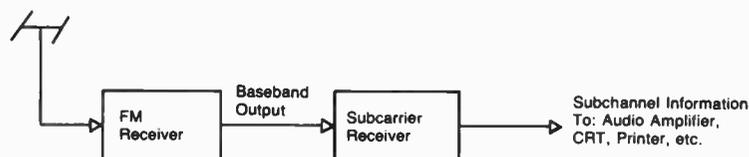
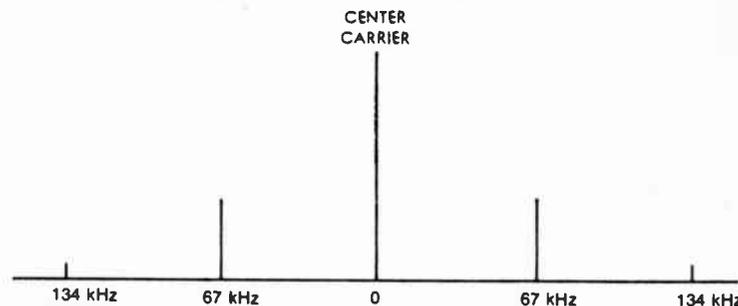


Figure 3. Sideband distribution when a subcarrier of 67 kHz is applied. Modulation of the main channel is limited to 10% to reduce the energy in the sidebands beyond ± 75 kHz to an insignificant noninterfering level.



ly the subcarrier power level is equal to 10% of the total modulation, with 90% permitted for the main channel.

A station can transmit on more than one subcarrier, but each time a subcarrier is added the main channel modulation must be reduced to accommodate

the additional subchannel information.

FM broadcasting with subcarriers—also referred to as SCAs (derived from the FCC's "Subsidiary Communication Authorization")—was once the province of background music heard in elevators, malls and restaurants. Today, SCA transmissions include data and visual information, along with telephone paging.

SCA transmission once was the main factor in keeping FM broadcasters solvent. There was a time when AM station owners would simulcast their AM programming on FM, and used FM SCA transmission as the sole purpose and source of revenue for the FM operation.

The SCA signal

The SCA signal is transmitted at a very low level.

SCA receivers work best in a fixed location with an external antenna aimed directly at the strongest signal the receiver can get. Multipath reflections from nearby moving objects tend to degrade signal reception.

Mobile SCA receivers often have less-than-desirable reception characteristics due to multipath problems.

Frequency division multiplexing is used in numerous communications systems. Communication satellites employ FDM in distributing video and audio information.

The communications satellite contains a broadband FM transmitter, with each transponder channel being a subcarrier. It is common practice to place a subcarrier within a subcarrier on these satellites. Often an audio signal will be "piggy-backed" onto an existing video channel.

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Avoid FM Downtime

by Ken Blake

Stockton CA ... Broadcast station owners have come to the realization that auxiliary transmitters are very valuable properties since the ratings game increasingly emphasizes the necessity of uninterrupted programming.

Many auxiliaries are former mains which were left in place when new facilities were installed elsewhere.

It is for this reason that KJAX's main and auxiliary FM transmitters are separated by several miles. If the AM jock is required to also tend the automated FM equipment, and the FM transmitter unexpectedly leaves the air, he (or she) is honored with the unwelcome opportunity to demonstrate a lack of electronic

Ken Blake is CE of KJOY-AM and KJAX-FM, Stockton, CA. He can be reached at 209-948-5569 or 209-944-5529. RW reminds its readers that this circuit has not been tested by RW and due caution should be utilized, with contact to the author when necessary, if you intend on building this circuit yourself.

acumen. The panic escalates when the auxiliary transmitter is at a different location from the main, and there are separate remote controls to assimilate.

If the operator should happen to be airing an AM newscast, the FM could be silent for many minutes.

Such frustrating delays in the restoration of transmission necessitated the formulation of a plan to accomplish this function by automatic means, requiring no extra toll circuits nor modification of the remote controls.

The plan

Briefly, the plan is this. During normal operation (main transmitter on the air), the program feed to the auxiliary is muted. If the main fails, program is then routed to the auxiliary, which is in standby mode with the filaments on.

The portion of our device which is located at the transmitter site senses the presence of audio and applies plate voltage to the auxiliary, after which it is immediately on the air.

When the main is back in service, the audio line to the auxiliary is again muted;

Device installed at KJAX to automatically put auxiliary FM transmitter on air when main FM transmitter fails and to turn off aux xmtr when main xmtr returns to the air.

Figure 1. STUDIO UNIT

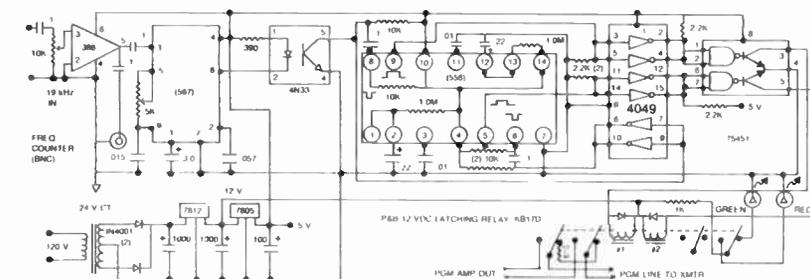
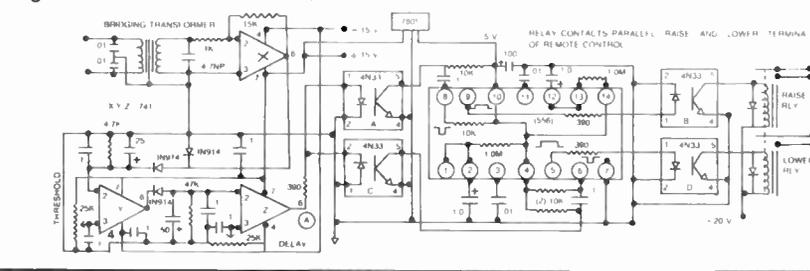


Figure 2. TRANSMITTER UNIT



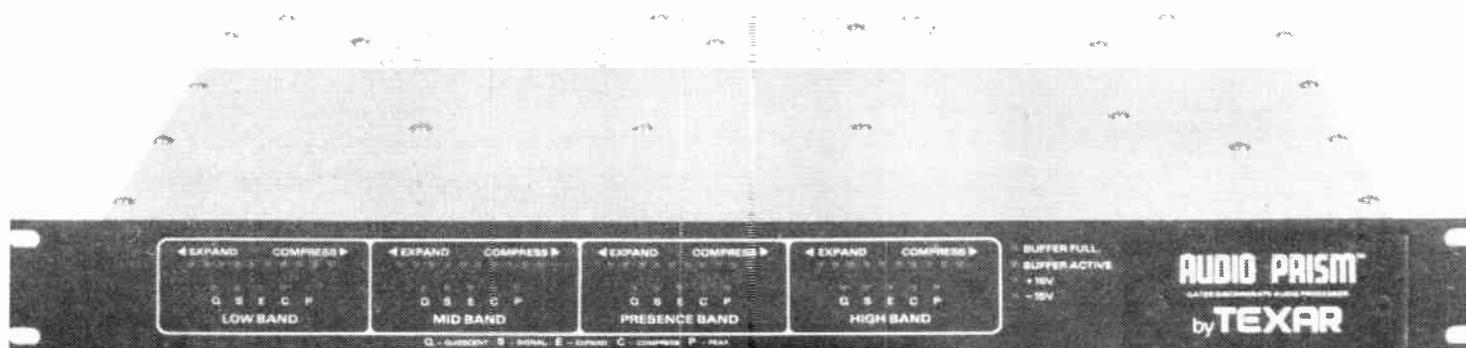
after an adjustable delay, plate voltage is removed from the auxiliary, and it is again on standby.

The practicality of using the program line for control becomes obvious since,

if this line were out of service, it would be futile to put a silent transmitter on the air.

An FM modulation monitor, when lo-
(continued on page 16)

PLAYING 'TAG' FOOTBALL IS FINE, EXCEPT WHEN...



You find that your competition is starting to play rough. Then you need to fight back ... get 'rougher' ... be smarter ... WIN the game!

Radio stations play much the same way: Perhaps your station and the competition both run bare Optimod's.* Then all of a sudden one morning you tune to the 'other guy' and he's rushing, tackling, and running away with the hot spot on the FM dial! You retaliate ... twisting and cranking on every conceivable knob on your Optimod, but to no avail, the competition just stopped playing 'tag' ... and now YOU'RE IT!

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So, you have but two choices: Wait till someone yells 'TAG, you're it!' and then get serious ... or do the yelling yourself!

Call TEXAR today, ask for Barry Honel or Glen Clark. We'll take the ball from there!

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Avoid FM Downtime

(continued from page 15)

cated at the studio, is driven by an RF amplifier.

An audio-dependent relay intended to actuate an "off-air" alarm does not properly function when the transmitter leaves the air, because the resulting "no-signal" noise holds the relay on. A phase-locked loop is insensitive to random noise, as it will lock on only an external tone which matches its internal oscillator frequency, so the presence (or non-presence) of the

stereo pilot provides a convenient key to the operation of this automatic device.

The pilot tone is derived from the stereo modulation monitor, although a stereo receiver could be used as well. If not transmitting stereo and instead employing SCA generators, one could utilize any one of these frequencies in the same manner.

Our auxiliary FM transmitter is not stereo equipped but, if yours is stereo, the unused contacts of Relay #2 could be

employed to mute the 19 kHz from the monitor, while the auxiliary could substitute for the main on the air.

When the main is back in service, the auxiliary can be shut down manually.

The studio unit

The 19 kHz signal from the monitor is amplified by the 386, with the level being set with the input control to a value which properly drives the 567 PLL (see Figure 1).

If your frequency counter likes more gain than the monitor provides, the output of the 386 serves as a convenient point at which to measure the amplified

pilot frequency. The 5K ohm trimmer sets the center frequency of the PLL to 19 kHz.

When this frequency is initially presented at Pin 3 of the PLL, its Pin 8 goes low and the 4N33 optocoupler then conducts. This produces a brief negative pulse at Pin 8 of the 556 Dual Timer, resulting in a positive pulse at its Pin 9 and 3 of the 4049 Inverting Buffer.

Pin 2 of the 4049 and Pins 1 and 2 of the 75451 Dual Peripheral and Driver are pulled low, turning Relay #1 to ON. This breaks the program feed to the auxiliary FM transmitter audio line as the relay latches in its ON position.

The reciprocal mechanical coupling of the dual relay's armatures causes Relay #2 to simultaneously assume its OFF position.

The green LED now indicates that the main transmitter is ON and that the pilot is being transmitted and received. After having been pulsed into the proper position, the relays remain at rest with no voltage present on either coil.

If the main FM transmitter should drop off the air, the pilot frequency is then not present at Pin 3 of the 567, so its Pin 8 goes high. The 4N33 is now turned OFF, allowing its Pin 5 and Pin 7 of the 4049 to also go high.

The resultant low on Pin 6 of the 4049 produces a brief negative pulse on Pin 6 of the 556 Timer, and a positive pulse at its Pin 5, as well as Pin 11 of the 4049, driving its Pin 12 and Pins 6 and 7 of the 75451 low. This pulls in Relay #2, mechanically reversing the armature of Relay #1.

Programming is now on the line to the auxiliary transmitter, and the red LED serves as a visual indication that the main FM transmitter is off the air.

The incoming audio causes the transmitter unit to immediately put the auxiliary on the air, as it has been in a standby mode with filaments on.

The transmitter unit

The transmitter unit's input terminals are connected in parallel with the auxiliary transmitter's audio input (see Figure 2).

The gain of the 741-X is tailored by means of a feedback resistor (or adjustable control) to ultimately provide sufficient gain to compensate for the input bridging loss.

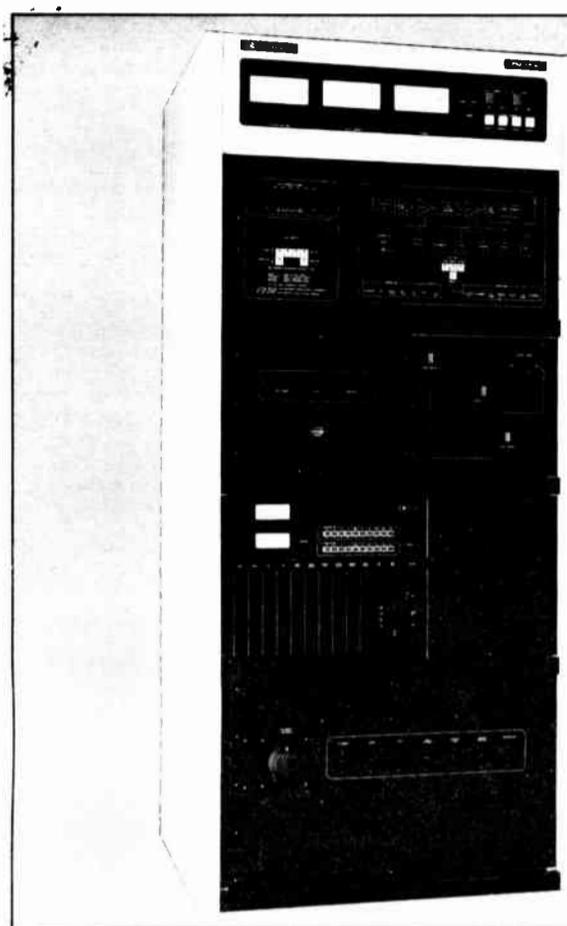
An adequate amount of DC must be developed at Pin 2 of 741-Y to provide the threshold control with sufficient range to maintain the needed negative voltage at Pin 6 to allow the transmitter to remain ON during low-level audio passages.

RF bypassing is of prime importance. Unfortunately, rectified RF could maintain a positive potential at Point A (Pin 6 of 741-Z), which would prohibit turning off the transmitter.

This explains the presence of the "Brute-Force Filter" (4.7 mF NP capacitor) across the secondary of the input transformer. In this device, super audio response isn't a factor, as the desired result is the development of the DC voltages required for its proper operation.

The delay adjustment at 741-Z is set to be of slightly longer duration than the silence sense delay in the program automation, thus avoiding the cycling of the

(continued on page 24)



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Save Time, Money in Readings

Editor's note: The following article is the second of two parts on saving time and money while conducting field intensity measurements.

by Bob Jones

Part II

La Grange IL . . . The FCC rules dictate the "ideal" intervals for taking field measurements; i.e., 1/10th mile intervals between the site and a point 2 miles away, then in 1/2 mile intervals from 2 to 6 miles away, then in 1 to 2 mile intervals beyond that.

This is the ideal—not the minimum or maximum—number of points to be taken. In fact, this is not even the norm. To save time you must take readings only at points that can easily and quickly be reached. Don't be a dummy and take readings where you have to park the car, hike through fences, and/or get on and off express highways.

Logic says take only those points you can drive right up to, like those where there is a gate providing access into an open field, etc.

In many cases, those close-in 1/10th mile points have to be obtained on foot. Don't. Find somebody else who needs training and have him do the walking.

You should prepare your maps in advance and draw on each the radial bearing you intend to measure. Scale each radial bearing off in miles, preferably in pencil, because you will have to erase these hash marks later.

Bob Jones is president of Robert A. Jones Consulting Engineers. Call him at 312-352-2275.

You need not mark the intervals stated in Section 73.186 if you are cognizant of them. For example, you know the intervals for the first 2 miles are 1/10th mile. Take all cross streets or accessible points you can reach by car, then fill in later with the trainee.

Likewise, between 2 and 6 miles, you need not pencil in the 1/2 mile distance, but you could. I find it quicker to just know that over this 2 to 6 mile span I need to take about two readings each mile.

What I do next, after laying out my radial bearings, is to study the maps, and look to see where each radial bearing crosses any convenient road or highway. It is good to study roads that parallel a given radial bearing so you can plan out in advance the probable route you will follow.

I find that laying out your route in advance is one of the biggest time savers when it comes to taking field measurements. I then mark, in pencil, a small circle at each point that I think I will be able to use as a measuring location, keeping in mind the FCC intervals and logical accessibility.

Obviously, I omit a point that falls on an interstate highway whose nearest entrance is 10 miles away.

Similarly, it makes no sense to drive a mile down a dead-end road and then back out again just to obtain one more point, when over that FCC defined span you already have more than the minimum number of locations.

I don't pretend you should always ignore dead-end roads and streets, but be sure to select in advance a sufficient number of points. If you do, then when you travel along the given radial bearing, you can adjust the number of points depending upon what you encounter in

the field.

Route selection is critical to being efficient. Take advantage of natural barriers. If a lake blocks your path along a given radial, and also blocks the next adjacent radial bearing, be efficient—take all the measurement points on each radial bearing before you drive around to the far side of the lake.

Likewise, if your path is blocked by a river and there is not a convenient bridge, obtain all the readings on one side of the natural barrier before proceeding to the other side.

When you can, it is usually best to continue along one radial bearing until you complete it, then travel cross country to the end of the next radial and follow it back to the site.

Your vehicle does make a difference. Avoid vehicles that you have to climb up or down to get out of. These types waste time and are physically tiring.

It is important to use a vehicle that is comfortable over all types of roads, and that has climate control for your comfort. There is nothing worse than taking measurements in 99° F weather in a non-air-conditioned car.

If, on a given day, you plan to drive fire lanes on the upper peninsula of Michigan, you should switch to a four-wheel drive vehicle, even if it is not air conditioned.

I prefer a two-door car, since they have wider doors and are easier to get in and out of.

The meter must be carried in such a way that it is protected from damage. Don't throw it in the trunk with the spare tire, etc. Since the meter should be carried in such a way that it can be easily removed and redeposited each time you take a measurement, carrying the meter in the trunk obviously takes too long.

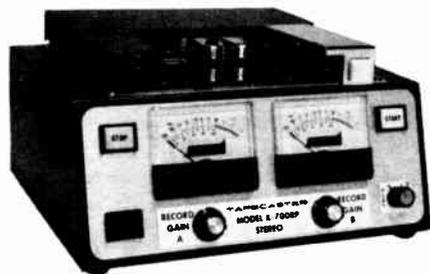
Carrying the meter in the rear seat or in the tail gate of a station wagon takes longer than if you carry it behind the front seat.

It is not safe to carry the meter on the seat. If you should have to make a sudden stop, the meter is on the floor with another dent in it. It's best to carry the meter where it's safe and protected, and where it requires a minimum of time to remove and redeposit.

The best operating position at which to hold the meter is at eye level. This allows for the most accurate reading of the dials and the needle on the meter. Setting the meter on the ground makes it more difficult to read and takes more time and energy to pick up and put down. I recommend holding the meter in one hand at shoulder height. The other hand is then free to tune, test and to operate the instrument.

(continued on page 19)

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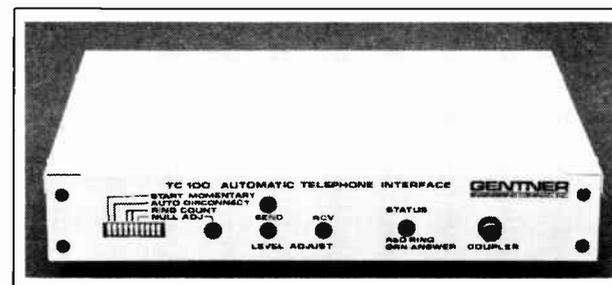
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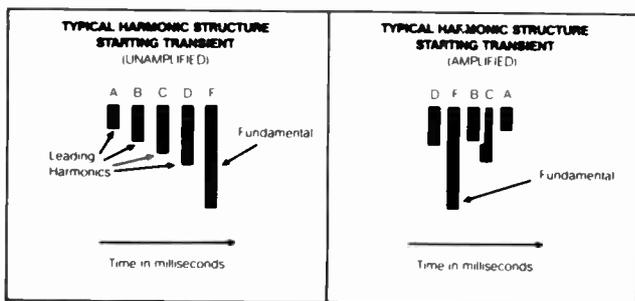
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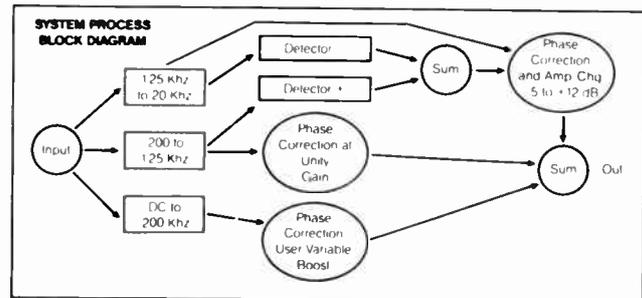
Whether your format is all-metal or all-Mozart, the BBE 202R can dramatically improve the quality of your broadcasts by correcting phase and amplitude distortion problems. This type of distortion

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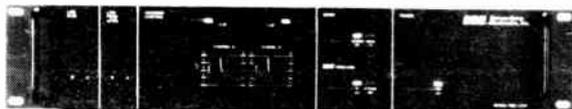
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Save Time, Money in Readings

(continued from page 17)

Aside from FCC-required data discussed above, there are other things are helpful to log on the data sheet.

If part of the readings were taken by somebody other than yourself, that should be noted.

I find it useful to record the general weather conditions, one reason being that the FCC often requires that directional and nondirectional readings be taken under similar environmental conditions.

It is good practice to write down the model and serial number of the instrument you used. If later you discover a particular meter was reading incorrectly, due to faulty calibration, you will be able to determine just which reading points have to be rechecked.

Does each and every point have to be measured precisely at the spot on the map where the radial crosses a given road? No.

Under certain circumstances, you can deviate from the precise point. I recommend that you try to hit each point on the head, but sometimes, where the road does not show on a map, or where things are not as depicted, you cannot be positive you are "on the radial bearing." In those situations, do the best you can.

The most critical measurement locations (critical, that is, to staying on the true bearing), are those taken for direc-

tional antenna readings. However, with nondirectional radial bearings it is not necessary to be precisely "on the radial bearing." Sometimes it is good practice to drive a few feet further down the road if you would be less inhibited by wires or reflections, or safer than if stopping your car along a busy road.

Deviation of 1/10th of a mile within the first mile of the tower site represents a 6° error in bearing. However, this same 1/10th mile deviation at 10 miles would represent less than one half of a degree error in bearing. The greater the distance you are from the station, the greater you can deviate, if necessary, from the true radial bearing without affecting the accuracy.

Partial proofs are probably the easiest measurements to take since somebody else has previously selected the bearings and measuring locations, and since you know what the field intensity reading should be before you arrive.

It is a big help if your predecessor left a set of measuring location descriptions and large scale maps. But don't take such descriptions and maps as gospel.

You may find that a particular description has changed. In rural areas, fire numbers or mail box route numbers change. The yellow house noted in the previous log may have been repainted blue.

When you uncover such changes, mark the new description on your notes.

When taking partial proof readings, it is not mandatory that you reach every single point previously measured. There can be good logical reasons why some points that still can be reached are no longer usable.

Examples include a large building erected on a previously open field, or a road now closed for repairs.

I recommend noting on your data sheet any reason why you skipped a particular point.

FCC rules do not prohibit taking signal measurements at night. However, good engineering practice suggests it is not always a prudent idea.

However, let's assume you have no choice. How should you proceed?

The most difficult part of night measurement is navigation. First, acquaint yourself in daylight with each and every point you intend to measure after sunset. This permits you to select only points that are clean and clear, and to familiarize yourself with their locations.

Make certain you are reading only the true ground wave signal and not a skywave component. It helps to know in advance whether the station you are testing

receives a high limit of co-channel interference.

For example, I conducted a nondirectional proof on KMO (now KAMT) where we took readings until midnight with no inaccuracies! A 5000 W nondirectional at night, KMO's skywave interference level is below 2.5 m/Vm.

You do not often find situations like KMO's. I recommend when recording nighttime measurements (and you are not at KICY, Nome, Alaska) that you audibly monitor the station at all times. This will keep you alerted to co-channel modulation or interference. Normally, if you do not hear interference you will not see it on the meter.

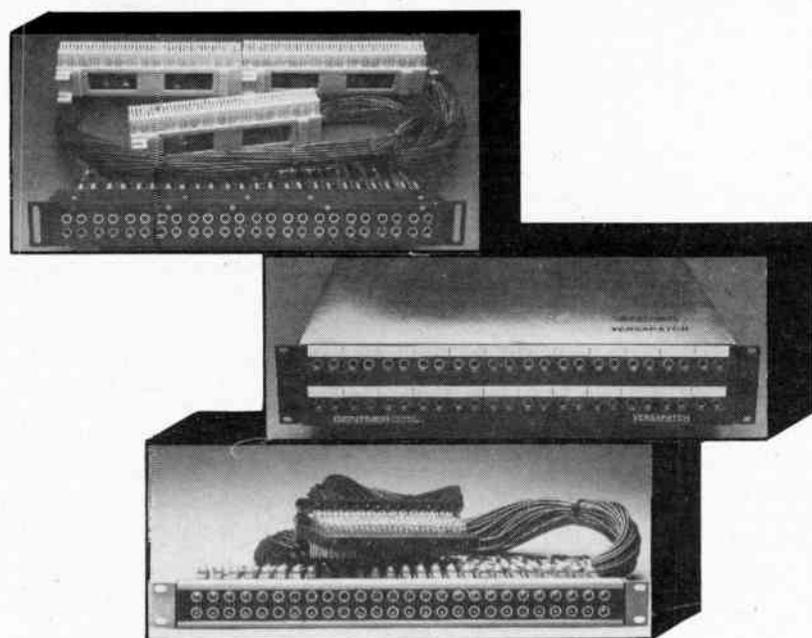
What if, when turning the instrument on, you observe a slight swing of the needle on the meter? One thing you could do is omit that location.

You could also stand and observe the needle swing over two or three cycles of its variation. If the swing is repeatable and you have determined by audible monitoring that your station is the stronger, then average the maximum and minimum swing and record the median value as your station's contribution to the RSS.

In cases of varying skywave, or when you find three or more signals, it may

(continued on page 24)

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RFI Puzzlers Require Patience, Hard Work

by John "Q" Shepler

Rockford IL ... When high power radio waves come out of the ether (if you believe in ether) and get into the wrong equipment, you've got a troubleshooting puzzle. This month, I'll pass along six more personal experiences from the RF twilight zone.

Computer garble

Computers have their own language, such as ASCII, and their own way of communicating, such as RS-232. The

Q-Tips

RS-232 spec is hairy enough to create a puzzle of its own with handshaking, null modems and the lot.

I've long suspected that the strange behavior of certain radio personnel is caused by RF overload. Computers have weaker minds, so they should succumb first, right?

Actually, digital circuits are pretty resistant to RF fields. The logic thresholds are high enough, and the connections are short enough, that the RFI noise gets ignored. Only when you start adding long antennas between computers and their peripherals does the induced voltage become a problem.

If your computer burps random characters at random times, try grounding and shielding the cables. On slow speed

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

RS-232 lines, you can use the filter circuit shown in Figure 1. Communications lines running 300 and 1200 baud won't notice any effect on the data.

At higher data rates, the pulse frequencies may start to approach the RFI frequencies, and filtering will make matters worse. Grounding and shielding are your major deterrents to RF-induced glitches.

There are a couple of more esoteric antidotes for the real tough-dog cases. If you must drive long cables, try building a booster with high voltage line drivers. You step up the logic levels at the sending end, and pad them back down at the receiving end.

This is essentially the same reasoning that justifies boosting mic and tape levels before running them around the plant.

If you're building your own equipment, consider CMOS instead of TTL.

Too slow? Take a look at the new HC and HCT parts. They are pin-for-pin compatible with the standard 7400 series LS and TTL chips, but consume a lot less power.

The HCT parts run on +5 VDC, while HC logic uses the higher voltage thresholds of 4000 series CMOS. However, both HC and HCT families run at LS speeds.

Ghost in the PA

It's the day of the big game and you set up your RPU equipment for an audio check. Everything sounds great back at the studio but, as you speak, your voice comes booming out of the school's PA. Oh-oh.

If they don't want you announcing the game at the field, you better get that RFI out of their PA system.

Figure 1. Data Garble Filter

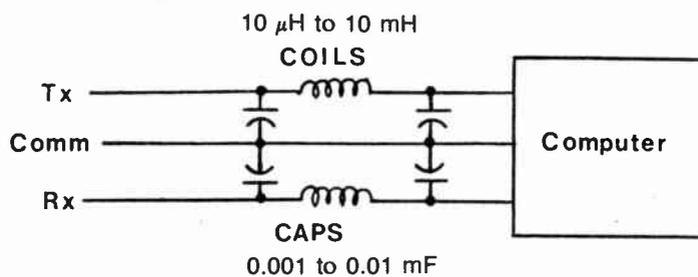


Figure 2. Cassette Isolation

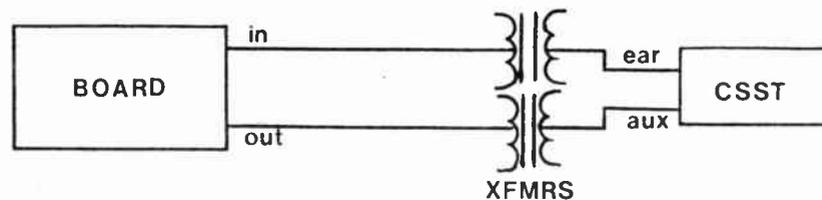
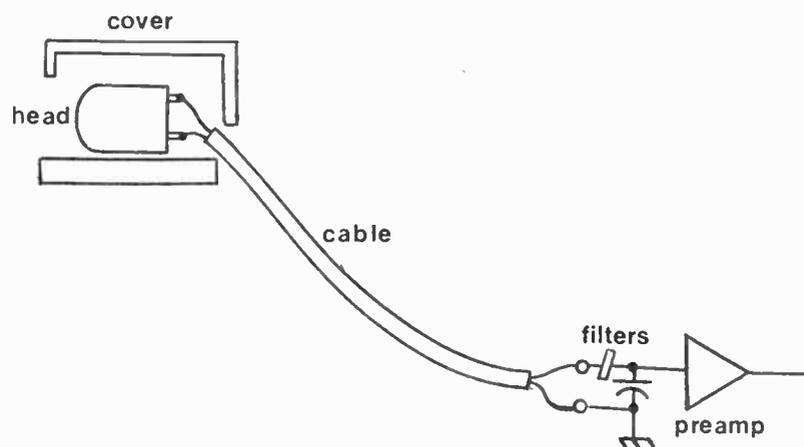


Figure 3. Tape Head Bypassing



When this happened to our sports crew, I had one of them stand guard while I poked around the PA amp.

It turned out that someone in the AV department had reversed the signal and shield connections in the microphone plug. With the RPU antenna 10' from the unshielded mic cable, pickup was

inevitable.

A hot soldering iron and a few minutes were all it took to straighten out their connector. Just make sure to put any left-over wire or solder scraps in your pocket, and no one will be the wiser.

Cleaning up a cassette

News reporters love cassettes. The machines are small, and the tapes sound amazingly lifelike on the air.

The only problem comes when you want to dub to and from cassette at the studio. If you are in an RF field, you can wind up with "Weird Al" singing in the background of a tornado disaster report. (Very bad for public relations.)

Adding bypass caps in the cassette recorder may or may not help. What seems to work well is to add a 1:1 transformer as close to the cassette I/O as possible. Use the circuit shown in Figure 2.

Build the whole thing into a small Bud Box and keep the cords to the cassette machine as short as you can.

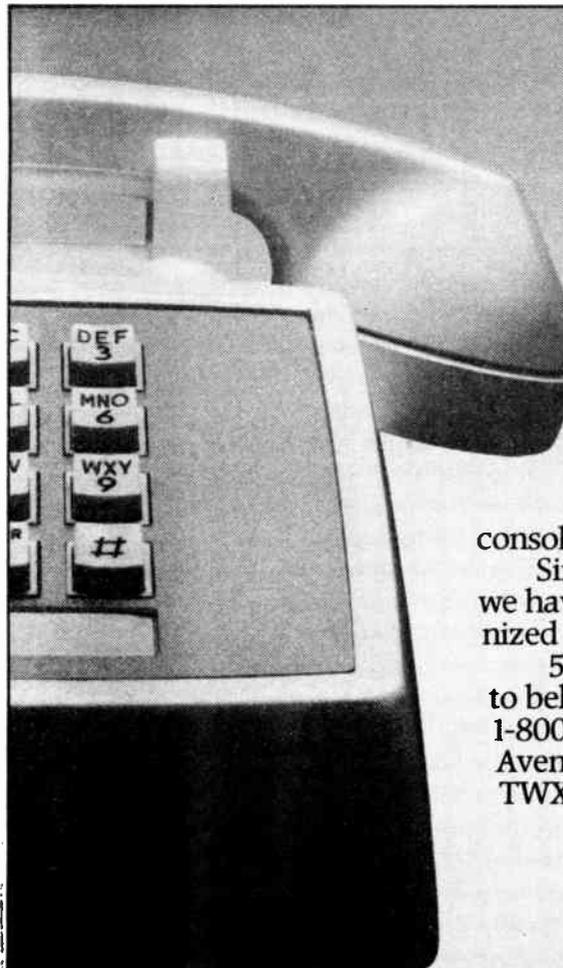
The board as a radio

This story is so strange I wouldn't have believed it myself if I weren't plugged into the headphone jack at the time.

We were rewiring some studio equipment and trying to devise a good grounding scheme.

The transmitter was off. The headphone amp was in CUE, with the volume fairly high. None of the board pots was in CUE. The phones should have been dead quiet, right?

Well, in the midst of the rework I could hear faint voices coming from the phones around my neck. I put the
(continued on next page)



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RFI Puzzlers Require Patience

(continued from page 20)

phones on and, to my surprise, the control board had suddenly become the world's most expensive crystal set. I could hear several stations and some 10 kHz squeals. WGN about a hundred miles away was the loudest.

A fat ground braid took away the late night entertainment, but from then on I've had to smile when broadcasters with rats-nest wiring schemes innocently ask: "How come it doesn't sound so hot?"

The naked tape head

Cart machines and reel-to-reel recorders have healthy amounts of heavy metal in their construction. The decks are milled aluminum blocks, and the cases are often respectably-heavy sheet metal.

Do these make good RF shields? You bet they do.

The problems arise when the tape head and its connections are dangling in mid-air. The signal from the head is weak and the exposed connections may allow just a smidgen of RF to get into the audio cables. With heavy pre-amplification, it doesn't take more than a smidgen.

Some reel-to-reel machines have plastic head covers which look snappy but offer no resistance to RF. Some cart machines may have originally come with metal head covers, but these are now missing.

What to do? You might try making some snap-on metal covers out of thin sheet metal.

Another approach is to let the RF in at the head but stop it at the preamp. Small ferrite beads or a few turns of wire with 47 pF ceramic caps on each side will often form enough of a low pass filter to solve the problem (see Figure 3).

You don't need a lot of filtering because, as long as the RF doesn't get boosted enough to be rectified, you won't hear it.

Be careful of too much filtering. Head outputs are high impedance as well as low level. A brute force 470 pF cap may filter the RF, but it will also have a detrimental effect on the head equalization. This same reasoning applies to phono preamps.

AM in the FM/FM in the AM

This problem is so insidious that you can't just point a finger and say "Aha ... that's where it's getting in!"

Transmitter sites are bathed in RF. Just because you don't hear it in some equipment doesn't mean it's not there. A little gets in here, a little gets in there, and pretty soon it's embarrassingly loud.

Substituting equipment can make the problem better or even worse.

The cures for crosstalk between stations—or "bleedthrough," as it is sometimes called—are the same practices that will solve a lot of other audio problems. If you have inherited a facility that looks like it was engineered by hungry bears on a rampage, the best technical approach, and the only humane solution, may be to put the poor mess out of its misery. Blow it up and keep only the big pieces.

Frustration has driven me to the demolition tactic a number of times. Basi-

cally, you gut the studio or perhaps the entire station and start from scratch.

First comes a good, solid grounding scheme. Then you put the board back in place by itself and test every input for hum, noise and RFI pickup. If any of these exist, don't proceed until you get them licked.

Only then should you add the peripheral equipment, a piece at a time, continually checking to make sure the system is still clean.

Ok, that's easy for me to say. Obviously, you can't pull the plug on your only facility or you'll run out of money before the RFI is ever eliminated.

But perhaps you can take one recording studio out of service for a few days or so. When the crew hears how great it sounds after the reconstruction, you probably won't have too much trouble getting them to do their shows in there while you rejuvenate the main studio.

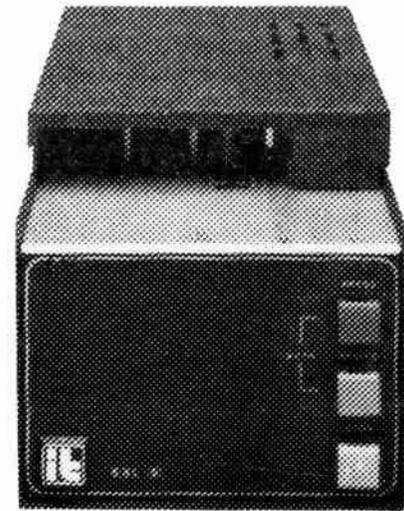
If all else fails, once-a-week all-nighters

will make an incredible difference over the course of a few months.

The trick is to clean up absolutely everything. Use your headphones with an amplifier to poke around the audio lines. You should be able to hear a clean noise floor with no radio stations, CBers, Ham operators, 60 Hz hum, or TV sync buzz.

Once the haywiring and the rectifying circuits are fixed, you'll be rid of more than just RFI problems. A lot of other mysterious buzzes and pops will also have magically disappeared. Best of all, the crew will think you're a magician. Let 'em.

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Broadcast Computing

L-Network

by Dave Hebert

Pasco WA ... An L-network is very easy to construct, and is often overlooked because of its very simplicity. It can be an efficient method for impedance transformation and is naturally broadbanded.

The program, as shown in Figure 1, calculates component values in designing an L-network.

The user friendly program will calculate leg impedances as well as actual component values for both leading and lagging networks. It will also configure a network for matching given impedance

Dave Hebert is a broadcast engineering consultant. You can talk with him at 509-545-9672.

to another impedance—either a higher or lower one.

The program was written for a Commodore C-64 computer, which accepts

the Pi symbol used in lines 560 and 570. Be sure to make the conversion if you are adapting this listing for another computer.

Figure 1.

```

100 REM
110 REM L NETWORK -I FORMULA PGM BY
120 REM DAVE HEBERT ENGINEERING, PASCO,
130 REM WASHINGTON ON 09/29/85
140 REM
150 PRINT"(CLR)(C/DN)"
160 PRINT"      L-NETWORK DESIGN PROGRAM"
170 PRINT
180 PRINT"      WRITTEN BY DAVE HEBERT ENGINEERING"
190 PRINT
200 PRINT"*****"
210 PRINT
220 INPUT"ENTER COAX IMPEDANCE";LI
230 PRINT
240 PRINT
250 INPUT"ENTER LOAD IMPEDANCE";SI
260 PRINT
270 PRINT
280 PRINT
290 IFLI>SITHENGOTO310
300 IFSI>LITHENGOTO370
310 R=LI/SI
320 XL=SI*SQR(R-1)
330 XC=LI/SQR(R-1)
340 X=1/SQR(R):GOTO410
350 XC=LI/SQR(R-1)
360 X=1/SQR(R):GOTO410
370 R=SI/LI
380 XL=LI*SQR(R-1)
390 XC=SI/SQR(R-1)
400 X=1/SQR(R):GOTO500
410 PRINT"THE INPUT SHUNT CAPACITOR"
420 PRINT
430 PRINT"IS";XC;"OHMS, AND THE OUTPUT"
440 PRINT
450 PRINT"SERIES INDUCTOR IS";XL;"OHMS"
460 N=1/SQR(R)
470 Q=-ATN(N/SQR(-N*N+1))+(3.1415927/2)
480 P=(Q)*180/3.1415927
490 GOTO500
500 PRINT"THE INPUT SERIES INDUCTOR"
510 PRINT
520 PRINT"IS";XL;"OHMS, AND THE OUTPUT"
530 PRINT
540 PRINT"SHUNT CAPACITOR IS";XC;"OHMS"
550 N=1/SQR(R)
560 Q=-ATN(N/SQR(-N*N+1))+(PI/2)
570 P=(Q)*180/PI
580 PRINT
590 PRINT"(C/DN)(C/DN)(C/DN)WOULD YOU LIKE FURTHER ANALYSIS? (Y/N)"
600 GETA$:IFA$(">Y"&ANDA$(">N")THEN600
610 IFA$="Y"THENGOTO630
620 END
630 PRINT"(CLR)(C/DN)"
640 INPUT"ENTER STATION FREQUENCY (MHZ)";SF
650 SF=SF*10E6
660 A=XL/(6.2832*SF)
670 B=1/(6.2832*SF*XC)
680 B=B*10E12
690 A=A*10E6
700 PRINT
710 PRINT
720 PRINT
730 PRINT"NETWORK +J VALUE IS";XL;"OHMS"
740 PRINT
750 PRINT"NETWORK -J VALUE IS";XC;"OHMS"
760 PRINT
770 PRINT
780 PRINT"EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE"
790 PRINT
800 PRINT"THE VALUES OF COMPONENTS REQUIRED ARE:"
810 PRINT
820 PRINT"CAPACITOR: ";B;"PICOFARADS"
830 PRINT
840 PRINT"INDUCTOR : ";A;"MICROHENRYS"
850 PRINT
860 PRINT
870 PRINT"PHASE SHIFT IS";P;"DEGREES"
880 PRINT
890 PRINT
900 PRINT"NOTE-VALUES SHOWN ARE FOR A TYPICAL LO-"
910 PRINT"PASS NETWORK. ANY X IN THE LOAD CAN BE"
920 PRINT"COMPENSATED WITH A SERIES COMPONENT OF"
930 PRINT"THE OPPOSITE SIGN IN THE OUTPUT LEG."
940 PRINT
950 PRINT"WOULD YOU LIKE HI-PASS FILTER VALUES?"
960 GETA$:IFA$(">Y"&ANDA$(">N")THEN960
970 IFA$="Y"THENGOTO990
980 END
990 PRINT"(CLR)(C/DN)"
1000 A=XC/(6.2832*SF)
1010 B=1/(6.2832*SF*XL)
1020 B=B*10E12
1030 A=A*10E6
1040 PRINT"L-NETWORK PROGRAM:"
1050 PRINT
1060 PRINT"AS A HI-PASS FILTER, THE CIRCUIT LAYOUT"
1070 PRINT"REMAINS THE SAME AS A LO-PASS NETWORK."
1080 PRINT"EXCEPT THE INDUCTOR AND CAPACITOR ARE"
1090 PRINT"TRANSPPOSED WITH EACH OTHER."
1100 PRINT
1110 PRINT"THE PHASE SHIFT REMAINS UNCHANGED, BUT"
1120 PRINT"THE NETWORK IS NOW A LEADING NETWORK"
1130 PRINT
1140 PRINT"*****"
1150 PRINT
1160 PRINT"THE NEW VALUES ARE NOW:"
1170 PRINT
1180 PRINT"CAPACITOR: ";B;"PICOFARADS"
1190 PRINT
1200 PRINT"INDUCTOR : ";A;"MICROHENRYS"
1210 PRINT
1220 PRINT
1230 PRINT"DAVE HEBERT ENGINEERING"
1240 PRINT
1250 PRINT"(C/DN)DO YOU WANT TO RUN THIS PROGRAM AGAIN?"
1260 GETA$:IFA$(">Y"&ANDA$(">N")THEN1260
1270 IFA$="Y"THENGOTO150
1280 END
    
```

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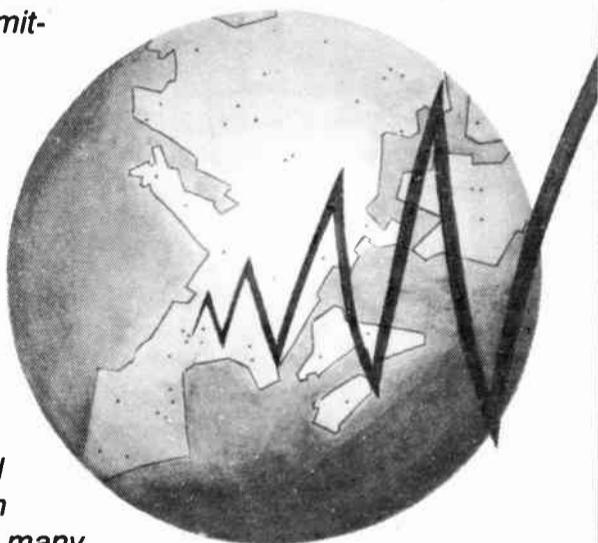
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CSI transmitter design is straightforward, using time-proven stable circuits and mechanical design features, assuring many years of superb performance.

CSI transmitters are designed for the broadcaster, with standardization of parts so that all are interchangeable for ease of operation; simplicity of design to control maintenance cost; and proven reliability.

You can count on CSI transmitters for many exceptional features, such as front panel circuit breakers, lighted pushbutton switches, high-low switch and local-remote switch that enables the operator to disable the remote control for safety purposes.

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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Broadcast Computing

Broadcast Computing Update

Coverage Calculation

Compucurves is a new, low-cost microcomputer program to help broadcast engineers analyze coverage areas. It can help you in planning antenna pattern modifications and in new station applications.

The software allows calculation of different contours, and has provisions for both directional and nondirectional antennas. It runs all eight standard FCC bearings, or less, if desired. The results have been checked against similar output from the FCC's mainframe program.

Compucurves runs on most MS-DOS compatible micros, and includes an 8087 version for those of you who have installed this faster math chip. Best of all is the price, which is only \$42.95, plus \$3 shipping.

ping.

Order the program from Pi R Systems Engineering, PO Box 8534, Chattanooga TN 37411, or call Rick Jordan at 615-842-7326 for more information.

New Bulletin Boards

Your news director may be interested in learning about JFORUM, a recent addition to the growing number of commercial bulletin boards specializing in broadcast related services.

JFORUM is run by Jim Cameron, a broadcast news consultant and former radio network news anchor and administrator.

One of the strong features of this board is "The Experts Index," a giant file of news contacts and experts. This could be invaluable when you are researching

a story and need to know how to quickly find the right source.

Also included on the system are such standard features as message boards, job

8528.

RW has also learned of another national bulletin board now being developed. "Radio Resources Network," being organized by Nat Phillips, will initially be offered to noncommercial radio stations, but should expand rapidly. The network will be available via a local telephone call through the Tym-Net system.

The Program Watch

Interstellar Communications (a modest name for any company) recently introduced its "The Program Watch" system, which keeps track of what actually goes on the air and when it was broadcast.

All tape cartridges are coded with pertinent information. Any other event that involves an electrical contact closure interface can also be noted. This means everything from turning on a microphone to the ringing of a request line telephone.

The computer work is done through a Commodore 64 microcomputer. The user does the wiring and decides how best to use the system. To find out more, call Bill Bordeaux in San Luis Obispo at 805-549-6262.

The software allows calculation of different contours, and has provisions for both directional and nondirectional antennas.

files and "real-time" professional conferences.

There are no membership fees, but you can expect to pay the standard CompuServe hourly connect charges. Access to the system in most cities is accomplished with a local telephone call.

To connect with JFORUM, just dial your local CompuServe number and type GO JFORUM when you get through. Jim Cameron can give you more details if you call him at 718-788-

Find VSWR Quickly

by Dale Heidner

Belgrade MT ... Sometimes we have the mistaken idea that a loss of just a few watts of RF doesn't make a difference in our transmission line and matching system.

In the case of a 250 W AM station, however, it does! In fact, even a 50 W loss on a 5 kW station is a VSWR of 1.2 to 1.

The short program in Figure 1 is similar to the program by Terry Green and Scott Roberts listed in the 1 February 1986 issue of RW. It is another example of how to calculate the voltage standing wave ratio (VSWR) when both the forward and reflected power are known.

Dale Heidner's short programs appear each month. Contact him at 406-388-4281.

Figure 1.

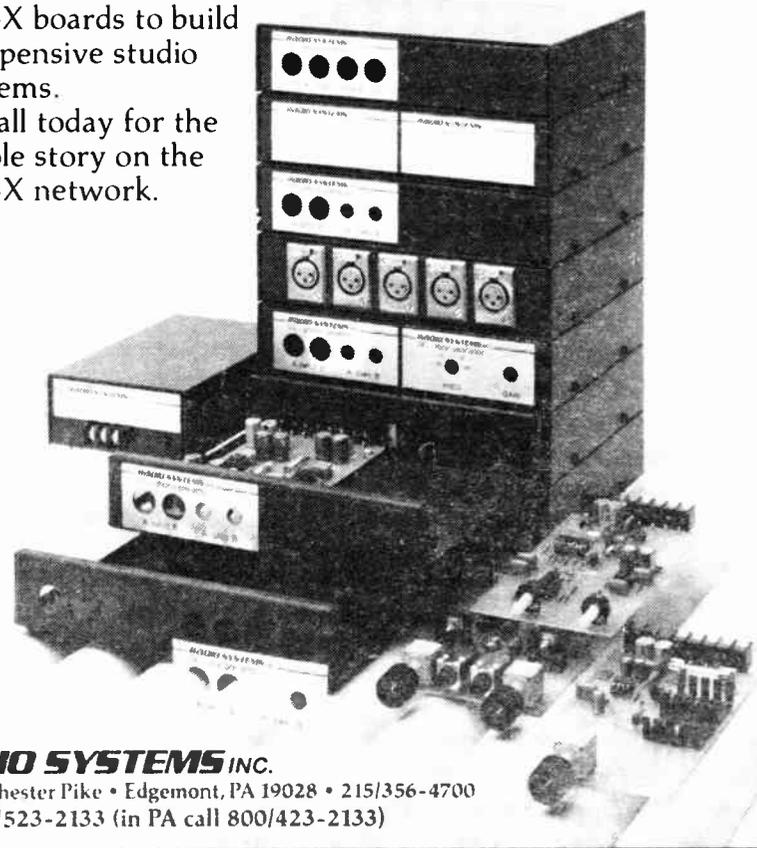
```
15000 REM* VSWR CALCULATOR. BY JULES GILDER
      AND HEIDNER.
15010 CLS
15030 PRINT:PRINT
15040 PRINT"THIS PROGRAM CALCULATES THE VOLTAGE"
15050 PRINT"STANDING WAVE RATIO WHEN "
15060 PRINT"THE FORWARD POWER AND REFLECTED
      ARE KNOWN. "
15070 PRINT"KNOWN. "
15080 PRINT: PRINT: PRINT
15090 INPUT"ENTER REFLECTED POWER>":PR
15100 INPUT"ENTER FORWARD POWER>":PI
15110 PRINT: PRINT:
15120 A=1+SQR(PR/PI)
15130 B=1-SQR(PR/PI)
15140 VSWR=A/B
15150 PRINT" VSWR= ";VSWR;" TO 1. "
15199 END
```

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Carrier Current Configurations

by Thomas L. Vernon

Harrisburg PA . . . The last two installations of "Station Sketches" introduced the fundamentals of carrier current radio, including basic transmitter installation procedures for a single, isolated building.

Real-world applications aren't usually that simple, however. There are quadrangles, highrise buildings and even quadrangles of highrise buildings. This month we'll discuss some guidelines for multiple-building installations.

Once you've determined how many dorms need to be wired, a decision must be reached regarding equipment utilization. Usually there isn't any one method of wiring a campus that is perfect. There are different plans of attack, each with advantages and tradeoffs.

One extreme, one central transmitter can feed all dorms via a power splitter, coax and numerous couplers. Frequently an older 250 or 500 W broadcast transmitter is used for such installations.

This approach eliminates beat notes from adjacent transmitters and has the simplest maintenance scheme. It also has the disadvantage of running miles of coax to a central location, as well as the highest potential for disaster if the transmitter fails. Usually this scheme is only employed at large universities.

On the other extreme, you can install a transmitter in every building. Though this scheme is the most expensive to install and maintain, and has the highest potential for beat note problems, it is the least affected by single transmitter failure.

A third method, something of a compromise, involves the use of a few transmitters, power splitters and linear RF amplifiers.

Financial considerations usually pro-

duce a compromise somewhere between ultimate reliability and minimal existence.

As you plan for the installation of a carrier current system, save yourself the trouble of reinventing the wheel by utilizing the resources available through the buildings and grounds department.

They usually have blueprints showing locations of tunnels and conduits between buildings, as well as riser diagrams.

Station Sketches

Frequently they have tools for pulling cable through large conduits, as well as the expertise to do the job right. Good working relations with these people are essential to a successful installation.

It's best to think of buildings grouped together as a single unit, and feed them with one transmitter, a splitter and couplers for each building.

If all the buildings are identical in size, as in a quadrangle with four dorms, a coupler can be specified which gives each feed 25% of the transmitter power.

If the buildings you've grouped together are all different, you'll have to experiment and determine how much power is needed for each dorm. Then a coupler must be custom wound to your unique requirements.

Feeding RF into highrise buildings is a bit trickier. This is due to the fact that there are several schemes for feeding power into highrise buildings. This is where access to the riser diagrams from your buildings and grounds department can be a lifesaver.

You may find a single feed from the transformer with breaker panels on each floor, or you may discover schemes with a different feed for odd- and even-numbered floors.

At its worst (for carrier current), you'll find an individual feed for each floor running back to the transformer.

Situations with a single feed are the easiest to deal with. Typically, transmitters are installed halfway up the building, that is, on the fifth floor of a 10-story dorm. Alternate floor feeds are often handled with a transmitter and 50/50 splitter feeding odd- and even-numbered floors, as mentioned above.

Buildings with individual feeds to each floor are the most difficult to handle. Usually you start out with a transmitter at the transformer, and hope enough RF makes it up to the top floor. When this doesn't work, splitters and multiple feed points can be attempted, usually with mixed results.

For all practical purposes, it doesn't matter if you use 50 or 75 ohm coaxial cable. Problems arise when the two types are mixed in a single system.

For 50 ohm installations, your choices boil down to RG-8/U (larger diameter, lower losses) and RG-58/U (smaller diameter, greater losses).

For longer outdoor runs, stick with the RG-8. It costs more, but its lower losses and greater strength make it more economical in the long run. RG-58 is okay for indoor runs.

No matter what cable you use, keep in mind that it doesn't last forever. After prolonged exposure to the elements, it will become very lossy and the imped-

ance may not resemble anything close to 50 or 75 ohms. Outdoor cable runs should be inspected occasionally, and replacement planned during the summer months or at other times when the station is usually shut down.

Like all electronic systems, carrier current transmitters require maintenance. This means more-than-twice-yearly trips to the boiler rooms to turn them on in the fall and off in the summer.

Monthly inspections can reveal small problems before they turn into blown output transistors or modulation transformers with the tar melting all over the chassis.

Many smaller colleges still use the older carrier current transmitters with 6AL11s or other tubes. Tubes should be checked at least quarterly. The transmitters should be brought back during the summer, and cleaned up and checked out on the bench before going back for another year of service.

You should also have a good collection of surplus catalogs on hand, as purchasing transformers and tubes for these transmitters over the counter gets more expensive every year.

Finally, if you're running the older transmitters in small dorms, you very often don't need the full 5 W output for good coverage. Consider modifying the power supply for a choke input filter. This will give better power regulation, make the transmitters run cooler, and lengthen the tube life.

Avoiding FM Downtime

(continued from page 16)

transmitter between off and on during short pauses in the audio.

This, of course, will hold the transmitter ON for approximately 6 seconds following the intentional muting of the incoming audio.

When the main FM transmitter fails, the demuting of the audio by Relay #1 in the studio unit results in a positive voltage at Point A, which then turns on 4N33-A. This produces a brief negative pulse at Pin 8 of the 556 Timer, resulting in a positive pulse at its Pin 9, which causes 4N33-B to conduct and thereby operate the RAISE Relay for 1 second, thus applying transmitter plate voltage.

With the normally open relay contacts paralleling the RAISE terminals for the auxiliary transmitter on the remote control unit, the functioning of the relay nets the same result as that which ensues when one selects that position on the studio remote control unit and presses the Raise button.

When the main transmitter is returned to the air, the audio to the auxiliary transmitter is muted by the studio unit. As a result, the same circuitry that developed a positive voltage at Point A with Audio now produces a negative voltage at Point A with no audio. This, then, turns on 4N33-C, which produces a negative pulse at Pin 6 of the 556, resulting in a positive pulse at its Pin 5, causing 4N33-D to actuate the lower relay for one second, thus removing transmitter plate voltage.

Duplicating the action of the Raise function, the relay is held ON only briefly and released. Operation of the relays for only a minimal ON time allows full,

normal remote control of the transmitter.

Consider the dilemma if the lower relay were to be held in its ON position; it would then be impossible to turn ON the transmitter from the studio control position if an emergency were to require it.

This automatic device has been in continuous operation for more than a year and has performed as intended when power failures or main FM transmitter malfunctions have required it to take immediate action to keep our FM signal on the air.

Save Time

(continued from page 19)

well be impossible to obtain an accurate reading for the desired station.

I have, on rare occasions, observed a swinging of fading of a station's signal when I could hear no interfering signal. This can be accounted for in two possible ways. The interference signal could be coming from an unmodulated transmitter, or the station's groundwave signal is being interfered with by its own skywave signal.

If either of these occur and the swing is less than 10%, it would be perfectly proper and accurate to record the median signal as the desired station's contribution to the RSS.

In summary, you can improve your efficiency at making field intensity measurements. You can save time, and you can save money. But more important is that you can feel a greater sense of pride and accomplishment if you employ some of these recommendations and your own common sense.

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007	027	047	067	087
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014	034	054	074	094
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AMPLIFIERS

Want to Sell

University 600T solid state PA mixer/amp 60 W, gd cond. \$80; University 100T solid state PA pwr amp, 100 W, gd cond. \$100. W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504. 402-466-8670.

Roland 240A, 240 W ch. \$600; McIntosh 2100 105 W ch. \$375, mint cond; DynaTubes ST70 (2), \$150 ea; Mark 2, \$75 ea, all mint cond. F McCall, Performance Svcs, 1521 W St Marys, #229, Tucson AZ 85745. 602-623-2110.

PEI transformerless mic preamps, \$75 ea. A Polhemus, Excaltur Snd, 750 8th Ave, NY NY 10036. 212-302-9010.

Shure M64 stereo phono preamp, \$55/BO. C Zalenski, EDS Comm Svcs, POB 92, Johnson City NY 13790. 607-798-7111.

Altec Lansing 352A, solid state mixer amp, 100 W (3), \$150 ea. B Mountjoy, Custom AV, POB 1240, Elizabethan "N 37643, 615-543-5849.

Shure SE20 & 22 preamp & line amp RIAA/NAB EQ, new, \$75 ea. C Elmasian, Tri Core Rec, 27503 Five Mile Rd, Livonia MI 48154. 313-427-8784.

McIntosh M30 mono 30 W, gd cond. \$85 plus frt; McIntosh M40, mono 40 W, gd cond. \$100 plus frt. J Phillips 2323 London Dr, Lima OH 45802. 419-222-9292.

Dynaco 400 pwr amp, as is, \$75. G Falk, Falk Recdg, 7914 Fegenbush, Louisville KY 40228. 502-239-1010.

McMartin B-200B stereo phono preamps (6), \$100 ea. CE, KQIZ, POB 7488, Amarillo TX 79114. 806-353-6662.

Altec 1568A tube amp, \$25 or BO. L Houck, Rollin Recdg, 210 Altgelt, San Antonio TX 78201. 512-736-5483.

BGW 75 excel cond, \$250. D Smith, Group One Prod, 2597 Romig Rd #114, Akron OH 44320. 216-753-4733.

Want to Buy

SW Tech Tiger Saurus 250, working or not. C Weisel, Weisel Tech Sres, 228-1/2 Melrose, Youngstown OH 44512. 216-783-2509.

Marantz, McIntosh tube & SS MC2300, MC2500, C29, etc. C Dripps, Kurluff Ent, 4331 Maxson, El Monte CA 91732. 818-444-7079.

ANTENNAS & TOWERS

Want to Sell

Andrew 1-5/8 heliax, 400', jacketed, all copper, w/flanges; Collins FM isocoupler, \$250, you ship; new Austin ring transformer, \$650, you ship. J Runkle, 208-344-0947.

RCA BFC-10, 10 bay antenna on 100.7' excel cond, in use, \$7500. F Roberts, Capital Cities Bdctg, 2407 Enfield, Austin TX 78703. 512-474-9233.

Cablewave heliax cable, 160', HCC 158-50J, gd cond, w/1 5/8" flange connector sealed to cable at one end, \$900 w/connector, \$800 w/o connector. C Frodsham or M Hoffman, KYSV, POB 7, Beloit KS 67420. 913-738-2206.

Truscon 4 leg self support tower, 183', excel cond, Angle 4" sides, 12' between legs. WTAN, 200 Pierce Blvd, Clearwater FL 33516. 813-461-1341.

Guy wire-supported AM radio tower, on 1490, approx 160' tall, to be dismantled & removed within reasonable period, must bid. L Walrath, Walrath & Voigt, 333 Arapahoe, Thermopolis WY 82443. 307-864-3773.

Andrew PLB-650 antennas (2) w/radomes & mounts; (2) 250' EW63 waveguide w/connectors & hangers, package, \$9000. C Bryson, Comserv, 93 Robinhood Dr, Zellenople PA 16063. 412-776-3793.

Bulkhead fitting for 3-1/8" transmission line, \$25. B Umberger, W-Lite, 51 S Main, Clearwater FL 33575. 813-446-0957.

RCA BFA-8B 8 bay, HP, tuned to 94.9 MHz w/transformer section, inside storage, \$1500/BO. R Meyers, 4700 SW 75th Ave, Miami FL 33155. 305-372-5594.

Phelps Dodge, 2 bay, CPMF2 tuned to 103.9, 4 yrs old, excel cond, BO. D Nixon, WOCQ, POB 1850, Ocean City MD 21872. 301-641-0001.

RCA coax elbows, 3-1/8", 17 indoor elbows, some sleeves & bullets avail, 3 flanged elbows, 2 gas barriers, \$45 elbows ea, gas barriers \$30 ea, all in gd cond. C Sears, WTVY, 1020 S Highland, Bloomington IN 47401. 812-332-3685.

Lapp base insulator for 220' tower, \$500. L Gradick, WIYN, Box 5226, Rome GA 30161. 404-291-9496.

FM CP antenna, 2 bay, presently at 100.1 MHz, can retune. T Dodge, WTJJ, POB 150, Waterberry VA 15676. 802-244-5683.

ECFM-2, 2 bay tuned to 88.5 MHz, vgc. \$100/BO. E Simmons, WWSU, Wright State Univ, Dayton OH 45435. 513-873-2000.

Gates (ERI) FMC-2A, 2-bay CP FM antenna, \$1200. L Ayer, KRPL, POB 8849, Moscow ID 83843. 208-882-2551.

Andrews JH5-50, 50 ohm heliax transmission line w/Andrews 75AR & 75AN, \$250. L Ayer, KRPL, POB 8849, Moscow ID 83843. 208-882-2551.

Want to Buy

FM antenna, 2-3 bay, B Speichinzer, KVSR, 40 Tower Rd, Rapid City SD 57702. 605-342-6822.

Antenna bays on or near 95.3 MHz, coax & fittings. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

FM antenna, 3 bay, tuned to 98.3 MHz. B Taylor, KQSS, POB 292, Miami AZ 85539. 602-425-4378.

AUDIO PRODUCTION (OTHER)

Want to Sell

UREI 920-16, Cooper Time Cube dual chan acoustic delay line, Ch A-14 ms, Ch B-16 ms, can be series'd for 30 ms, \$600/BO. J Krepol, 6147 Walker, Phila PA 19135. 215-331-1432.

UREI 527-A (2) 27 band graphic EQ's, +10 or -10 dB boost or cut, both \$800. J Krepol, 6147 Walker, Phila PA 19135. 215-331-1432.

Mobile studio, custom built on Dodge frame & engine, call for details. BO. B Klaus, WNIR, Box 629, Kent OH 44240. 216-673-2323.

Eventide BD955 3.2 sec, 15 kHz mono, 6 mos old, new cond, \$2600 neg. J Weitauf, WKYX, POB 2397, Paducah KY 42002. 502-554-8255.

Craig head sets (10), \$100. W Burchett, Bur-K Inc, 842 Bellefonte Pr Rd, Ashland KY 41101. 606-324-8812.

Realistic 10 band EQ w/mixing/dubbing facilities, \$95 plus ship. J Emmel, WRGE, POB 401, Olyphant PA 18447. 717-383-1118.

UREI 532 10 band graphic EQ, mono, \$150. B Umberger, W-Lite, 51 S Main, Clearwater FL 33575. 813-446-0957.

Muzak PB-16 playback machines (2), rack mounted, runs fine, also Muzak M4RA injector, \$500 total package. J Wener, WFMA, POB 4005, Rocky Mount NC 27803. 919-977-6810.

Howe 2100 Phase Chaser, brand new in box, \$950/BO. S Reynolds, WFFX, POB 2000, Tuscaloosa AL 35403. 205-758-5523.

CBS air alert, \$400. T Pounds, WREL, POB 902, Lexington VA 24450. 703-463-2161.

Nortronics QK76 head mount, new (2), \$10 ea; Nortronics 9223 heads, new (2), \$60 ea. CE, KQIZ, POB 7488, Amarillo TX 79114. 806-353-6662.

LPB S2 audio compressor, \$200. T Pounds, WREL, POB 902, Lexington VA 24450. 703-463-2161.

Want to Buy

Equip to build new class A FM on 95.3 MHz. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Wegener 1648/1626/1601/2-1644 audio processing units. B Dodge, WTJJ, POB 150, Waterbury, 802-244-5683.

Shure M62V Level Lock, K Smith, WMER, 583 Warren Ave, Portland ME 04103. 207-775-3439.

AUTOMATION EQUIP.

Want to Sell

Tec CRT terminal, 70 Series w/2 keyboards, \$1400. S Portier, WNOE, 529 Bienville, New Orleans LA 70130. 504-529-1212.

Shafer 800, comp system w/4 Ampex R-R's, 3 Carousels & remote control, TLC since new, immac shape, \$4500/BO. H Jenkins, KFMM, POB 549, Pina AZ 85543. 602-485-2228.

Harris System 90, 3 racks, 3 Carousels, 4 ITC R-R's, 2 cart decks, full stereo, \$16,000. K Harnack, WPAD, POB 450, Paducah KY 42001. 502-442-8231.

IGM 500 4 reels, 3 Carousels, 1 single play deck & time announce, \$2000/BO. T Smith, WAMI, POB 169, Oppalusa AL 36467. 203-493-3588.

IGM Instacart 48 tray, stereo, brand new cond, \$8000. S Portier, WNOE, 529 Bienville, New Orleans LA 70130. 504-529-1212.

Gates/Sono-Mag 250 monaural cart Carousel, fair cond, BO. R Taner, News 7, POB 126, Van Wert OH 45891. 419-238-4793.

Harris equip: 4 Carousel interfaces; 4 Ampex interfaces DCU-3; RA-10; KSP-10 system switching CTR & 9 source extenders; TS-4 time selector; plus Marti M30B; Scully tape machine 270-4 & Ampex 600-2 R-R, BO. K Holtmeyer, Great River Comm, POB 1017, Hannibal MO 63401. 314-221-2221.

SMC RSC-100 random select for 2 250/350 series Carousels, excel cond. V Argo, KYLT, Box 2277, Missoula MT 59806. 406-728-5000.

BE Control 16, 6 Carousels, log printer, video mon, 5310B cart machine, encoder, cartridge load/dump, excel cond. D Tyler, WENC, POB 709, Whiteville NC 28472. 919-642-2133.

Instacart 48 tray (2), fair cond; ITC 750 R-R playback only (2), fair cond; BO. E Miller, KXLE, 1311 Vantage Hwy, Ellensburg WA 98926. 509-295-1488.

IGM (2) 48 tray stereo Instacart, \$7000 ea. E Miller, KXLE, 1311 Vantage Hwy, Ellensburg WA 98926. 509-925-1488.

Gates Automation Systems, (2) recently rebuilt, complete w/main programmers, sub-programmers, tape decks, random access Carousels & cart decks, priced to sell. K Carlson, KEEP, POB 246, Twin Falls ID 83303. 208-733-7512.

IGM 48 tray Instacart stereo machines, in excel cond, \$8000 ea/BO. S Cilurzo, KGMG, Box K, Oceanside CA 92054. 619-757-1320.

Carousel 350 (2), mono, perfect cond, \$2000 ea. Edwards, KJKL TV, Rt 1 Box 24AA, Utica NE 68456. 402-534-2071.

Harris R-R source interface cards (2) for System 90 or 9000 P/M 995-7867-001, \$150 ea. C Bryson, Comserv, 93 Robinhood Dr, Zellenople PA 16063. 412-776-3793.

IGM 48-tray stereo Instacart, works gd, \$6000. M Meyer, KLQP, Box 70, Madison MN 56256. 612-598-7301.

Want to Buy

Logging/billing programs to run on TRS-80, Model 4. B Dickerson, WPXE, POD 520, Starke FL 32091. 904-964-5001.

CAMERAS (VIDEO)

Want to Sell

FP-21 side panels for cameras, new, \$35 ea. C Denke, AMPC, 7017 15th Ave NW, Seattle WA 98117. 206-789-1046.

Fujinon 17.5-105 f1.8 zoom lenses, C-mount, designed for CCTV camera, \$95 ea, new or like new. C Denke, AMPC, 7017 15th Ave NW, Seattle WA 98117. 206-789-1046.

Panasonic WV3990B color camera package w/studio monitor, rear lens kit, tripod & VCR, \$3900. L Froom, SPS Video, 1901 Chapel Hill, Silver Spring MD 20906. 301-598-5392.

Ikegami HL-33 EFP portable/studio camera w/2 CCU's, just rebuilt, excel, \$2000; Bosch KCN camera EFP portable/studio, 1" plumbs, just rebuilt, excel cond, \$1500. U George, 175 5th Ave Ste 3206, NY NY 10010. 212-475-3330.

Fujinon 10-110 motorized lenses for Hitachi SK-91, FP21 or 22, \$1395, will retro for Sony cameras for \$260 ea, also 9-108, 1-133, 10-140, 10-120 Fujinon zooms & 6mm wide angle lenses for SK-70 & SK-96. C Denke, AMPC, 7017 15th Ave NW, Seattle WA 98117. 206-789-1046.

Hitachi camera cable, 1984 & older cameras, all types & lengths, gd prices. C Denke, AMPC, 7017 15th Ave NW, Seattle WA 98117. 206-789-1046.

Hitachi warehouse surplus, all kinds cable, access, lenses, etc. C Denke, AMPC, 7017 15th Ave NW, Seattle WA 98117. 206-789-1046.

Ikegami 730 w/10:1 lens, \$4250. J Kohan, Video-It, 1016 N Sycamore, Hollywood CA 90038. 213-876-4055.

Want to Buy

Sony DXC1210 viewfinder in any cond. C Asplund, WATR, 79 Baldwin, Waterbury CT 06706. 203-755-1121.

RCA TK76C, need camera, lenses & access; also lenses, access & camera cable for TK761. H Henson, Henson Prod, 4569 Havencrest, Winston-Salem NC 27106. 919-924-8719.

CART MACHINES

Want to Sell

BE 3400RP/DL, delay tape machine, brand new cond, \$1800. S Portier, WNOE, 529 Bienville, New Orleans LA 70130. 504-529-1212.

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

ITC RP mono w/3 cue tones in gd cond, \$600/BO. W Chadwick, Sound Connection, 10 Conrad Terr, Saugus MA 01906. 617-233-4646.

ITC RP Stereo 1 stereo R/P unit, \$800; ITC SP (2) stereo play units, \$500 ea. P Christiansen, WIVY, 3100 University Blvd S, Jacksonville FL 32216. 904-721-9111.

ITC Premium Series I triple deck stereo PB, gd cond; 1 R/P stereo, BO. B Blake, KKKK, POB K, Midland TX 79701. 915-563-2266.

ITC 3 deck, excel cond, \$3300/firm. JB Ingram, WBLE, POB 73, Batesville MS 38606. 601-563-4664.

Spotmaster 505 rack mount, R/P w/solid state electr, \$500; Spotmaster 505 table top, tube-type, \$300, plus ship. J Emmel, WRGE, POB 401, Olyphant PA 18447. 717-383-1118.

Spotmaster 500DR rack mount (2), gd cond, one needs meter, \$495; one w/o meter, \$395. A Ishkanian, Advent Dupl, 9521 Riggs, Adelphi MD 20783. 301-439-7222.

Harris random select stereo, (3) in rack w/Carousel interface, \$1500/BO. L Haines, Quincy Prod, 816 S 11th, Quincy IL 62301. 217-222-5267.

Spotmaster 605, 5 spot, new motor & heads, looks & works like new, BO. P Badger, WKRE, Box 220, Exmore VA 23350. 804-422-5000.

Ramko ACL 251E 25E cart winder auto stop, \$200; ITC triple deck stereo, gd cond, \$2000; ITC triple deck mono, gd cond, \$2000. B Umberger, W-Lite, 51 S Main, Clearwater FL 33575. 813-446-0957.

Tapcaster X700RP stereo, like new cond, under 200 hrs use, \$850/BO. WMJS, Box 547, Prince Frederick MD 20678. 301-535-2201.

RCA & Collins cart machines, 2 RCA's mono PB & 1 Collins mono PB, RCA mdl \$15/BO & Collins mdl \$50/BO. L Houck, Rollin Recdg, 210 Altgelt, San Antonio TX 78201. 512-736-5483.

ITC RP Series R/PB, \$1250 ea. R Rocks, KZLS, 300 N 25th, #101, Billings MT 59101. 406-248-2681.

Harris triple cart deck, \$950. K Decamp, KUCV, 3800 S 48th St, Lincoln NE 68506. 402-488-0996.

ITC/3M Delta I mono, vgc, single play cart machine, \$1500. M Eliot, WWJ, 16550 W 9 Mile Rd, Southfield MI 48086. 313-423-3366.

BE 2100RPS brand new, excel cond, \$1900. J Pauli, Stage 4 Prod, 7352 Newburgh Rd, West Land MI 48185. 313-421-5330.

Audicord A3 series triple deck 3 tone stereo PB, \$1000/3. R Rocks, KZLS, 300 N 25th, #101, Billings MT 59101. 406-248-2681.

Sono Mag PB (1) & R (1), \$50 ea. J West, West Side Sound, 602 W Hemlock, Bozeman MT 59715. 406-587-1420.

Want to Buy

Cart machines wanted, dead or dying, comp. will pay cash. D Stebbins, KELK, 1800 Idaho St, Elko NV 89801. 702-732-7118.

Spotmaster 500 table top stereo players, broken/repairable OK, any cond, reasonable. C Asplund, WATR, 79 Baldwin, Waterbury CT 06706. 203-755-1121.

Stereo R/P, cue tones not necessary, cheap. J Walters, KJJO, 3019 Lovers Ln, St Joseph MO 64506. 816-364-3365.

ITC stereo record amp for ITC 3D series triple deck. P Mendenhall, WBDG, Indianapolis IN. 317-244-7691.

ITC RP, need motor w/high-speed cue. C Asplund, WATR, 79 Baldwin, Waterbury CT 06706. 203-755-1121.

ITC 3D, ITC SP, ITC WRA record amp, mono pref, will buy dogs for parts. R Wiles Sunflower Radio, 9421 Ballentine, Overland Pk KS 66214. 913-541-9674 eves.

Tapcaster cart machines, any cond. A Ishkanian, Advent Dupl, 9521 Riggs, Adelphi MD 20783. 301-439-7222.

Splice finder/eraser, gd shape, up to \$500. R Johnson, Triple R Prod, 312-395-3544.

Criterion 80 R/P mono w/150 Hz sec tone record capability. G Peterson, KIMM, POB 8205, Rapid City SD 57009. 605-348-1000.

Motor for Tapcaster 700-RP, spare parts for 700-RP & X-700. R Osborne, WMOV, Box 667, Ravenswood WV 26164. 304-273-2544.

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Want to Sell

Recordex CS-2500 5 place duplicator. GT-2A reel tape deck for reel tape masters. CW-600 cassette rewriter. 7-1/2 yrs old. low hr. excel cond. \$2900. K Cummings Jr. KC Creations. 5816 Lane. Raytown MO 64133. 816-356-3895.

Ampex 350, tube electr. complete & running. Ampex 600 in Samsonite case. choice cond. 2 more for parts. J Runkle. 208-344-0947.

Sony TC-353D 1/4 trk stereo. 7" reels. 1-7/8-3-3/4 & 7-1/2 ips. \$200. J Krepol. 6147 Walker. Phila PA 19135. 215-331-1432.

Magnecorder PT6-A w/PT6-BV. PT6-A. PT6-J & PT6-M. excel appearance. all \$350. J Krepol. 6147 Walker. Phila PA 19135. 215-331-1432.

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 Krepol. 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 Krepol. 6147 Walker. Phila PA 19135. 215-331-1432.

Magnecord 1048-4 1/4 trk. mdl 1028-4 1/4 trk & mdl 728 1/2 trk. all stereo w/cases. covers & hold down knobs. all for \$650. J Krepol. 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. 703-549-4429.

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 56. 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 Roszel. 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 A/V. 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.

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

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

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 Svcs. 20 Kennedy Pkwy. Monsey NY 10952. 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 Ste 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 Polhemus. 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.

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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. 213-466-6141.

Scully R-R 1970 vintage playbacks (2). \$400 ea. S Cashdollar. WWO. Box 185. Hartford City IN 47348. 317-348-2665.

ITC 850 R-R's (2). \$800 ea. S Portier. WNOE. 529 Bienville. New Orleans LA 70130. 504-529-1212.

Sony TC-788-4, 4 trk R-R. new cond. less than 30 hrs use. \$800. D Leininger. Leininger Enterp. RD2. Denver PA 17517. 215-267-5370.

Pioneer CT-F1000 (2). \$250 ea. Teac A601R. \$75 (need minor work). Paragon VI background music machine. 4 ch auto switch cart machine. \$250. F McCall. Performance Svcs. 1521 W St Marys #229. Tucson AZ 85745. 602-623-2110.

Scully 280-2 stereo. gd working cond. less cabinet. \$1250. I Kaufman. Natl Recdg. 460 W 42nd. NY NY 10036. 212-279-2000.

Nakamichi 550 like new cond. new heads. belts, etc. cosmetically perf. BO. R Kaufman. Ricky the K's. POB 29804. Atlanta GA 30359. 404-636-9911.

Grundig tube type stereo portable w/spkrs & trk selectors. \$75 plus ship. Roberts stereo w/crossfield heads & spkrs. \$75 plus ship. J Emmel. WRGE. POB 401. Olyphant PA 18447. 717-383-1118

Ampex PR10's, one complete. \$125; one w/PB heads only. \$100. A Ishkanian. Advent Dupl. 9521 Riggs. Adelphi MD 20783. 301-439-7222.

Ampex 600's several rack mount & portable units in gd cond. \$100/BO. R Meyers. 4700 SW 75th Ave Miami FL 33155. 305-372-5594.

Ampex 440 R-R remote control. \$40. Ampex 350 mono tube type R-R. Shafer playback amps for Ampex R-R. several avail. \$150. B Umberger. W-Lite. 51 S Main. Clearwater FL 33575. 813-446-0957.

Scully 280-B, 2 trk in formica cabinet. low hrs. \$2250. Scully 28G 8 trk in formica cabinet. low hrs. \$4500. W Burchett. Bur-K Inc. 842 Bellefonte Pr Rd. Ashland KY 41101. 606-324-8812.

Ampex AG440C, 2 trk in console. excel cond. \$1600. Ampex AG440. 2 trk PB on ly. \$400. H Landsberg. Henry Eng. 503 Key Vista. Sierra Madre CA 91024. 818-355-3656.

Tascam 80-8 w/dbx. gd cond. \$2000. Tascam 35-2 1/2 tk w/dbx. \$800. JVC KD65 cassette deck. \$125. B McPeck. Mirror Image. 619 S Main. Gainesville FL 32601. 904-376-1688.

Otari MX5050B, gd cond. 1/2 trk (2). \$1200 ea. B Berry. Excel Recording. 102 N Ditmar. Oceanside CA 92054. 619-722-8284.

Ampex 400 complete. in console. gd for parts. \$100 plus crating. J Phillips. 2323 London Dr. Lima OH 45802. 419-222-9292.

Ampex 600 FT. working cond. original tube type. BO. C Larko. Larko Audio. 124 W Washington Ste 730. Ft Wayne IN 46802. 219-424-2405.

Ampex AG600, FT portable case. excel cond. \$500. R Taner. News 7. POB 126. Van Wert OH 45891. 419-238-4793.

Magnecorder S36B. D Tabor. WLCK. 104-1/2 Public Sq. Scottsville KY 42164. 502-237-3148.

Ampex AG350, 2 trk stereo heads. mono electr. BO. C Larko. Larko Audio. 124 W Washington Blvd. Ft Wayne IN 46802. 219-424-2405.

Tascam 34, new. includes roll-around. \$1000. B Baron. Bdct Prod East. 23 Rustic. Medford NY 11763. 516-286-8125.

Ampex AG-440B 2 trk in console. \$1500. Ampex MR-70. 1/2" 4 trk in console 15-30 ips. \$800. G Falk. Falk Recd. 7914 Fegenbush. Louisville KY 40228. 502-239-1010.

Telex 1022 (2). 1/2 trk. \$150 ea. Dokorder 4 trk. \$370/BO. C Elmasian. Tri Core Rec. 27503 Five Mile Rd. Livonia MI 48154. 313-427-8784.

Grundig stereo deck w/NR. \$50. Pioneer F2121. \$125. Technics M205. \$125. Technics M227X. \$125. plus ship. J Emel. WRGE. POB 401. Olyphant PA 18447. 717-383-1118.

Ampex MM-1000, mint cond. \$8750. Ampex 440-4B 4 trk in Ampex console. mint. manuals. \$3800. Ampex 440-2B 2 trk in Ampex console. mint. manuals. \$2850. J Jones. RBY Recording. 920 Main St N. Southbury CT 06488. 203-264-3666.

ITC 750 (3) R-R stereo reproducers. \$850 ea. N Allebaugh. WICE 100 John St. Cumberland RI 02864. 401-725-9000.

Pentagon C-320, excel cond w/new belts & pinch rollers. \$695. R. Sumner. CAVU Comm. 3351 Contessa Ct. Annandale VA 22003. 703-560-0233.

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Ampex 960 portable stereo recorder. 7" reels. old but works. \$100. B Stallman. Mtn Forrest Comm. 95 Fraley. Kane PA 16735. 215-664-4539.

Want to Buy

Tapesonic 70-TRS cards & other usable parts. C Asplund. WATR. 79 Baldwin. Waterbury CT 06706. 203-755-1121.

Ampex 020 need speaker amp & spare cover. C Asplund. WATR. 79 Baldwin. Waterbury CT 06706. 203-755-1121.

R-R recorder 10-1/2" capable w/autoreverse w/1-7/8, 3-3/4, 7-1/2 speeds. S Stevenson. Stevenson Corp. POB 735. Blaine WA 98230. 604-531-4576.

Ampex MR70 elec &/or head assembly. entire machine? R Porter. Porter Recdg. POB 5452. San Mateo CA 94402. 415-349-0931.

CATV-MATV EQUIP.

Want to Sell

CATV system, small, in beautiful hill country resort area of Texas. excel growth potential. owner has other interests. \$75,000. R Smith. Lake Country Cable. Rt 1 Box 73. Comanche TX 76442. 817-879-2590.

CONSOLES

Want to Sell

Sun SPL 2212 12 ch mixer. 2 main. 2 mon. 2 effect. 1 sum outputs. \$950. F McCall. Performance Svcs. 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.

RCA BN17A 4 ch AC/DC remote mixer. gd cond. \$200. D Hansen. WESL. RR4 Box 3. Noblesville IN 46060. 317-773-1597.

Ampex MX-10 stereo bdct/recdg mixer. 4 inputs. mounted in carrying case. vgc. \$100 neg. J Barton. Barton Recdg. 5611 N Delaware. Indianapolis IN 46220. 317-255-7752.

Martin 8 chan radio board. BO. P Downes. Brandy Wine Prod. Box 2115. Wilmington DE 19899. 302-737-8273.

RCA 76B4 w/pwr supply. gd cond. mono. \$150 plus ship. S Bartkowski. WEDC. 4923 W 28th. Cicero IL 60650. 312-863-3090.

Clover System. 24x16 xformless 50K new. \$4000. K Fox. Mercantile Recdg. POB 2271. Palm Springs CA 92263. 619-320-4848.

Harris Gatesway 80 mono. 8 chan. \$750. M Ripley. 4-K Radio. Box 936. Lewiston ID 83501. 208-743-2502.

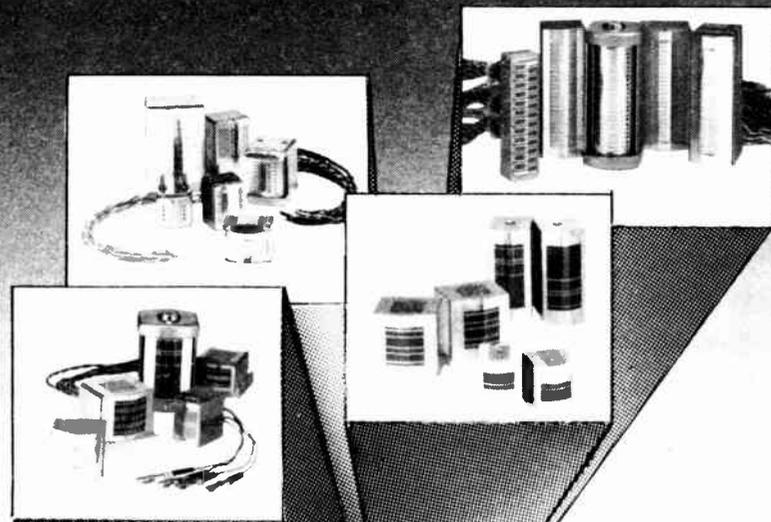
Gates Dualux, very clean & not modified. \$500 plus ship. R Mayben. CNN. 1805 Kimberly. Marietta GA 30060. 3404-426-0631.

Tascam 10, loaded w/meter & pwr supply assembly. patch bays. perf cond. BO. H Jenkins. KFMM. POB 549. Pina AZ 85543. 602-485-2228.

API & FAX mic & buss modules. \$75 ea. A Polhemus. Excalibur Snd. 750 8th Ave. NY NY 10036. 212-302-9010

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Altec Lansing 250 10 chan solid state for TV, AM, FM or FM stereo, complete w/2 wired in patch panels & solid state pwr supply, \$850 plus ship. R Osborne, WMOV, POB 667, Ravenswood WV 26164, 304-273-2544.

Novo EQ, BO. A Polhemus, Excalibur Snd, 750 8th Ave, NY NY 10036, 212-302-9010.

BE 10M350 10 ch slide pot dual out, vgc, \$2000, D Hansen, WESL, RR4 Box 3, Noblesville IN 46060, 317-773-1597.

Gates Producer mono, 4 ch, gd cond, no mods, BO, J Walters, KJJO, 3019 Lovers Ln, St Joseph MO 64506, 816-364-3365.

QMK 55, 5 chan stereo, 9 stereo inputs, gd cond, \$600, S Alexander, WALX, Persimmon Tree, Selma AL 36701, 205-875-9360.

Tangent 24 chan in Anvil road case, \$1800, G Falk, Falk Recd, 7914 Fegenbush, Louisville KY 40228, 502-239-1010.

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

E-V Tapco 5208, 8 chan stereo, perf cond, \$600, B Berry, Excl Recd, 102 N Dittmar, Oceanside CA 92054, 619-722-8284.

Tascam Mdl 10, 12x4 mixing console, \$750, B McPeak, Mirror Image, 619 S Main, Gainsville FL 32601, 904-376-1688.

Russco Studio Master 505 5 pot mono, gd cond, \$700, B Umberger, W-Lite, 51 S Main, Clearwater FL 33575, 813-446-0957.

Collins 212S-1 stereo 6 chan, gd cond, \$500/BO, R Meyers, 4700 SW 75th Ave, Miami FL 33155, 305-372-5594.

Gates stereo Yard, well kept, gd cond, \$500, A Ishkanian, Advent Dupl, 9521 Riggs, Adelphi MD 20783, 301-439-7222.

RCA BC17 A or B 10 pot 3 chan simulcast board; RCA BC7 A or B audio console, dual chan, D Brady, 601-684-5839.

Tascam Mdl 10 8 ch mixer, \$900; Master Room XL-210 stereo spring reverb, \$200, M Jones, MJ Prods, 2220 E 3rd St, Dayton OH 45403, 513-252-4480.

Quantum 22, 14 chan, 2 yrs old, loaded, BO, M St Cyr, WVIC, 2517 E Mt Hope, Lansing MI 48910, 517-487-5986.

BE Mdl 8S150, 8 chan stereo, excel cond, \$2650, P Gregg, Fremont Church, 460 Gaylord Ct, Sacramento CA 95864, 916-489-0757.

Want to Buy

Sparta AS30 or AS30B, 5 chan stereo, must be clean & in gd working cond. B Mountjoy, Custom AV, POB 1240, Elizabethan TN 37643, 615-543-5849.

Shure M67 mic line mixer, K Smith, WJBO, 583 Warren, Portland ME 04103, 207-775-3439.

Solid state mono console, 5 chan or more, in gd cond, send details w/best price, R Wiles, Sunflower Radio, 9421 Ballentine, Overland Pk KS 66214, 913-541-9674 eyes.

DISCO & SOUND EQUIP.

Want to Sell

Realistic dual 10-band graphic EQ, excel cond, \$75, W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504, 402-466-8670.

Clubman 2+2, \$150 ea; Womark disco mixer, \$125; Pioneer reverb, \$75; light controller pwr pack, 8 ch, pinspots, misc spots 1 kW/ch, \$1000, F McCall, Performance Svcs, 1521 W St Marys #229, Tucson AZ 85745, 602-623-2110.

Pultec EQP-1, tube EQ, N Jameson, Jameson Recd, 237 Woodview, Decatur GA 30030, 404-373-4210.

Technics M224, \$100, David, Wave Sound Recdrs, 1956 Cahuenga, Hollywood CA 90068, 213-466-6141.

Echoplite I reverb, \$2500, N Erickson, Rainbow Recd, 2322 S 64th Ave, Omaha NE 68106, 402-554-0123.

EV Sentry V (I pair), \$325/pr, David, Wave Sound Recdrs, 1956 Cahuenga, Hollywood CA 90068, 213-466-6141.

Technics SL1200MKII, never out of box, \$225, B Davidson, WJBD, POB 70, Salem IL 62881, 618-548-2000.

Delta Labs ADM 1024 Electron II digital delay, new & sealed boxes, \$300, G Ernst, Bayside Snd, POB 166, Lincoln City OR 97367, 503-996-6020.

Yamaha E1010 rackmount analog delay, \$160, G Ernst, Bayside Snd, POB 166, Lincoln City OR 97367, 503-996-6020.

UREI 1176, comp limiter; Delta Lab DL3 delay line; RCA BAGA tube limiter, N Jameson, Jameson Recd, 237 Woodview, Decatur GA 30030, 404-373-4210.

UREI LA-3A, (2), N Jameson, Jameson Recd, 237 Woodview, Decatur GA 30030, 404-373-4210.

Shure M-62 (2) audio-master EQ's, hi-Z line level in 600 ohm balanced out w/VU meter, excel cond w/19" rack mount panel adapter, \$65 ea neg, J Barton, Barton Recd, 5611 N Delaware, Indianapolis IN 46220, 317-255-7752.

dbx 118 (3) comp/limit/expander, \$85 ea, W Busetti, Lizard Elect, 114 N Robinson, Florence CO 81226, 303-784-3540.

Pultec EQ's, \$700, A Polhemus, Excalibur Snd, 750 8th Ave, NY NY 10036, 212-302-9010.

Pressing plant, 4 fine built, dies, pumps, tower, shrink wrapper, crusher, etc, trade for 16 bk or \$10,000, C Elmasian, Tri Core Rec, 27503 Five Mile Rd, Livonia MI 48154, 313-427-8784.

Hammond M-Zorgan, w/Leslie 251 speaker, 5 extra oil tubes inc, excel cond, \$825, R Zimmer, Curtis Comm, 1010 Ross, Terrell TX 75160, 214-563-9825.

Barwon DMF-1201A, dynamic noise filter, \$150/BO, C Beckwith, 700 County Rd, Westbrook ME 04092, 207-773-5106.

Eventide H949 Harmonizer, 6 mos old, \$2700, H Warman, Avalanch Recd, 10650 Irma No. 27, Northglenn CO 80233, 303-452-0498.

JBL 4301 speaker (I pair), like new, \$150 ea, H Underwood, Underwood Audio, Bldg 34A DeKalb/Peachtree Airport, Chamolee GA 30341, 404-457-1268.

Altec speakers, floor models, 15" woofers, \$100 ea; Crown amp D150A, factory rebuilt, \$350; McIntosh amp, factory rebuilt, \$250, W Burchett, Bur-K Inc, 842 Bellefonte Pr Rd, Ashland KY 41101, 606-324-8812.

Radio Shack Nova-5 spkrs, \$40 ea plus ship, new, J Emmel, WRGE, POB 401 Olyphant PA 18447, 717-383-1118.

Want to Buy

JBL, Haris Fields, Paragons, EV, Patricians, Tammy Red, Silver, Gold, etc, C Dripps, Kurluff Ent, 4331 Maxson, El Monte CA 91732, 818-444-7079.

Altec 1530, need (2) in gd cond, D Weston, Westone Electric, 5922 W 76th, LA CA 90045, 213-216-7814.

LIMITERS

Want to Sell

Harris Solid State AGC's (2), calibrated, \$200 ea, B Mattson, 904-383-1563 or 326-9231.

UREI LA3-A brand new cosmetically & functionally perf, excel cond, BO, R Kaufman, Ricky the K's, POB 29804, Atlanta GA 30359, 404-636-9911.

Dorrough DAP 310 matched set for stereo, \$900/both, perf cond, J Cunningham, YSDA Radio, Rt 2 Box 113B, Stonewall OK 74871, 405-265-4496.

Dorrough 310 compression/expansion model w/AM peak limiter card, BO, B Early, 1340 Marshall Apt 2, Lakewood CO 80214, 303-238-1292.

Audimax 444 mono, \$75; Volumax 4110 stereo, \$125; Moseley TFL 280 limiters (2), \$300/pr, A Bater, WPX, 220 E 42nd, NY NY 10017, 212-210-2773.

Harris MSP-90, AM limiter & AGC amp, 6 yrs old, excel cond, \$800 plus ship, A Decker, KDSJ, Deadwood SD 57732, 605-578-1826.

Collins 26U-2 stereo limiter, tube type, gd cond, BO, R Schaurtz, K65-AM, Ricks College, Rexburg ID, 208-356-2925.

CRL APP-300A & SEP-400A & PMC-300A AM processing system, \$1800, M Ripley, 4-K Radio, Box 936, Lewiston ID 83501, 208-743-2502.

Dorrough DAP 310, w/improved AM limiter card, aligned, w/manual, \$800, S Wilson, KLS FM, Amarillo TX 79114, 806-371-9797.

Gates FM Statesman & RDC10 remote control, D Tabor, WLCK, 104-1/2 Public Sq, Scottsville KY 42164, 502-237-3148.

Volumax 4300 gd cond w/manual, \$290; UREI LA-3, gd cond w/rack ears & manual, \$290, K Harnack, 895 Mt Rushmore Dr, Richmond KY 40475, 606-624-2181.

Volumax 400, \$125; Volumax 411, \$200; CBS R11Z, \$75; Inovonics 215 chassis, \$200, P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123, 619-565-6006.

DAP 310 (2) audio proc, gd cond, FM limiter cards, \$950 firm, B Harris, Duffy Bldg, 5350 S Roslyn Ste 210, Englewood CO 80111, 303-741-5654.

CRL APP300, SFP400, PMC300A, AM system, like new, BO, T Greenleigh, KJQ, 1506 Gibson Ave, Ogden UT 84404, 801-392-7535.

Optimed 8000A, rebuilt, excel cond, \$2000, V Argo, KYLT, Box 2277, Missoula MT 59806, 406-728-5000.

Orban 424A stereo comp limit, like new, BO, R Kaufman, POB 29804, Atlanta GA 30359, 404-636-2787 aft 2PM EST.

Harris MSP 90 tri-band audio processor, mint cond, \$1500 or trade for Optimed 8000A; Kahn Symetrapeak SP58-1A, \$100; Elcom WBL 11 composite clipper, \$200, B Umberger, W-Lite, 51 S Main, Clearwater FL 33575, 813-446-0957.

Gates solid-state FM audio limiters, \$500 ea (pair), L Ayer, KRPL, POB 8849, Moscow ID 83843, 208-882-2551.

Medelation Sciences CP803 composite clipper, excel cond, \$350, D Smith, Group One Prod, 2597 Romig Rd #1V, Akron OH 44320, 216-753-4733.

UREI dual LA4, 1176LN, 1178, all in gd cond, \$500, \$400 & \$600, D Smith, Group One Prod, 2597 Romig Rd #1V, Akron OH 44320, 216-753-4733.

CBS Volumax 411 w/manual, \$250; Gates Solid Statesman AM limiter w/manual, \$125, M Phillips, POB 985, Laurinburg NC 28352, 919-276-1306.

Harris MSP-100 audio processor, rack mount w/manuals, slight problem in limiter module, \$300, A Lee, KBRC, POB 250, Mt Vernon WA 98273, 206-424-4278.

Harris MSP90 audio processor, \$750, CE, KQIZ, POB 7488, Amarillo TX 79114, 806-353-6662.

Want to Buy

Dorrough 310 AM processor, \$500 or less, K Russell, WRPT, POB 418, Peterborough NH 03458, 603-924-7165.

Volumax 4111 stereo, gd cond; Audimax 4450, gd cond, B McGuire, WWHs, Box 606, Hampden-Sydney VA 23943, 804-223-8773.

MICROPHONES

Want to Sell

Turner 2302 dynamic, new, \$30; Turner 450D paging mic, new, \$10, W Laughlin, KDCV, 2636 N 56, Lincoln NE 68504, 402-466-8670.

Neumann U-67 tube type mic, excel cond, w/pwr supply, N Jameson, Jameson Recd, 237 Woodview, Decatur GA 30030, 404-373-4210.

E-V 1776 condenser & 647A dynamic, BO, L Emgsaad, Coulee Recd, Rt 1, Stoddard WI 54658, 608-788-8205.

Sennheiser MDM421U, \$150, P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123, 619-565-6006.

Shure PE35L (2), 565SD (2), PE15H, PE52, PE25L, new, \$425, C Elmasian, Tri Core Rec, 27503 Five Mile Rd, Livonia MI 48154, 313-427-8784.

Neumann U-64 (4) central pwr supply, gd, \$2000; RE-20's (4), new, \$250 ea; AKG D105, \$50; Sony EMC65 battery pwr, \$100, W Burchett, Bur-K Inc, 842 Bellefonte Pr Rd, Ashland KY 41101, 606-324-8812.

RCA 77 (2); Altec 639 (2); RCA BK5B (3), all mics complete & in excel cond, \$200 ea, I Kaufman, Natl Recd, 460 W 42nd, NY NY 10036, 212-279-2000.

RCA BX77 gd cond, \$295, A Ishkanian, Advent Dupl, 9521 Riggs, Adelphi MD 20783, 301-439-7222.

Neumann KM84 mics (2), \$250 ea; (2) Neumann KM83 omni capsules, \$110 ea, total system price is \$675 for both mikes & capsules, N Ewers, Inner-Vision, 1709 Prairie, Madison WI 53711, 608-274-7733.

Shure SM7 dynamic mic, \$225; Shure SM54, \$150, G Ernst, Bayside Snd, POB 166, Lincoln City OR 97367, 503-996-6020.

Sennheiser MKE 2002, brand new, \$500, K Decamp, KUCV, 3800 S 48th St, Lincoln NE 68506, 402-488-0996.

Sony C-38B/C37P (2) of ea avail, new in box, \$1350/all, D Curtis, Creative Sound, 2810 W 4th, Appleton WI 54914, 414-733-2299.

Sennheiser MDM421 almost new, \$175; Neumann KM84 (2) w/windscreen & case, like new, \$175 ea; EV RE20, top cond (2), \$300 ea, D Smith, Group One Prod, 2597 Romig Rd Ste 12, Akron OH 44320, 216-753-4733.

AKG C-33 stereo condenser mic, excel cond, needs pwr supply transformer, \$800, D Peacock, WTBC-FM, POB 445, Williston VT 05495, 802-878-8118.

Want to Buy

Sony C17B mic, R Porter, Porter Recd, POB 5452, San Mateo CA 94402, 415-349-0931.

Remier antique condenser mic, circa 1930's, spare parts for grill plate, acct. B Mountjoy, Custom AV, POB 1240, Elizabethan TN 37643, 615-543-5849.

RCA 77DX needs to be in excel cond, physically & elec, B Mims, WTSU, Troy St Univ, Troy AL 36081, 205-566-3000 X268.

Altec Lansing 639B mics, must work, F Spinetta, KCEA, 415-321-6049.

MISCELLANEOUS

Want to Sell

ADC patch bays cords & connectors, BO, A Polhemus, Excalibur Snd, 750 8th Ave, NY NY 10036, 212-302-9010.

48 V supplies, BO, A Polhemus, Excalibur Snd, 750 8th Ave, NY NY 10036, 212-302-9010.

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McMartin TG2/EBS & EBS2 encoder, gd cond, C Goodrich, Goodrich Enterprises, 114 35 Manderson, Omaha NE 68164. 402-493-1886.

Try our classifieds. Serves every radio station in Florida. Florida Radio News, Box 540915, Orlando FL 32854. 305-894-1830. 25¢ per word.

Transformers, (25) Beyer TR-145-BV35570; (20) UTC H-22; (3) UTC A-48; (3) UTC A-20; (6) UTC A-33; (2) Ampex B-17331-1; (9) Midwestern 250 ohm to 50 ohm & (9) Midwestern 5K ohm to 600 ohm & 8 ohm 1 wt, all \$350. J Krepol, 6147 Walker, Phila PA 19135. 215-331-1432.

ITT office intercom system, 15 phones inc switches & equip, \$800 plus frt. J Baltar, Reel Comm, 67 Green, Augusta ME 04330. 207-623-1941.

Telephones, (7) rotary dial, 3-line w/div hold for each line, does not require Amphenol, just modular, various colors, \$25 ea; Record-A-Call tele answering machines (2) mdl 560 not remoted, \$65 ea, plus ship. J Emmel, WRGE, POB 401, Olyphant PA 18447. 717-383-1118.

ASR-33T send & receive w/stand, rolls of paper, ribbons, punch-tape paper, BO, J Emmel, WRGE, POB 401, Olyphant PA 18447. 717-383-1118.

3M Alpha Secretary I plain paper copier, needs work, BO, J Emmel, WRGE, POB 401, Olyphant PA 18447. 717-383-1118.

Multicon, 230" plus, 30 conductors paired, unshielded on spool, new, requires ship by freight, \$95; 270" plus coax cable, new, \$35. R Zimmer, Curtis Comm, 1010 Ross, Terrell TX 75160. 214-563-9825.

Racks, (3) 7", 19", \$125 plus frt. J Baltar, Reel Comm, 67 Green, Augusta ME 04330. 207-623-1941.

Century 2 roller, new, (5) & one Colortran HAG-6, \$45 ea. A Ross, 8022 27th NE, Seattle WA 98115. 206-575-4624.

AM/FM station, WNDI, real estate included, \$400,000. A Stanley, WNDI, POB 545, Sullivan IN 47882. 812-268-6322.

Radio Station, AM 1000 watt fulltime, western WA station, must sell, building & equip included, \$250,000 terms. E Kazmark, KAPA, 2065 Ocean Ave, Raymond WA 98577. 206-875-5551.

Sylvania EGK (9); EHK (1); BTL (1); 176-018 (4); 176022 (1), \$7 ea. A Ross, 8022 27th NE, Seattle WA 98115. 206-575-4624.

AES Journal, Vols 1-14, 1953-66, 56 issues, \$200 PPD, R Schneider, Savage Ind, 183 Woodside Terr, Springfield MA 01138. 413-736-5853.

ADC patchbays & cords, trade or \$25/BO; Duncan faders, \$15 ea. A Polhemus, Excalibur Snd, 750 8th, NY NY 10036. 212-245-2435.

Want to Buy

Radio & TV equip from 40's & 50's for museum. R Weinburger, Ripleys Believe It or Not, 800 Parkway, Gatlinburg TN 37738. 615-436-5096.

MONITORS

Want to Sell

Potomac three tower AM-19 (204), new cond. J Runkle, 208-344-0947.

McMartin TBM 3700, TBM 2200A, TBM 2000B, complete monitor package, excel cond, tuned & factory tested on your frequency, C Goodrich, Goodrich Enterprises, 114 35 Manderson, Omaha NE 68164. 402-493-1886.

McMartin TBM 3500 FM mod mon. D Tabor, WLCK, 104-1/2 Public Sq, Scottsville KY 42164. 502-237-3148.

Station gear incl: Gates M-5693 & RCM 12/14; Clarke 108C; Roberts 191 & 192; Magnacord PT63A; Wilkinson S1A2; ABC pulse decoder rcvr; Fidelipac 300 carts; Gates 245PM102, call for details, BO, J Hendrick, WKCT, POB 930, Bowling Green KY 42101. 502-781-2121.

Collins 900-F SCA monitor, 67 kHz, works, gd shape, will trade, \$300/BO, J Schloss, KICD, 2600 Hiway Blvd, Spencer IA 51301. 712-262-1240.

Nems-Clarke 112 in 2 towers, w/remote panel, \$350. P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123. 619-565-6006.

Collins 900C2 SCA mon, \$300. B Umberger, W-Lite, 51 S Main, Clearwater FL 33575. 813-446-0957.

Gates M-5693 rack mount, no manual, \$50. A Lee, KBRC, POB 250, Mt Vernon WA 98273. 206-424-4278.

Nems-Clark 108E phase monitor, BO, L Houck, Rollin Recdng, 210 Altgelt, San Antonio TX 78201. 512-736-5483.

Gates GTM-88F FM freq mon, \$400; Gates GTM088S FM stereo mod mon, \$1500; Gates GTA-88F, \$200; Gates GTM-88R FM RF amp, \$400; McMartin TBM-2000A SCA freq/mod mon, \$1000. L Ayer, KRPL, POB 8849, Moscow ID 83843. 208-882-2551.

Belar FM RF amp, gd cond, sell or trade; Belar remote FM mon/freq mon meter panel, sell or trade. C Frienwald, KNBQ, POB 11000, Tacoma WA 98411. 206-383-9700.

GR 1181A freq mon for 600 kHz; RCA Lissajous type phase mon; Nems-Clark 112 phase mon w/remote panel; McMartin TBM-2500 FM mon RF amp; P Wells, KLZZ, 8665 Gibbs-Dr #201, San Diego CA 92123. 619-565-6006.

Want to Buy

Belar FMM1 & FMS1. Mr. Sherwood, WKGR, 600 Atlantic, Ft Pierce FL 33450. 305-461-0899.

FM monitors for 95.3 MHz, prefer Belar. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

MOVIE PRODUCTION EQUIP.

Want to Sell

Camera Flex, 35mm w/variable shutter, 5 magazines, 2 motors & zoom lens, BO, L Meister, Meister Prod, 321 River Rd, Nutley NJ 07110. 201-667-2323.

Arriflex S16mm camera w/variable & constant motors, 12-120 Angenieux zoom w/motor, 3 400" mags w/talk cue motor, mattbox, 3 primes 10/25/50mm, Cine 60 new belt battery, filters, cables, case, more! \$3900. C Wieseahn, Wieseahn Studios, 249 W 29th NY NY 10001. 212-503-6612.

Bell 552 16mm projector, \$450 plus frt. Katherine, Linden Inc, 229 N Henry, Alexandria VA 22314. 703-549-4429.

Auricon Pro 1200, 16mm sound on film optical & magnetic, comp, like new cond, BO, L Meister, Meister Prod, 321 River Rd, Nutley NJ 07110. 201-667-2323.

Synchronizers, (2) 3 gang, 35mm, brand new, still in box, BO, L Meister, Meister Prod, 321 River Rd, Nutley NJ 07110. 201-667-2323.

Magnetic Sound CP-16 camera, Angenieux 12-120 zoom, extra batteries, magazines, etc, \$1400 as is. U George, 175 5th Ave Ste 3206, NY NY 10010. 212-475-3330.

Want to Buy

TTL C mount zoom lens, magazine for Bolex cameras & all Bolex access, repairable, gd cond. H Deans, Deans Prod, 170 Grand, White Plains NY 10601. 914-949-5920.

RECEIVERS & TRANSCEIVERS

Want to Sell

Marti xmtr & 2 receivers, 4 yrs old. J Runkle, 208-344-0947.

Bearcat BC300 vgc, 50 ch search, \$250. B Harris, Duffy Bdct, 5350 S Roslyn Ste 210, Englewood CO 80111. 303-741-5654.

Motorola Moxy base 2-way radios w/cable/antenna, UHF, \$400; Motorola HT-90 portables, \$400 ea wchargers & cases; Motorola HT-220 UHF portable w/charger/case, \$400; Motorola MH-10 VHF w/charger/case, \$400. J Emmel, WRGE, POB 401, Olyphant PA 18447. 717-383-1118.

Motorola UHF ENG system w/HT's, mobiles, voting system & more, wide audio bandwidth, \$35000. P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123. 619-565-6006.

Motorola 2 way, Moxy base 16 W, Maxar 80 mobile 30 W, BO, M St. Cyr, WVIC, 2517 E Mt Hope, Lansing MI 48910. 517-487-5986.

Kenwood TS430S & MC50 mike & mnt bracket, \$600. G Cash, KBOW, 660 Dewey Blvd, Butte MT 59701. 406-494-7500.

Harris RF1501, 6 chan VHF Hi-band 25 W xcvsr (3), on RPU freq 5, \$150 ea. R Levandowski, WBOBNR, 1601 Ramsey, Hastings MN 55033. 612-437-6510.

Want to Buy

McMartin EBS-2 EBS monitor, K Smith, WJBO, 583 Warren, Portland ME 04103. 207-775-3439.

Sony SRF-A100 multimod AM stereo radio, C Beckwith, 700 County Rd, Westbrook ME 04092. 207-773-5106.

REMOTE & MICROWAVE EQUIP.

Want to Sell

RCA BTX 101 (2) 67 kHz SCA gen, \$350. A Bater, WPIX, 220 E 42nd, NY NY 10017. 212-210-2773.

Harris UPI, 3 motor disk & electr, 4 yrs old, BO plus ship. A Decker, KDSJ, Deadwood SD 57732. 605-578-1826.

Moseley PCL505CXI xmtr tuned to 949.50, as is, BO, M Rolnick, WMGK, 1 Bala Plaza, Bala Cynwyd PA 19004. 215-879-6000.

Microdyne 1100-FDC(X1)R(DCL) satellite down converter w/DC block, BO, D Zachary, KCAM, POB 249, Glennallen AK 99588. 907-822-3434.

Modulation Assoc Demod 1 SCPC 1 yr old, tuned for Dow Jones, \$1800. J Lyons, KLSK, 121 Sandoval, Sante Fe NM 87501. 505-983-5873.

S-A SA7325 digital audio processor w/7.5 kHz dual audio decoder, voice cue decoder, SA 7300 wide band DPSK rcvr, crystals for ABC & NBC, D Voss, KCTN, Rt 1 Box 86, Elkader IA 52043. 319-245-1400.

Motorola MR-96 microwave system, 6 chan, comp system incl antennas & cable, never used, B Ferguson, WJIC, Box 132, Salem NJ 08079. 609-935-1510.

Marti 30BT, 161.67 needs work, great for parts, BO, M Shannon, WAMJ, 1129 N Hickory, South Bend IN 46615. 219-234-1580.

S-A elec for digital audio sat reception incl downlink converter, rcvr, digital processor, (1) 3KC voice cue card, freq select switch, crystals for ABC, NBC, CBS, ABC tone decoder & manuals, \$6000. L Ludovici, WICC, 177 State, Bridgeport CT 06604. 203-366-9383.

Wegener 1615 demod card, \$550; S-A 15 kHz dual audio decoder, \$700; voice cue decoder \$100, both like new. E Martin, WKGN, 2900 Sutherland, Knoxville TN 37919. 615-521-6220.

Ant reflectors, (3) type 812-655 passive reflectors 8'x12' microwave, BO, J Cunningham, KEOR, POB 1110, Atoka OK 74525. 405-265-4496.

Tellabs FM stereo telco EQ system w/program amps & repeat coils, BO, M Meyerm, KLOP, Box 70, Madison MN 56256. 612-598-7301.

Comrex RLX TLX set, in gd cond, \$1200. K Decamp, KUCV, 3800 S 48th St, Lincoln NE 68506. 402-488-0996.

SSC 3348X-R(6) ABD DTMF decoder panel rack for satellite network, \$325; SSC 307SY-ABD DTMF encoder for satellite network, \$185. CE, KQIZ, POB 7488, Amarillo TX 79114. 806-353-6662.

Marti M-20BT UHF tube type w/manual, working cond, somewhat broadbanded, pwr supply whine on audio when used on DC crystal for 455.150 & 455.450 MHz, \$100; Marti RMC-1C remote control console, w/manual, working cond, remote control of Marti xmtr. A Lee, KBRC, POB 250, Mt Vernon WA 98273. 206-424-4278.

Marti M-100/450-460 DF rack mount, tube type, w/manual, needs alignment, \$100. A Lee, KBRC, POB 250, Mt Vernon WA 98283. 206-424-4278.

Hallikainen TAX 161 time announce controller, \$300. G Kippel, KAMB, 90 E 16th, Merced CA 95340. 209-723-1015.

Moseley MBB-1, brand new, w/remote meter panel, IP & EP, extra note for meter, \$200. A Lee, KBRC, POB 250 Mt Vernon WA 98273. 206-424-4278.

Micro Control chan expander DLT-10E for DLT-9, \$500. CE, KQIZ, POB 7488, Amarillo TX 79114. 806-353-6662.

ABC MRP-1 cue command decoder, like new, \$850. E Martin, WKGN, 2900 Sutherland, Knoxville TN 37919. 615-521-6220.

McMartin B113R, 67 kHz, subcarrier gen in excel cond, \$550. H Dybedock, WBSW, POB 999, Kankakee IL 60901. 815-939-4541.

Moseley TRC-15 metering gen/demod cards, panel meter, & front panel, P Wells, KLZZ, 8665 Gibbs Dr #201, San Diego CA 92123. 619-565-6006.

TVC 1/2 VR 80 pagers (27); one RK22 console; Moseley SCG4 SCA gen, complete paging system. J Pollock, WMMG, Rt 2 Bypass Rd, Brandenburg KY 40108. 502-422-3961.

Andrew type whip antenna, 405-1 fiberglass w/mnts, BO, J Cunningham, KEOR, POB 1110, Atoka OK 74525. 405-265-4496.

Dish ant 10', 890-960 MHz type P-9120 (2), BO, J Cunningham, KEOR, POB 1110, Atoka OK 74525. 405-265-4496.

Want to Buy

Rust FMT15A SCXB schematic drawing needed for xmtr. B Speichinzer, KVSF, 40 Tower Rd, Rapid City SD 57702. 605-342-6822.

Marti xmtrs, preferably older type UHF, any cond, for parts. R Wright, WLLX, 1208 N Locust, Lawrenceburg TN 38464. 615-762-2916.

STL dual or composite system w/antennas & remote control, E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

RPU xmtr & rcvr in 160 or 450 MHz band. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Marti STL 8 needed in top cond for mating to stereo, will pay, C Farmer, KTDO, POB 568, Toledo OR 97391. 503-336-2252.

Marti xmtr & rcvr STL, older model, in gd cond, prefer w/antenna. T Hite, WAUC, Box 936, Wauchula FL 33873. 813-773-5008.

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HELP WANTED

New York station has opening for highly qualified technical supervisor. Maintenance exper required for all phases of broadcasting. Contact Kenneth Stout, WPAT AM/FM. 201-345-9300.

Manager of Radio Operations of New lower Manhattan facility, needs 5 yrs exper w/2 yrs managerial, & BSEE or equiv. Duties will include directing, training, etc. Salary 33-38K commensurate w/exper. Send resumes and cover letter to: Personnel Director, WNYC, 1 Center St, 32nd Fl, New York NY 10007.

Radio Engineer w/minimum 2 yrs radio

Bdct Equip Salesman wanted to cover the mid-Atlantic area. Must have bdct sales & eng exper & be knowledgeable in configuring complete AM & FM systems. Send resume to: Northeast Bdct Labs, POB 1176, S Glens Falls NY 12801.

maint exper, studio & xmtr, FCC general & SBE certification preferred. Send resume, salary requirements. E.O.E., WHBC, POB 9917, Canton OH 44711.

POSITIONS WANTED

ENG/RF ENG, former TV CE Fargo ND, 18 yrs exp TV & xmtrs, FCC genrl & ham extra, for resume write: F Kovell, Rt 3 Box 35C, Fargo ND or call 701-282-3501 aft 6.

Hardworking corp eng looking for FT position, will consider announcing, well qual, 9 yrs exp in AM/FM, worked w/former FCC eng, prefer KS, parts of CO, MO, NE, OK, TX & AR, avail immed. 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.

Engineer, problem-solver, 15 yrs AM/FM/TV/translators/construction, desire long/short term work in West. M Miller, Box 3437, Chico CA 95927. 916-893-8737.

CE (radio), any market. Former CE Boston, Houston, Miami, Ft Lauderdale, Ham, General, Nondrinker, now! Meyer Gottesman, 3377 Solano #312, Napa CA 94558. 415-550-8506.

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Want to Sell

Scotch Cartr, all lengths, over 700, some brand new, comp research AC library content. D Scott, WCLZ, POB 900, Brunswick ME 04011. 207-725-5505.

Ampex 671 Tape-bulk, used (60 per ctn), \$3.35 ea/\$21 per ctn, plus UPS; Ampex (406 & 456) & 3M (206 & 208) mastering tapes, avail on reels & hubs, usec, excel prices; NAB metal reels, not warped, used (25 per ctn) \$1 ea plus UPS. Burlington Audio, 1-800-331-3191 or 516-678-4414.

EIAJ videotape, new, cartons of 10 1-hr rolls, \$50/ctn. Soundesign, Box 921, Beverly Hills CA 90213. 213-276-2726.

Capitol A2's, never used, (18) 3.5. (4) 5.5; (20) A2500, BO takes all. K Hunter, KLKT, POB 6063, Incline Village NV 89450, 702-832-1000.

Audiopak A2 carts, . 719 various lengths incl 240 2-1/2 min length, 198 70-sec, also 117 shells, BO. T Bondurant, WO-1Y, POB 2808, Highpoint NC 27261. 919-869-0101.

Metal reels, 10.5" NAB 1/4", gd cond, \$1.50 ea. G Falk, Falk Recd, 7914 Fegenbush, Louisville KY 40228. 502-239-1010.

Audiopak, 100 plus carts, most need recond, \$100. D Cann, KSMK, POB 10, Cottonwood AZ 86326. 602-634-3693.

Scotch R-R recdg tapes, approx 350 10-1/2", each master tape has approx 25 MOR or Beautiful Music songs, most w/cue tones, recorded at 7-1/2 2 trk stereo, playlist on most, \$4 ea, sold as package. G Merrill, 605 W Haven Dr, Logan UT 84321. 801-753-1178.

Want to Buy

Collector of radio station jingles would like yours, will trade. I Gordon, WGHS, 203-357-7847.

Top 100 Hits 1954-1985, lost old copies in fire. S Stevenson, Stevenson Corp, POB 735, Blaine WA 98230. 604-531-4576.

TAX DEDUCTION EQUIP.

Radio equip, anything for donation. C Sline, WRHS, Rich Central HS, 203rd Governor's Hwy, Olympia Fields IL 60461. 312-747-1695.

Non-profit tax exempt company needs video equip. D Davis, Manna Ministries, POB 43, Lacon IL 61540. 309-246-2662.

Bdct Equip for donation to WPPJ Point Park College, interested in McMartin B802 consoles, cart decks & Fidelipac 300 carts. P Hess, 134 Derwent Dr, Pittsburgh PA 15237. 412-366-1249.

TEST EQUIPMENT

Want to Sell

HP 205AG audio sig gen w/return input monitoring in porta case, \$250; Fluke 407D power supply (3), \$100 ea or all \$450. J Krepol, 6147 Walker, Phila PA 19135. 215-331-1432.

Tek 528 waveform monitor, excel cond, \$2500/BO. A Haines, Quincy Prod, 816 S 11th, Quincy IL 62301. 217-222-5267.

B&K 3050 audio gen, excel cond; B&K 2050 RF gen, excel cond; Heathkit IM 5258 dist analyzer, gd cond. D Delapointe, Ingstead Bdct, 3301 So Univ, Fargo ND 58103. 701-237-4500.

Heathkit IM-2420 freq counter, \$150. P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123. 619-565-6006.

Tek 529, waveform monitor, \$600; Hitachi VO59B, \$850. J Kohan, Video-It, 1016 N Sycamore, Hollywoo CA 90038. 213-876-4055.

Deven 35A harmonic noise & dist set in gd working cond w/inst, \$200. I Kaufman, Natl Recdg, 460 W 42nd, NY NY 10036. 212-279-2000.

Tek 7613 scope w/7A26 dual trace amp & 7B53A time base, 7L5 spectrum analyzer w/option 25, \$17,000. R Erickson, WNIC, 15001 Michigan Ave, Dearborn MI 48126. 313-846-8500.

TRANSMITTERS

Want to Sell

RCA B-TA1R1, 1 kW AM xmr, gd running order, 125 tubes & 2 drivers, \$4000. R King, WLNG, Sag Harbor NY 11963. 516-725-2300.

McMartin BF-3/5 K FM 3-1/2 Kw xmr, tuned & tested on your frequency, complete w/mono or stereo exciter, vgc, completely reconditioned, C Goodrich, Goodrich Ent Inc, 11435 Manderson St, Omaha NE 68164. 402-493-1886.

Collins 20V2 1 kW AM xmr, all new Peter Dahl transformers installed, excel cond, \$3500 plus ship. J Keller Jr, WKOK, POB 1070, Sunbury PA 17801.

McMartin BF-25K, 25 Kw FM xmr tuned & tested on your frequency, spare tubes, w/stereo exciter, excel cond. C Goodrich, Goodrich Ent Inc, 11435 Manderson St, Omaha NE 68164. 402-493-1886.

Harris TE3, Solid Statesman FM exciter, \$800. S Cashdollar, WWO, Box 185, Hartford City IN 47348. 317-348-2665.

McMartin BA-1K 1 kW/500/250 W AM xmr, excel & very clean, spare tubes tuned & tested on your freq, xmr was operated 4 yrs in clean air conditioned environment. C Goodrich, Goorich Enterprises, 114 35 Manderson, Omaha NE 68164. 402-493-1886.

McMartin BF-25K 27.5 kW FM xmr completely reconditioned, tuned & tested on your freq w/spare tubes, FCC approved 15kW to 27.5kW. C Goodrich, Goodrich Enterprises, 114 35 Manderson, Omaha NE 68164. 402-493-1886.

Gates SIC72480, tuned to 104.9 MHz, 1000 W carrier pwr, S Cashdollar, WWO, Box 185, Hartford City IN 47348. 317-348-2665.

Gates 5 kW FM, very clean in excel working order, easily retuned, \$7500. J Kautz, KKEI, 1490 E Street, Utica NE 68456. 402-534-2071.

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.

RCA BTA-5T, later mdl, super cond, w/spare inventory, 5 kW AM & Gates FM-5B 5 kW FM xmr, type exciter, comp, out of service, will run, spares. J Runkle, 208-344-0947.

Gates BC-500T 500 W AM xmr, gd cond, sitting idle, ready for use, \$1700. R Christiansen, KDAX, 859 Main, Carrington ND. 701-652-3151.

RCA BTA50F 50 kW AM xmr, full operational, recently removed from service, ready to ship immed, all tubes, schematics & floor layout, \$18,000 plus ship. L Smith, 2880 W Lake, Wilson NY 14172. 716-751-6187.

Collins 8300-1A 1 kW FM xmr, clean, very reliable, now on 103.1 MHz. D Matthews, KASK, 120 First Natl Tower, Las Cruces NM 88001. 505-524-2103.

RCA BTA 250Lw/BTA1K 1000 W AM xmr, spare parts, BO. H Jenkins, KFMM, POB 549, Pina AZ 85543. 602-485-2228.

Harris 2.5K FM, spares & backup finals; MS-15 exciter, avail 4/86, \$15,000. C Edwards, WWJM, 210 S Jackson, New Lex OH 43764. 614-342-1988.

Collins 250 W FM in great shape. T Dodge, WTJJ, POB 150, Waterberry VA 15676. 802-244-5683.

Gates BC1J 1 kW w/cutback to 250 W, gd cond but needs new final tubes, BO. E Albrecht, KOAL, POB 875, Price UT 84501. 801-637-1167.

RCA BTF-3B 3 kW FM xmr, w/tube type exciter (needs work), avail immed, \$2500/BO. C Sears, WTTV, 1020 S Highland, Bloomington IN 47401. 812-332-3685.

ITA 15,000B FM xmr, great for parts or could be rebuilt. B Allen, Harvest Bdct, POB 105 FM, Hinsdale NH 03451. 603-336-7267.

Harris TE-3 exciter, rebuilt, spare output transistors, \$750. V Argo, KYLT, Box 2277, Missoula MT 59806. 406-728-5000.

RCA BTF1-D FM exciter w/exciter & stereo gen, avail immed, BO. P Badger, WKRE, Box 220, Exmore VA 23350. 804-442-5000.

McMartin B910 FM exciter, spare RF module, \$1000. B Umberger, W-Lite, 51 S Main, Clearwater FL 33575. 813-446-0957.

RCA BTA50F1, 6 kW AM xmr in gd cond w/spares, B Sowell, WMAZ, POB 5008, Macon GA 31213. 912-741-9494.

Wilkinson 25 kW calorimeter/dummy load, built 1978, BO. R Palmer, WXTR, 5210 Auth Rd, Marlow Heights MD 20746. 301-899-3014.

RCA BTF-5D, 5 kW FM, excel cond, spare tubes, harmonic filter, McMartin B-910 exciter, all manuals, \$6000. C Drien, WREZ, POB 5000, Montgomery AL 36192. 205-832-4295.

Gates BFE-10A 10 W FM, BO. C Sears, WTTV, 1020 S Highland, Bloomington IN 47401. 812-332-3685.

Want to Buy

FM xmr, 2.5 or 3.5 kW, w/exciter, 240 V single phase, S Mueller, KQLX, Box 1008, Lisbon ND 58054. 218-681-4554.

UHF xmr, 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.

Continental or CCA 20 kW FM xmr or used 25 kW Harris FM xmr, need not inc exciter. M Hayward, WMVO, Box 348, Mt Vernon OH 43050. 614-397-1000.

RCA TT2A or TT10A UHF xmr or CE TT-25 or TT-24A; parts for GE UHF xmr's TT25 or TT-24A; LPTV xmr's 100 watts to 1 kW. J Paley, WHGM, POB 2248, Altoona PA 16603. 814-943-2607.

RCA BTA1R, need crystal assembly at 1090 kHz. H Kneller, WKII, 522 Cottage Grove Rd, Bloomfield CT 06002. 203-243-0730.

Blower for final cavity for Sparta 602A, 2.5 kW FM xmr, exact replacement is Rotron Centrimax blower mdl CX33A3G-027555. C Frodsham or M Hoffman, KVSF, POB 7, Beloit KS 67420. 913-738-2006.

FM 100-250 W, gd cond, working, reasonable. D Bryant, Eastern Oregon Radio, POB 821, Elgin OR 97827. 503-437-0990.

TTC/Tepco FM translators, B Dodge, WTIJ, POB 150, Waterburg VT 05676. 802-244-5683.

FM xmr w/exciter 1 kW capable of going on 89.9 MHz, in gd-excel cond w/all manuals, older equip OK. K Stiles, Peninsular, POB 4, Lake Bay WA 98349. 206-884-3379.

AM xmr, 1 kW, Collins pref but will consider others, price important. B Allen, Harvest Bdct, POB 105 FM, Hinsdale NH 03451. 603-336-7267.

Collins 43/D1 comm xmr, 2-30 MHz w/Collins autotune, 240 V single phase. R Smith, 2245 Felspar, San Diego CA 92109. 619-483-9330.

10 W exciter, 103.5 MHz, under \$500. M Celenza, 64 Belmont, Plainview NY 11803.

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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.

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Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 3 issues of Radio World. Contact information will be provided, but if a box number is required, there is a \$2 fee which must be paid with the listing (there will be NO invoicing). Responses will be forwarded to the listee, unopened.

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Broadcast Equipment Exchange

TRANSMITTERS . . . WTB

FM stereo xmt 20 kW, public telecomm facilities program guidelines will apply. D Karns, KOPN, 915 E Broadway, Columbia MO 65201. 314-874-5676.

TUBES

Want to Sell

EIMAC 3CX1000A7 never used, \$350. K Harnack, 895 Mt Rushmore Dr, Richmond KY 40475. 606-624-2181.

Tubes, all new. (1) type 813; (3) type 5933A; (2) type 6080; (2) 575A; (1) type 866A, BO. J Hendrick, WKCT, POB 930, Bowling Green KY 42101. 502-781-2121.

Want to Buy

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, KYSV, POB 7, Beloit KS 67420. 913-738-2206.

TURNTABLES

Want to Sell

QRR 12C w/turnarm & cartridge in gd cond. \$180/both. D Cody, Cody Prod, 6431 Inkster, Garden City MI 48135. 313-425-8794.

Micro-Trak 306, 16" tonearms (2), new. \$110 ea. K Harnack, Harnack Eng, 895 Mt Rushmore, Richmond KY 40475. 606-624-2181.

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R.E. (Dick) Witkovski
Owner. 214-630-3600

Russco MK V (2), w/Harris EQ's pre-amps. Micro-Trak 303 arms & Stanton 500 cartridges. \$400 ea. M Ripley, 4-K Radio, Box 936, Lewiston ID 83501. 208-743-2502.

Stanton 681E, (2) brand new. \$30 ea. J Glass, WLBK, 711 N 1st, DeKalb IL 60115. 815-758-8686.

Sparta GT w/pedestal cabinet, \$200; Gates large platter w/Syntec arm, \$250 plus ship, both in vgc. J Emmel, WRGE, POB 401, Olyphant PA 18447. 717-383-1118.

Dual 1229 (2), \$60 ea; (2) Kenwood direct drives. \$75 ea; Bic 960 (2), \$50 ea. all mint cond. F McCall, Performance Svcs, 1521 W St Marys #229, Tucson AZ 85745. 602-623-2110.

Collins rim drive units (2) w/Rek-O-Kut arms. \$200/pr. P Wells, KLZZ, 8665 Gibbs Ste 201, San Diego CA 92123. 619-565-6006.

Rek-O-Kut 12" tone arm, like new w/comp mounting info. \$40. C Lindstrom, Sel-Nar Prod, 36 Laurel, Wichita KS 67206. 316-685-3047.

Gotham PFB150WA amp & pwr supply w/Grampian cutting head B1/AGU, w/Rek-O-Kut TT & lathe w/100 transco discs, w/Ampex 350-2 R-R, \$2000/BO. J Tortorelli, Hills Snd Svcs, 137 W Boylson, Worcester MA 01606. 617-753-8373.

Want to Buy

EMT 927, 928, 930ST complete. Gerrard 301, C Dripps, Kurluff Ent, 4331 Maxson, El Monte CA 91732. 818-444-7079.

VIDEO PROD EQUIP.

Want to Sell

Microtime Genesis-1 digital special effects. new. \$15,995; Datatron SMPTE timecode gen. new. \$995. Soundesign, Box 921, Beverly Hills CA 90213. 213-276-2726.

Hitachi CM182 bdcct color 18" mon. new. \$995. Soundesign, Box 921, Beverly Hills CA 90213. 213-276-2726.

EFS 1 disc cassette, frame store by Arvin Echo, TV cameras, Angineux 10:1 for Norelco PC-70, BO. N Macray, Technichrome, 1212 S Main, Las Vegas NV 89104. 702-386-2844.

Chyron VP-1 character gen, genlock & software upgrades. \$3950; Microtime T120 TBC, \$5350. L Froom, SPS Video, 1901 Chapel Hill, Silver Spring MD 20906. 301-598-5392.

Hitachi surplus equip, new or like new. call for details: Crosspoint Latch 6112 switcher, 4 yrs old. \$2500. C Denke, AMPC, 7017 15th Ave NW, Seattle WA 98117. 206-789-1046.

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.

Ampex HS100's must be comp but need not be working (slo mo). H Henson, Henson Prod, 4569 Havencrest, Winston-Salem NC 27106. 919-924-8717.

IVC parts, new video heads, 1 new scanner, \$200 comp. C Potorti, 1005 Lacey, Morrisville PA 19067. 215-945-3990.

Quasar VR-100 color VCR (2), \$100 ea; VC120 & VC60 tapes, \$8 ea. F McCall, Performance Svcs, 1521 W St Marys #229, Tucson AZ 85745. 602-623-2110.

Ampex VR-2000 comp w/2 headwheels. \$4000. R Gianni, Gateway Stds, 225 Ross, Pittsburgh PA 15219. 412-471-7224.

Buy from manufacturers and distributors who advertise in Radio World—they support radio.

Dynasciences edit controller for type 2 VCR's. R Spain, KCWY, POB 170, Casper WY 82602. 307-234-1111.

Skypans w/Pantagraph; RCA TK-44s w/spares; RCA TR-70s; RCA TPR-10 VTRs; RCA TK-760, 76B, 76s; RCA FM ant, 14 bay 102.9 MHz; RCA TK-22 B&W camera; RCA TFU 46K ch 44 ant; RCA TCR-100s w/extras; Sony BVU-110 3/4" VTRs w/extras; RCA TR-60s. Contact George Merrill or John Reinfield at 612-646-5555.

Bdct Video Equip: various items from Tek, GVG, Sony, RCA, Fortel, etc, to numerous to list, call for details. T Smith, CCI Comm, 192 Lancaster, Frazer PA 19355. 215-289-1725.

Want to Buy

Tape cleaner/evaluator, 3/4" in gd cond. H Henson, Henson Prod, 4569 Havencrest, Winston-Salem NC 27106. 919-924-8719.

Microtime 2020, buy for parts w/service manual. \$500/less. J Scheppers, Schepers Design, 4740 Charlotte, Kansas City MO 64110. 816-561-6622.

JVC KY2000 camera cable in 165' length or longer. R Oakley, Gospel Graphics, 288 Gold Rush, Lexington KY 40503. 606-276-4883.

Convergence controllers, parts & access. J Kohan, Video-It, 1016 N Sycamore, Hollywood CA 90038. 213-876-4055.

Video cameras, recorders, & misc equip for religious bdcct network, needed are working WFM & vectorscope. 3/4" VCRs & edit system. SEG, (2) studio cameras w/controller & lenses, will pay top \$\$\$, Rev T Smith, Harvest Time Ministries TV Network, POB 3393, Portland OR 97208. 503-281-1862.

VIDEO TAPE REC.

Want to Sell

Sony VP-2000 3/4" U-matic, auto repeat & auto stop function & pause frame mode remountable, \$650. J Krepol, 6147 Walker, Phila PA 19135. 215-331-1432.

Sony VP-1200, (2) U-matic video cassette players, completely overhauled, excel cond. \$650 ea. D Leininger, Leininger Enterp, RD2, Denver PA 17517. 215-267-5370.

AVR 1 (3), VR2000, dist amps, vectors WFM, spare head, etc. BO. N Macray, Technichrome, 1212 S Main, Las Vegas NV 89104. 702-386-2844.

Sony VO-2610 3/4" U-matic R/P, auto repeat & auto stop func. & pause frame adv. w/8 pin audio/video signal cable & ch-1 audio dub remountable, \$900. J Krepol, 6147 Walker, Phila PA 19135. 215-331-1432.

Sony AV-3600 (2) 1/2" EIAJ format w/manuals & (1) Sony AV-8400 color portable w/approx 24 reels of tape & video cables, all \$650. J Krepol, 6147 Walker, Phila PA 19135. 215-331-1432.

Hitachi SV650 VHS portables, new w/battery & AC pwr, pro-audio connectors, \$675; Panasonic NV8200E PAL format VHS, new, \$995. Soundesign, Box 921, Beverly Hills CA 90213. 213-276-2726.

Want to Buy

IVC 600, 700, & 800 series, heads & color boards for IVC mdl's 600, 700 & 800 1" VTRs. C Asplund, WATR, 79 Baldwin, Waterbury CT 06706. 203-755-1121.

Ampex VPR1-C, TBC-1, TBC-2, parts, consoles, boards, also VPR2. J Kohan, Video-It, 1016 N Sycamore, Hollywood CA 90038. 213-876-4055.

RCA TR600A, need quad access, remote control panels, also AE600 editors & spare modules. H Henson, Henson Prod, 4569 Havencrest, Winston-Salem NC 27106. 919-924-8719.

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clean, and
loud..."*

Jim Davis
General Manager
Radio Station WVAF

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(304) 925-4947

October 6, 1983

Mr. Eric Small
Modulation Sciences Incorporated
99 Myrtle Avenue
Brooklyn, N.Y. 11201

Dear Eric;

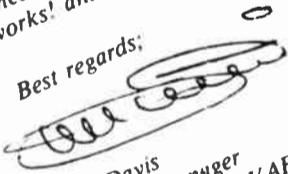
As I was connecting up my new Sidekick to our Harris 20 K, I was thinking back about all the electronic marvels that Eric Small has contributed to the radio business. From early development work on the Optimod, to that clever Upstart unit, your contributions have been many.

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
General Manager
Radio Station WVAF

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Everybody's talking about CD's and digital. It's as if all analog tape technology and the cart machine were obsolete. Although CD's are a terrific new program source, it should come as no surprise that carts are still the best way to handle the huge quantity of individual program elements that comprise a typical day in radio broadcasting.

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The engineer's challenge is not CD versus the cart, vinyl LP or reel tape—but improving all broadcast

source and delivery systems. Digital audio technology is here with exciting potential for the future. For today's programming needs though, you can't beat the features and performance of our Tomcat and Micromax cart machines.

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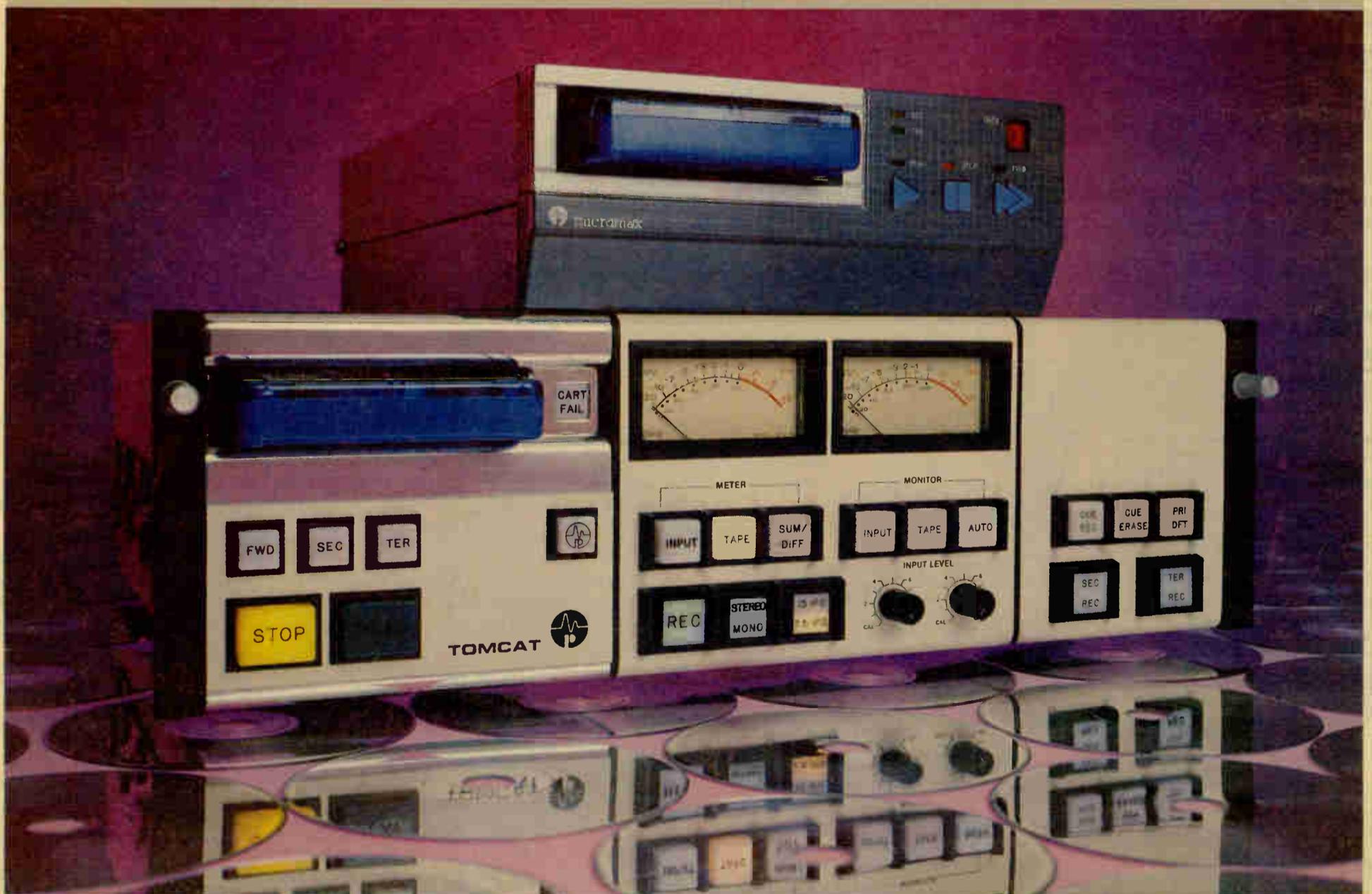
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