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Radio World®

Vol 15 No 5

Radio's Best Read Newspaper

March 13, 1991



The Great Crane Hoist: WFTL's official tower solution. For details, see p. 28

Avionics Specs Urged

by Arthur Cole

WASHINGTON A San Antonio consulting firm has petitioned the FCC to set standards for avionics navigation receivers in a bid to reduce FAA objections to radio and TV broadcast towers near airports.

The petition, filed Dec. 21 by John Furr and Associates and made public Feb. 7, puts into writing what many broadcasters have been arguing for the past year: that low-quality avionics receivers are to blame for commercial broadcast interference with navigational equipment.

The FCC and the FAA have been involved in a dispute involving current and proposed FAA regulations that can block the construction of new broadcast towers if it determines they present a hazard to air travel in terms of location and potential interference to avionics communications.

The FAA said it must use its authority to control where towers are placed because FM and VHF TV broadcasts can interfere with aviation communications. The broadcast industry has maintained that the FAA would not need such power if avionics radios were built to be less interference-prone.

Fewer objections

Furr said his petition was designed to defuse numerous FAA objections to radio and television tower applications near airports.

Just as important, he said, it also would eliminate the need for proposed FAA regulations that would give the agency even greater authority over electromagnetic interference (EMI).

The FAA's latest proposal would require broadcasters to seek FAA approval for any changes to existing FM or VHF TV stations—even if there is no increase in effective radiated power.

Furr said the FAA's desire to control new broadcast construction and station upgrade permits is unnecessary. In his petition, Furr charged that the FAA uses "worst case" avionics equipment to gauge potential interference; the proposed regulations would force broad-

casters to downscale tower construction or broadcast alterations so as not to interfere with the lowest quality navigational receivers.

"Basically what the FAA wants to do
(continued on page 8)

In-Band DAB Pushed

by Judith Gross

NEW YORK Gannett Broadcasting, possibly with the support of other large radio groups, has unveiled a new in-band DAB system that would require only a small amount of new equipment and little in the way of FCC action.

The public unveiling was made at a joint SBE-AES meeting here in mid-February. The plan had also been presented to a Radio Operators Caucus meeting in Washington, DC.

The system is called Project Acorn, and was developed for Gannett at Stanford Research Institute (SRI) in Palo Alto, Calif. Corporate Computer Systems, the only U.S. company with hardware for the MUSICAM data compression system, is also involved in the project.

Gannett VP of Engineering Paul Donahue outlined the system along with CBS Radio Technical Director Tony Masiello on a panel that included most of the active DAB proponents in the industry. Masiello is a technical consultant on the project, since CBS has not yet announced its formal affiliation with it.

In-band system

Project Acorn allows a digital signal to be placed simultaneously with an analog signal within the 200 kHz of bandwidth existing FM's occupy. The key is a technology called digital coded poly-vector modulation (DCPM).

Gannett patent attorneys placed restrictions on the amount of technical in-

formation Donahue could reveal about the system, but he said it uses military
(continued on page 10)

Translator Curb Eyed

by Charles Taylor

WASHINGTON In a petition for reconsideration filed in January, the NAB urged the FCC to take a tougher stance on the use of FM translators.

The filing followed the Commission's November rulemaking on the issue.

The NAB's filing was prompted because "a few aspects of the Commission's final decision appear surprisingly at odds with the main themes adopted in the Report and Order," it said.

Along with the NAB petition, a handful of other filings asked the Commission to relax translator use. Included was a petition for reconsideration filed by Power DuPree, an Arkansas translator company that has long been a vocal and potent supporter of their use.

"We feel like the Commission could have gone farther to serve the public," Power DuPree President John La Tour said. La Tour was in Washington in late January to meet with Commission and other government officials to promote his stance.

Changes recommended in the NAB petition include granting only a one-year grandfather period, rather than three years, to comply with the FCC's new translators; requiring licensees of translators to prove they are in line with new Commission anti-interference standards; and forbidding FM's to establish translator service in unserved areas without filing for a waiver of the rules.

The NAB also looked down upon translators being allowed to air commercials within the 30 seconds of original air-time allowed by the rules and opposed stations being allowed to split that time into smaller segments within the hour.

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NEWS BRIEFS

Virginia Station Fined

WASHINGTON Norfolk, Va. AM station WZAM was fined \$7,500 by the FCC for multiple violations including unauthorized transmission after sign-off.

The daytime-only station was cited for transmitting an unmodulated carrier several hours after its authorized sign-off.

According to the FCC, the AM directional station was operated by unauthorized re-

mote control; there was no way of shutting the transmitter off from the station during an emergency.

Authorized remote rules require stations to cease transmitting via remote within three hours of a detected remote malfunction.

Other technical violations WZAM was cited for included inoperative EBS equipment, failure to observe tower lights at least once a day, failure to report a tower beacon light outage to

the FAA and failure to designate a chief operator.

TV Marti Off the Air

CUDJOE KEY, Fla. The TV Marti broadcast service went off the air in mid January because the Air Force blimp housing its transmitter broke loose from its tether line, according to the Voice of America (VOA).

The blimp, which floats 10,000 feet in the air, apparently drifted over the Florida Everglades after wind gusts broke its line, a VOA official said.

The Air Force was able to secure the blimp by deflating it via remote control, but the transmitter was slightly damaged

when it came down in a wooded area. It will remain off the air until late March, VOA said.

The controversial pro-western TV service, which has targeted Cuban viewers and resulted in retaliatory jamming of Radio Marti, was criticized for being weather-prone when it went on the air last March.

Survey Said FM Quality OK

WASHINGTON A national survey revealed that radio listeners would settle for FM-quality digital radio services via satellite.

The survey, conducted by Broadcast Investment Analysts

(BIA), was commissioned by Radio Satellite Corporation, a firm planning to launch a digital radio service with FM-quality sound using satellite delivery.

According to the survey, 79 percent of respondents answered yes to questions about whether they would be willing to listen to digital radio that is comparable to FM.

Nearly 90 percent of respondents said "they are satisfied with the quality of the sound of their favorite FM stations when receiving a strong signal," a RadioSat press release said.

The poll indicated that listeners may not be lured as much by the CD quality sound proposed by other digital radio services. In fact, only 40 percent of the respondents believe an auto CD player is a good idea, RadioSat said.

FCC to Adopt Digital Noise Test Procedure

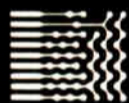
WASHINGTON The FCC has proposed adoption of the American National Standards Institute's (ANSI) C63.4-1990 test procedure for measuring digital device emissions that could affect radio broadcasts.

The Commission decided to pursue adoption of the ANSI standard rather than its own proposal, formerly called TP-5, because of private sector engineering recommendations.

"The Commission believes that ANSI C63.4-1990 represents the state-of-the-art with regard to radio noise testing of digital devices and is consistent with international standards," the FCC said.

Also, use of the ANSI standard complies with a federal initiative to cooperate with the private sector in developing standards, the Commission noted.

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ROC Withholds Eureka Support

by Judith Gross

WASHINGTON "You can't put the DAB genie back in the bottle." That was the sentiment as radio group owners met here in February to discuss recent developments in DAB.

During the Radio Operators Caucus (ROC) all-day meeting, some radio owners said they had grave reservations about the Eureka 147 system as a U.S. standard for DAB.

Eureka criticisms included both economic and technical concerns.

At that meeting, attended by 40 ROC members, the NAB presented its plan for DAB, including endorsement of the

European-developed Eureka 147 system, which received unanimous approval by the association's radio board in January.

The ROC approved the NAB's overall DAB plan, but stopped short of endorsing Eureka 147.

Also presented at the meeting was a new in-band DAB system under development by Gannett and Stanford Research Institute, with participation from Corporate Computer Systems and CBS.

Beyond technical problems

Eureka was criticized for the high antenna gain and power requirements needed at the 1500 MHz frequency that the NAB is favoring for DAB implementation.

Some ROC members also pointed out that at that frequency, the signal will not penetrate most buildings and that gap fillers would be needed in most structures to get the DAB signal to listeners.

But some of the biggest concerns center around potential allocations schemes for DAB stations. With heavy investment and

debt built into the structure of FM ownership today, owners of successful FMs in competitive markets pointed out that a DAB system providing parity between AM and FM stations would destroy the economic underpinnings of the industry.

"Radio today is an FM game, along with the 1A AMs. That's all the banks care about," one ROC member said.

The Gannett presentation also maintained that the overall number of stations might be increased if certain DAB allocation plans are adopted—meaning more competition in already crowded markets.

Another concern is that clear channel AMs might be forced to give up their skywave coverage. Wayne Vriesman of Tribune, which owns Chicago's WGN, said AM clears "need to be on the satellite." He suggested that they be grandfathered into a DAB system noting, "we (AM clear channels) built this industry."

In defense of the plan

NAB DAB Task Force Chairman Alan Box defended the NAB's desire to seek L band spectrum for a Eureka DAB system. "We operated under the premise that we have to be a part of this band or else it will go to our competitors—maybe satellite," Box noted.

NAB Senior VP of Science & Technology Michael Rau was called upon to answer some of the technical concerns about Eureka. He noted that high power requirements would be more modest if instead of an F(99,99) coverage as proposed in the NAB's spectrum study, an F(90,90) coverage requirement was used.

Because of the all-or-nothing nature of

the digital signal, as opposed to a gradual degradation of an analog FM signal, an IEEE paper done by Rau's department had suggested the F(99,99) requirement.

But Rau noted that new developments in on Eureka allow for an unequal error correction at the outer limits of the coverage area, providing a more graceful drop-off of signal.

Tentative support

Box answered the concerns about building attenuation by noting that instead of a temporary simulcast period, where AM, FM and DAB are transmitted at the same time, there may be areas where simul-

casting will "go on forever."

When a vote was taken at the meeting's close, despite the debate, ROC members gave support to the 11 general points of the NAB's DAB plan.

However, they stopped short of backing Eureka, withholding endorsement of any technical standard "pending technical evaluation," according to Shamrock Broadcasting's Bill Clark, who chaired the meeting.

To address the ROC's concerns, the NAB also invited four ROC members to sit on the DAB Task Force for future work. The four are Randall Odeneal from Sconnix Broadcasting, who had circulated a letter with concerns about Eureka prior to the NAB Radio Board action; Wayne Vriesman of Tribune Broadcasting; Scott Ginsberg of Evergreen Media and David Gingold of Barnstable Broadcasting.

The ROC approved the NAB's overall DAB plan, but stopped short of endorsing Eureka 147.

SO, JUST WHO USES TELOS ANYWAY ?



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Mulling a DAB Future, Poolside

by Judith Gross

FALLS CHURCH, Va. You've heard about the NAB endorsement and move towards licensing of Eureka. You may be aware of industry opposition on the basis of economic concerns.



In the middle of all this are the satellite proponents, and Ron Strother, who may get the FCC nod for experimental testing of DAB and then have no system to test. And now comes the in-band systems as well (more on that in a bit).

Well, I'm here to tell you what it all means. Really.

But before I do, you just gotta know what a great idea it is to have a business meeting at a posh hotel in a tropical resort in the middle of bleak, blechy January. I could get used to this.

No fools, those folks at NAB. It was the annual winter Board meeting, the Ritz Carlton in Naples, a sleepy little Gulf (of Mexico, not Persian) resort town and once the fog cleared the sun was strong and the beverages at the pool had umbrellas in them.

Then there was the beach. And golf and tennis. But in all fairness, the only folks (besides assorted spouses and offspring) who really had time to check out the amenities were reporters, who weren't allowed into any of the meetings (no surprise).

Board members and staff were usually stuck inside auditorium type rooms in endless confabs. Hey, but for once, we didn't moan and groan about the closed door policy, when the pool was only a few yards outside that closed door.

Not that I want you to get the idea that it was all fun and frolic. There were ban-

quets every night. And high tea in the hotel lounge. Did I mention the jacuzzi?

DAB was definitely the topic of the day. Even for the TV Board, who passed a couple of resolutions on it, to the effect of "don't use UHF-TV spectrum, etc."

There was a five-hour presentation to industry biggies on Saturday, with non-members and even some engineers flying in just to hear the NAB's plan.

Then there was the unanimous vote to endorse the plan, including a push to make Eureka 147 the DAB standard in North America and have the NAB enter into a licensing agreement.

The grumbles of early opposition that leant an exciting edge to the Saturday session were gone by Tuesday's Board vote. But they haven't gone completely away.

Now comes word of an in-band system under development by Gannett, Stanford Research Institute, Corporate Computer Systems and participation by CBS.

Project Acorn (see story, this issue) would not need new spectrum and is supposed to be ready for viewing at the NAB convention.

Anyway, in the weeks following the sunny days in Naples, a bunch of state broadcast associations have met to talk about DAB (one, Oklahoma, endorsed the NAB's action). And one very impres-



sive AES-SBE meeting, which had most of the DAB proponents on a single panel, took place.

Thus the dark fog of mystery surrounding DAB is starting to clear. So where does it stand now, and whatzit all mean?

Well, we got NAB singing the praises of Eureka on the basis that it already exists in hardware form. And we've got an early spectrum study from their DAB Task Force coming up with a three or four class allocations plan that could accommodate all existing AMs and FMs.

A lot of group owners, who have invested heavily in FM stations, some of which have been over-leveraged and are feeling the pinch in this tight economy, don't like the possibility that a DAB allocations plan would make AM stations their technical equals.

Then they worry that with some of the allocations schemes being tossed about, we could actually end up with more stations than we have now... like maybe 2800 more?

And what about clear channel AMs? They don't welcome the prospect of having to give up that regional skywave coverage. So some of them are talking satellite.

Engineers point out that at 1500 MHz a terrestrial DAB system is a terrible idea. Eureka, which has been shown to work better at lower frequencies, won't go through buildings at that high frequency. How about a gap-filler on every floor of every office?

And if you run some calculations on the power requirements needed at that frequency, well, let's just say that those who have are kind of upset.

So along comes Gan-

net, SRI, CCS and CBS with a system that is still relatively shrouded in secrecy but which they say has its origins in military defense technology (so that's where all those R&D dollars are). Yes, it's even being used over in the Gulf (Persian, not of Mexico).

Meanwhile, WARC '92 is less than a year away, spectrum requests and satellite proponents are moving along fast and furiously and there are still some folks who wish the whole thing will just go away.

One thing that helps is getting the word out more to engineers and managers. They did just that in the Big Apple. Noo Yawk SBE and AES members had that panel I mentioned with most of the big DAB players.

There was Ron Strother, John Leonard, who also has an in-band system, Peter Dolan of Satellite CD Radio, Emil Torick representing Eureka, Michael Rau of the NAB, and Paul Donahue of Gannett and Tony Masiello of CBS presenting their new in-band system.

As Strother said "It set the standard for discussions of this type." You bet. And one thing that came out of it is the need for an independent group to test systems and report back before any standards work is done.

But you don't see a lot of clamoring among industry groups for this dubious headache—oops, I mean distinction. So the fighting goes on.



NAB Board meeting? It was work. Honest.

And when you get right down to it, what it all means is this: Any day you can contemplate the future of your industry while sipping a paradise punch looking up at palm fronds through sunglasses with the gentle lapping of the ocean serenading your ears is a good day for business regardless of the battles ahead.

But the pool party is just a blurry memory. The DAB battles have started. Now the real fun begins.

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McRadio and big bucks boys

Dear RW,
A great deal has been said and written about the decline of AM radio and what might be done to prevent its final demise. I do not propose to add anything to this cacophony. AM radio as a business is already a dead issue in many places. It may yet be that some technical wizard will bring it back to life, but I doubt it. The problems of AM radio are not all or even largely technical.

The same turn of events now looms on the horizon (quite literally, one might say) for FM radio. In its earlier days, FM radio was a breath of fresh air. Over the intervening years, commercial FM radio has become the same sort of stagnant mire of standardized formats AM radio had become earlier. It is not uncommon to find a half dozen or more stations in a major market area differentiated only by the rotation pattern of their playlists.

Oh, there are a few mavericks who aren't running with the herd here and there, but on the whole, it's McRadio coast to coast, AM and FM.

All this talk about what harm satellite-delivered DAB will do to localism is a lot of self-serving propaganda from folks who know more about debt service in the

name of self-interest than they care to know about community service. What localism is there anymore when so many stations are programmed via a satellite feed from a studio hundreds or even thousands of miles away? Even the local weather report often does not originate locally! You're not fooling anyone, guys.

Satellite DAB may actually do more to promote the revival of localism than it is likely to hurt it further. McRadio will almost certainly move there. At the same time, though, having such a broad coverage area available from the Clarke Belt will make it feasible for special interest programmers to stay in business, so it's not likely to be all more of the same thing. That and possibly terrestrial DAB will probably depopulate both the AM and FM dials (at least for a while) in many localities, but those who remain will have to offer something besides the standard homogenous blends to attract listeners.

The best public service the big bucks boys could perform is turning in their AM and/or FM licenses once they switch over to DAB. That might open up these bands to small scale, low power community-oriented broadcasters and restore really local service. If that were to happen, satellite DAB would be the best thing that ever happened to local broadcasting in a long time.

Andy Melnyk
Savona, N.Y.

Call assignment among services

Dear RW,
Andrew Dart, of Andy's Bureau of Standards, proposed a new call sign assignment system (*Reader's Forum*, Jan. 9, 1991) that could possibly duplicate calls currently used in other FCC-licensed services. That's the one he says the FCC shot down.

I recall reading somewhere—quite possible in *QST* (the journal of the American Radio Relay League)—of someone spotting a light airplane with its call sign on the fuselage. It was identical in makeup to an amateur radio call, one assigned to a California resident. When the writer spoke to someone from the FCC about it, the response was along the lines of, "Don't worry about it; the two services are so distinct nobody would ever confuse them."

Think of that the next time you see an American plane with a typical amateur call sign. There's at least one out there now. If they can assign frequencies to different services (do you really think all that maritime VHF stuff is protected in Kansas?), they can do it with calls.

Thomas Carten
WRKC-FM
Wilkes-Barre, Pa.

In defense of the FAA

Dear RW,
The Aircraft Owners and Pilots Association (AOPA), representing 300,000 pilots and aircraft owners, must take exception to a recent article published in the Nov. 21, 1990 issue of *RW*. The article, enti-

Radio's importance in keeping America informed shouldn't be underestimated. With the right tools, it's still the nation's best pipeline to current events.

From the first moments of the Persian Gulf War, radio proved to be a vital information source. Indeed, CNN's four-wire connection out of Baghdad — an audio connection — provided most Americans with initial coverage of the conflict.

As the war went on, radio continued to provide its audience with important access to events unfolding in the Middle East. Some stations had given over their broadcast day to around-the-clock coverage; most still provide regular updates on conditions in the Gulf.

The broadcasters who most quickly responded to the hostilities are now reaping the benefits of their timely coverage with improved ratings, higher status, and the respect and gratitude of their communities. They have solidified their places as leaders within the industry.

Stand Ready

These broadcasters all have one thing in common: They had the tools in place to do their jobs properly before the crisis was upon them. They had foresight to know that without the right equipment there could be no coverage, and without coverage a vital link with their listeners would be lost.

That kind of thinking not only is appropriate for reporting on the war-torn Middle East, but here on the home front as well. Every day, hundreds of crises and emergencies break out in the United States, in areas of every market size.

People affected by these emergencies still look to radio as their best source of news and official information. And that's a responsibility radio broadcasters should be proud to bear.

The equipment available to the industry today allows stations to provide such crisis information faster than ever before. But you can't use the equipment if you don't have it. Without the proper tools, the mad scramble to bring news to listeners is made madder still — or worse yet, just can't happen at all.

Broadcasters stand to lose a great deal by guarding their budgets instead of investing in their futures and the welfare of their listeners. Every important purchase that's put off — whether it's EBS, RF or remote gear — is another chance that a station will be caught unprepared at a critical moment.

Can anyone really afford to take that kind of chance?

—RW

itled "FAA Flexes Its Muscles Over EMI" and concerning the proposed changes to the Federal Aviation Regulations, Part 77; Objects Affecting Navigable Airspace, does not tell the entire story regarding the effects of EMI.

The author of this article acknowledged the "... harmful interference could conceivably screw-up a plane's (or an airport's) system just long enough to cause an EMI hazard in the vicinity of airport landing systems." The author also believes the FAA is effectively deciding how the spectrum should be utilized, and is encroaching on the FCC's primary function of spectrum allocation.

AOPA believes that the effects of EMI on aviation navigation and communication frequencies have the potential to affect aviation safety in areas of EMI and, therefore, must be addressed by the FAA. Clearly, the FCC has not recognized that aviation safety is adversely affected because of nearby high-power broadcast emissions as opposed to the very low power of aviation navigation and communications emissions.

The author is correct in his statement that harmful interference will "screw-up" the avionics systems and cause interference to an Instrument Landing System (ILS) during the most critical phase of a flight, namely during a landing. The

FAA has engineered the present system to be interference free. They have reduced the transmitted power of NAV-AIDS to more effectively utilize the spectrum by allowing more NAV-AIDS to share a limited number of channels. In fact, a typical ILS transmits at 20 W.

Think about an aircraft trying to receive a 20 W signal on 108.3 MHz while flying in close proximity to an FM station broadcasting 100,000 W on 107.9 MHz. Keep in mind that the usual interference indication to an ILS receiver is one of being on-course for a landing, no matter where the aircraft is in relation to the runway.

Scary? Sure it is. But this is the situation that can happen and has in situations where a station has increased power from 3 kW to 50 or 100 kW with no FAA notification necessary. This is the situation the FAA is trying to avoid with the proposed rule changes.

In our view, the author of this article has missed the point. While he recognizes that EMI can "screw-up" an aviation radio frequency, thus "screwing-up" aviation operations and safety, he prefers to ignore this life-threatening phenomena.

Clearly, this article does not tell the whole story and it should.

Phil Boyer, President
AOPA
Frederick, Md.

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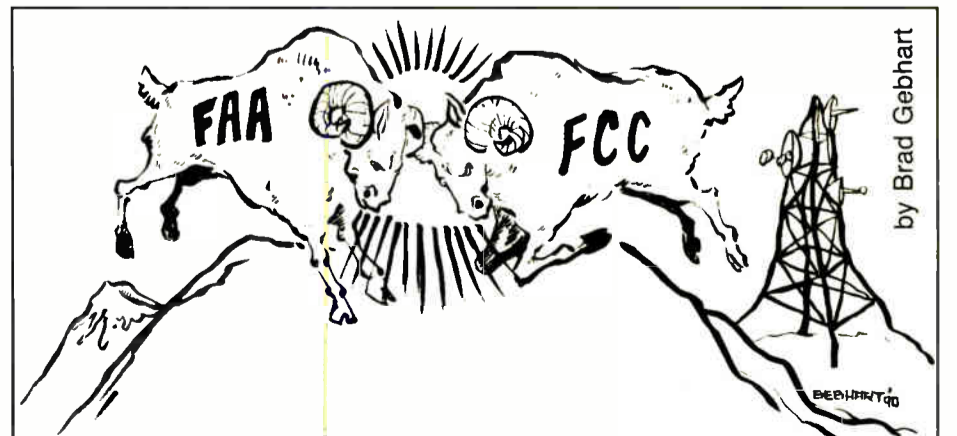
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World Radio History

AM Comments Reflect Concern

by John Gatski

WASHINGTON A number of broadcasters and consultants have expressed strong disagreement with portions of the FCC's proposed AM improvement package, according to recent comments filed at the Commission.

Such comments were filed during a 30-day extension period for the FCC's AM improvement proposal, Docket MM 87-267. The comment period was scheduled to end Dec. 17, but was extended an additional 30 days because of the magnitude of the proposal.

While the NAB has been supportive of most of the FCC interference reduction proposals contained in Docket 87-267, several engineering consultants said there are problems with the suggested remedies.

Docket 87-267 proposals include filling the newly created expanded band (1605 kHz-1705 kHz) with worst case interfering stations, increasing the ad-

jacent channel protection ratio from 0 dB to 16 dB, possible elimination of FM simulcasting of AM, mandatory 10

wrong problem with its proposed rules," according to engineering firm du Treil, Lundin & Rackley. "Stations

approach to interference reduction, stating the "Commission should reject the line of argument that calls simply for more power rather than new standards designed to reduce interference."

In other comments, Radio Elizabeth Inc. said AM expanded band preference should be given to daytimers that have problems with receiver intermodulation interference and are located in the .5 mV/m-50 percent contour of a Class A AM. Qualifying stations should also be licensed to serve a community of at least 100,000 that has no other full-time service.

The latest comments emphasized that the Commission proposals are attacking the problem from the wrong angle.

percent interference reduction when making major changes, and new interference profile calculations including the 1.0 mV/m nighttime limit.

Much of the latest comments emphasized that the Commission proposals are attacking the problem from the wrong angle—mainly in trying to eliminate interference through adjustments of protection ratios.

"The Commission is going after the

need more power to provide more service before they need less interference."

The firm criticized the 16 dB first adjacent interference ratio proposal as a remedy based on an "unscientific study." It "cannot be used as an allocation standard," the company maintained.

If the 0 dB ratio needs to be increased, a 6 dB ratio in conjunction with a 2 mV/m protected contour would be appropriate, du Treil, Lundin & Rackley added.

Greater Media, Inc.'s filing also suggested that the FCC is taking the wrong approach.

"First, man-made electrical noise, not co-channel or adjacent channel interference, is the single most critical limiting factor in the ability of today's AM stations to serve their audience with low noise 'FM quality' signals," Greater Media said.

Tighter interference standards will not address problems stemming from AM stations' inability to service their broadcast areas due to population growth, the group said.

AM would be better served if the adjacent channel ratio was left at 0 dB or increased to a moderate 6 dB and the 5 kW power cap on Class III stations was removed, Greater Media said.

The Clear Channel Broadcasting Service agreed with the FCC's overall

NAB Backs AM Mark

by Judith Gross

NAPLES, Fla. In light of the stalled attempt to establish a certification mark for high quality AM receivers, the NAB Radio Board has approved giving the Electronic Industries Association (EIA) a 30-day ultimatum.

The action came at the Board's winter meeting here in late January, tucked in between massive activity on DAB.

The Board resolution stated that the NAB's AM Receiver Task Force should "offer to finalize" an agreement with the EIA for a "dual-service mark—one for AM monaural radios and one for AM stereo radios."

But if no agreement between NAB and EIA is reached within 30 days of the NAB's official notification, the Board said that NAB should move ahead to implement its own certification mark for AM radios.

The certification mark idea surfaced after the NRSC standard for AM was adopted in the hopes of educating consumers that better fidelity AM radios exist.

The fight to interest receiver manufacturers in the idea has been a tough one for NAB. Only four manufacturers showed up at the first meeting to discuss the idea more than two years ago.

Since that time, NAB formed its Receiver Task Force and talks have proceeded more smoothly. Last year, the talks were helped along by the prospect of congressional action.

The Radio Improvements Act, which died when the previous congressional term ended, would have forced receiver manufacturers to include AM stereo on receivers with FM stereo.

Manufacturers kept talks on the certification mark going to head off NAB support and lobbying for such legislation.

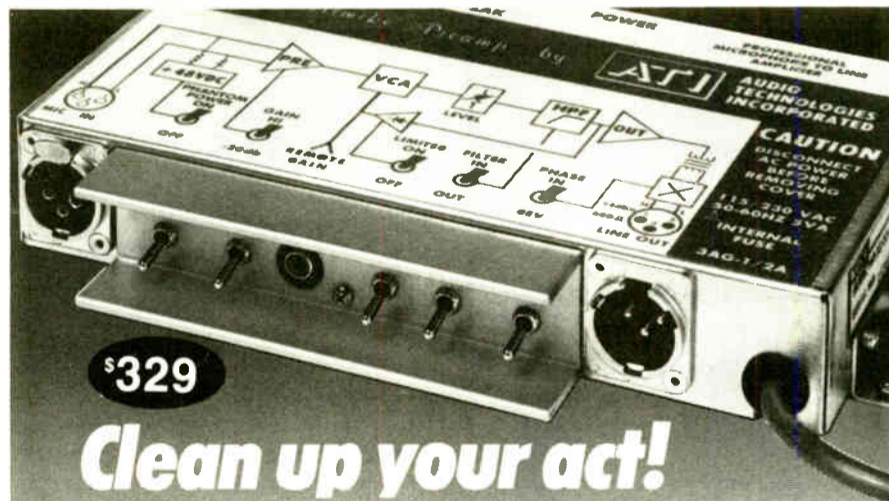
But discussions have gotten bogged down in such issues as whether or not to include stereo, and how wide a bandwidth would earn receivers the mark.

The task force now recommends the dual mark to cover both stereo and mono AM receivers and suggests the mark include noise blanking, the NRSC standard and variable bandwidth tuning.

NAB Senior VP of Science & Technology Michael Rau said the official notification to EIA will be sent out the third week in February.

If, after 30 days, no progress is made, NAB will establish its own certification mark and attempt to enlist receiver manufacturer support, he said.

He noted that the mark should be attractive to receiver manufacturers even if NAB undertakes it without EIA because stations have pledged to provide free on-air promotion to products with the mark.



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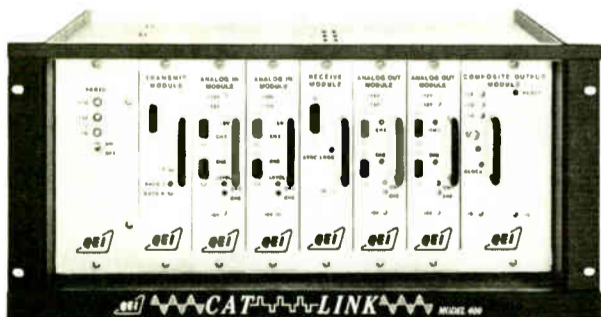
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Ad Sales Reflect LA Radio Market Growth

by Frank Beacham

LOS ANGELES Jammed onto an endless jungle of freeways, Southern California's nine million cars were sweet images to area broadcasters in 1990, as the nation's number one radio market continued to see explosive growth.

Los Angeles radio advertising revenues for 1990 jumped nine percent over those of the preceding year to set an all-time record of \$411 million in measured billings, the Southern California Broadcasters Association (SCBA) reported. Estimated billings from non-reporting stations boost the sales total to \$454 million.

"This marks the tenth consecutive year that these consolidated figures from 29 radio stations have set a new record," SCBA President Gordon Mason said.

Local revenues increased by eight percent and national by ten percent, in comparison to radio's national average increases of five and seven percent, the SCBA said. The Los Angeles increase was two percentage points over the national average of seven percent.

An additional 34 stations did not report figures and the SCBA estimated their combined 1990 billings to be approximately \$43 million. The \$454 million figure was achieved by combining the reported and unreported totals.

The SCBA also announced that a continuing study found more than forty advertisers spent a million dollars or more each on L.A. radio last year, with auto, financial services, beverages, supermarket chains and television audience promotion leading the way. Other major categories of advertisers contributing to the record year were department and discount stores, food products and restaurants.

L.A. traffic drives the seemingly endless radio market. Nine million radio-equipped autos roam the city's 650 miles of freeways and 22,000 miles of surface streets. Traffic is so heavy that 7.2 million Southern California commuters are delayed an average of 1.1 hours each day due to congestion on the roadways.

Avionics Specs Proposed

(continued from page 1)

is place the cost of these inferior receiver designs on the backs of broadcasters," Furr said.

Despite repeated phone calls from RW, FAA officials could not be reached for comment on the Furr petition.

Improved radios needed

Furr argued that an easier way to protect avionics equipment is to equip aircraft with improved amplifier components and filter devices that eliminate commercial frequency interference without harming directional signals.

"In solid state devices, there are always non-linearities that draw signals from three existing frequencies to create a fourth frequency, which can fall anywhere," he said. "On a cheap receiver, that frequency often comes out on an aviation band. And if it shows up a glide slope frequency, it will tell a pilot he is on course when he's not."

"I can't fault the FAA for being worried about safety," Furr added. "But if I was a pilot, I'd be more concerned about having a sub-standard receiver."

Furr maintained it would be easier to upgrade avionics equipment than it is to subject broadcasters to additional application and regulatory procedures.

Also, the FCC's cost in ensuring compliance with the new FAA rules, as opposed to requiring better aviation radios, would be enormous, he added.

"Every major airport has mixes of frequency, according to the FAA, but we have not had any major crashes due to false information," Furr said. "That tells me that most air services are already using higher-quality avionics equipment. So establishing new standards will not have a great impact on the (aviation) industry."

The Furr petition also claimed that establishing avionics standards would afford greater protection to aircraft operating near Canada and Mexico, countries that would have the same broadcast regulations as the U.S.

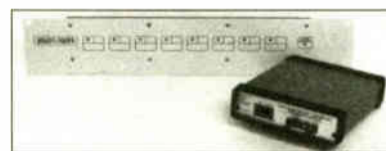
The International Civil Aeronautics Organization, a worldwide aviation advisory body, has suggested establishing international standards for avionics equipment by 1993.

In a related matter, it appears that a letter to Transportation Secretary Samuel Skinner from FCC Chairman Al Sikes has led to a meeting of FCC and FAA attorneys.

FCC Mass Media Assistant Chief Bill Hassinger said the first of what could lead to a series of meetings over the proposed FAA regulations took place in early February.

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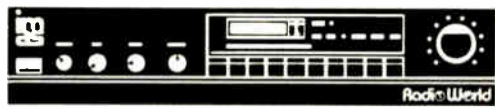
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CUE and REVIEW



A Return to Tail Fins?

by John Gatski

FALLS CHURCH, Va. Now that it appears the U.S. is on the road to adopting some type of digital radio system that eventually will replace AM and FM, what about receivers?

We haven't heard a lot about them. What ingenious electronic delights are these companies planning for these future radios that will take airborne digital bits and convert them to our favorite music? Will they have tone controls, local/distant switches, noise filters, mono buttons... perhaps coffee making capability?

Publicly, we haven't heard much from receiver companies about what kind of features the consumer can expect on DAB receivers. Based on conversations with manufacturers' representatives, most consumer electronics companies already have done the engineering research and development for the receiver section. Some even have worked in conjunction with DAB transmission system proponents.

Companies are confident that whatever type of system is adopted they can respond quickly—probably within a year—to produce DAB radios.

In no hurry

Although the companies are in no hurry to produce DAB radios until a transmission system standard is adopted, one company official noted that manufacturers are "licking their chops" at the prospect of selling millions of replacements for analog radios.

But several company officials noted in private conversations that a number of production engineering concerns must be confronted in designing DAB radios that are affordable and user friendly for the masses.

First, radio stations will likely continue to simulcast their AM and/or FM signals for some time as well as the DAB signal, which means car receivers should have circuitry for all three bands. This presents an engineering challenge for companies to incorporate analog and digital into a unit at reasonable price—unless they want to try and sell the public on two receivers. Not likely.

Car listeners are used to the efficient AM/FM and tape combos that fit neatly in-dash. In the last couple of years, CD player/radio receiver designs have followed suit. Design engineers will have to keep this in mind. People are not likely to go for a bulky underdash AM/FM/digital unit—or worse, two separate receivers.

Speaking of the automobile environment, what about antennas? Americans are not keen on those obtrusive metal rods protruding from their front or rear fenders as it is. You may notice that many cars have motorized antennas that telescope into the fenders for security and cosmetic purposes.

For DAB, engineers may design one antenna for analog and digital reception, or we might end up with one for each band.

If two antennas are required, one possible solution is a throwback to the 1970s.

Remember when T-shaped, wire antennas were placed in car windshields? For DAB receivers, that design again could be used for AM/FM reception and a separate antenna would be used for digital broadcasts.

I have my own idea, but it probably won't be taken very seriously. How about designing cars with tail fins again and placing two whip antennas on the ends? Looked good back then, and the reception was pretty good.

New features

A DAB receiver also is likely to have some new features, beyond those you are used to seeing in current AM/FM designs.

The Radio Data System (RDS) may be an option that could become useful for automatically switching a radio from a station's analog to digital signal or from satellite or terrestrial digital signal. As with RDS-equipped receivers in Europe, it also could be used for traffic alerts, flashing station call letters and automatic format switching when traveling.

Another feature that could end up being mandated in DAB receivers is some sort of anti-tape copying circuitry, courtesy of copyright groups who demand royalty compensation for music that they insist can be "perfectly" copied from a digital broadcast.

Like DAT, the receivers may end up with a Serial Copy Management System (SCMS) or similar type chip that would inhibit or limit recording of such broadcasts.

In fact, one receiver manufacturer said the copyright question is one of the major unknowns in designing a DAB receiver, because the issue is far from settled.

Mixing chickens and eggs

Another factor that could affect DAB receivers' availability and price is one that many broadcast engineers may equate with AM stereo—the chicken or the egg theory. Which should come first, DAB receivers or DAB broadcasters?

As with AM stereo, manufacturers could wait and see how many broad-

casters decide to broadcast digital before they begin producing radios. But, if you recall, that didn't work. AM stereo's market penetration was further hindered by stations that felt they should not start broadcasting stereo until enough receivers were out there.

Of course, other factors also held back AM stereo, including lack of a standard, but you can bet that manufacturers will pay close attention to how many stations decide to transmit DAB in making their marketing decisions.

Because it is so early in the game, I guess we just have to wait and see how the DAB story plays out before we know what kind and how many receivers will be available. But I do have one more question: Since analog radios have digital clocks, can we expect analog clocks in digital radios?

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NRB Conclave Keeps the Faith

by Charles Taylor

WASHINGTON A host of familiar faces were seen at the 1991 National Religious Broadcasters (NRB) Convention & Exposition, including President George Bush, retired U.S. Supreme Court Chief Justice Warren Burger, televangelist Jerry Falwell and numerous

registered attendees and 3,500 members of the general public—from all 50 states and at least 30 foreign countries, according to NRB.

More than 200 vendors pushed everything from equipment to religious programming, "Let's Do Heaven" T-shirts and other "faith" paraphernalia.

Some 60 equipment vendors displayed their existing lines and some new equipment. Broadcast Electronics previewed its new Air Trak 90 series linear broadcast console. The system, available in six, 12, 18 and 24-channel configurations, will make its official debut at NAB in April.

Other companies exhibiting at NRB included Burk Technology, Comrex, Continental Electronics, Fidelipac, Gentner, Harris-Allied, Inovonics, Jampro, QEI, Radio Systems, Shively Labs, and Wegener.

In a prepared statement, NRB Executive Director E. Brandt Gustavson said, "People are telling us, writing us, that NRB '91 was one of the most helpful, spiritually beneficial conventions we've ever had. From the work-

shops to the media exposition, the convention was designed to equip, encourage, and inform the broadcasters."

Several vendors said floor traffic was good and they were able to establish some sales leads. One company salesman, however, said religious broadcasters do not always send engineers to NRB and the attending GMs or

programmers are not as technically aware as at other shows.

In his fifth appearance before the NRB, President Bush appropriately addressed the situation America faces in the Persian Gulf and its relationship to religious worship.

The 1992 NRB will again be held at the Sheraton Washington, Jan. 25 to Jan. 29. After nearly 25 years in D.C., the 1993 NRB show will be moved for one year to Los Angeles.

For more information, contact NRB at 201-428-5400.



Broadcast Electronics' Bill Harland talks with potential customers at this year's NRB.

broadcast equipment vendors.

Held at the Sheraton Washington Hotel, total attendance at the 1991 conference was 7,255, down slightly from the 1990 show. The numbers included 3,755

In-Band DAB Pushed

(continued from page 1)

technology developed by SRI; that it's a single channel system which includes high speed digital subcarriers; that it eliminates multipath and that no FCC license would be required.

MUSICAM is the encoding algorithm used in the project and Donahue and Masiello said that the technology is being investigated for AM stations as well as FM, although more study needs to be done to see how AMs might be accommodated.

Donahue said stations can use existing transmitters and antennas to implement Project Acorn and that the cost of implementation is around \$20,000.

He also said that SRI has had a long history of working with receiver manufacturers and that DAB receivers could be on the market quickly.

The rush to unveil a new, in-band DAB system that is still in development was prompted,

in part, by the NAB's recent endorsement of the Eureka technology, which Masiello and Donahue claimed "could cause economic upheavals."

The criticisms are directed not at Eureka 147, but at its implementation at the 1500 MHz L band being eyed as new DAB spectrum.

Eureka weaknesses

"At 1500 MHz, the signal can't get into buildings, and an extensive network of gap fillers would be needed," Masiello explained.

In addition, power requirements at that frequency could be as much as 500 times higher than current analog broadcasting, according to the Gannett presentation.

There is also concern that Eureka allocation schemes, in order to be spectrum efficient, might give AM stations parity with FMs or increase the number

of station licenses overall.

One additional concern is obtaining the necessary spectrum, which could be a lengthy process and might even prompt the FCC to initiate spectrum auctions or use fees.

Donahue and Masiello also criticized Eureka for not being a U.S. technology, although U.S. patents were originally part of the MUSICAM technology.

NAB still going with Eureka

NAB is still pursuing a licensing agreement with Eureka 147, despite the possibility of new systems emerging. "It's the only system with hardware already

developed that has been proven to work," according to NAB Senior VP of Science & Technology Michael Rau, who was also on the SBE panel.

He said NAB received a presentation on the Acorn system before the Radio

Board endorsed Eureka at its annual meeting in January, but at the time the system excluded AM stations.


Masiello and others present at the meeting said that an independent standards group to evaluate all DAB systems would be helpful in setting a technical standard.



"The industry should hold developers' feet to the fire on their claims for DAB systems," Masiello said.


Project Acorn's timetable calls for Gannett to have prototype demonstration equipment available in April at the NAB convention in Las Vegas and a mobile demonstration is planned for September at the Radio 1991 show in San Francisco. Experimental systems are scheduled for on-air tests in 1992-93 with system implementation in 1994-95.

Masiello told the SBE-AES gathering that it isn't just smoke and mirrors. "We absolutely have a DAB system," he said.

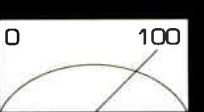
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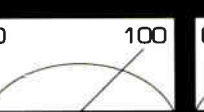





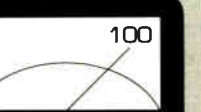
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Circle 117 On Reader Service Card

World Radio History

LA FM Brings Home the War

by Frank Beacham

Santa Monica, Calif. At a dinner party a few days after the start of the Persian Gulf war, a successful Hollywood screenwriter blurted out that Ruth Hirschman was driving him crazy.

Like so many area listeners who had turned into war news junkies overnight, this man had become addicted to war coverage on his car radio. He had locked onto KCRW, the high energy Santa Monica public radio station run by the controversial human dynamo Hirschman.

"This woman has probably turned that little station into the best in America

right now. But she gets me so upset I want to turn the station off. But I can't because I'm hooked on every word," the screenwriter told the dinner guests.

The abrasive, aggressive manager/programmer/fund raiser/on-air star of KCRW has used a blend of high technology and compelling war programming, known as "War Watch," to galvanize a huge radio audience interested in every nuance of news from the Middle East.

From a 24-hour-day monitoring post in the station's basement studio at Santa Monica College, Hirschman and a group of volunteers listen to satellite audio feeds from National Public Radio, CNN

and the BBC to see who is on top of war news at any given moment.

Network and local news sources are monitored on a Bang and Olufsen Video System 500, which displays 12 programs on a screen at one time. Whoever is ahead at any given moment goes on the air at KCRW.

War coverage, KCRW-style

But that's just the beginning. A Who's Who of foreign policy analysts, military experts, politicians, and national journalists are interviewed daily by telephone as Hirschman milks them for information and opinions. In some cases,

the expert who appeared mid-day on KCRW appeared later that night on ABC's "Nightline" or another network television news program.

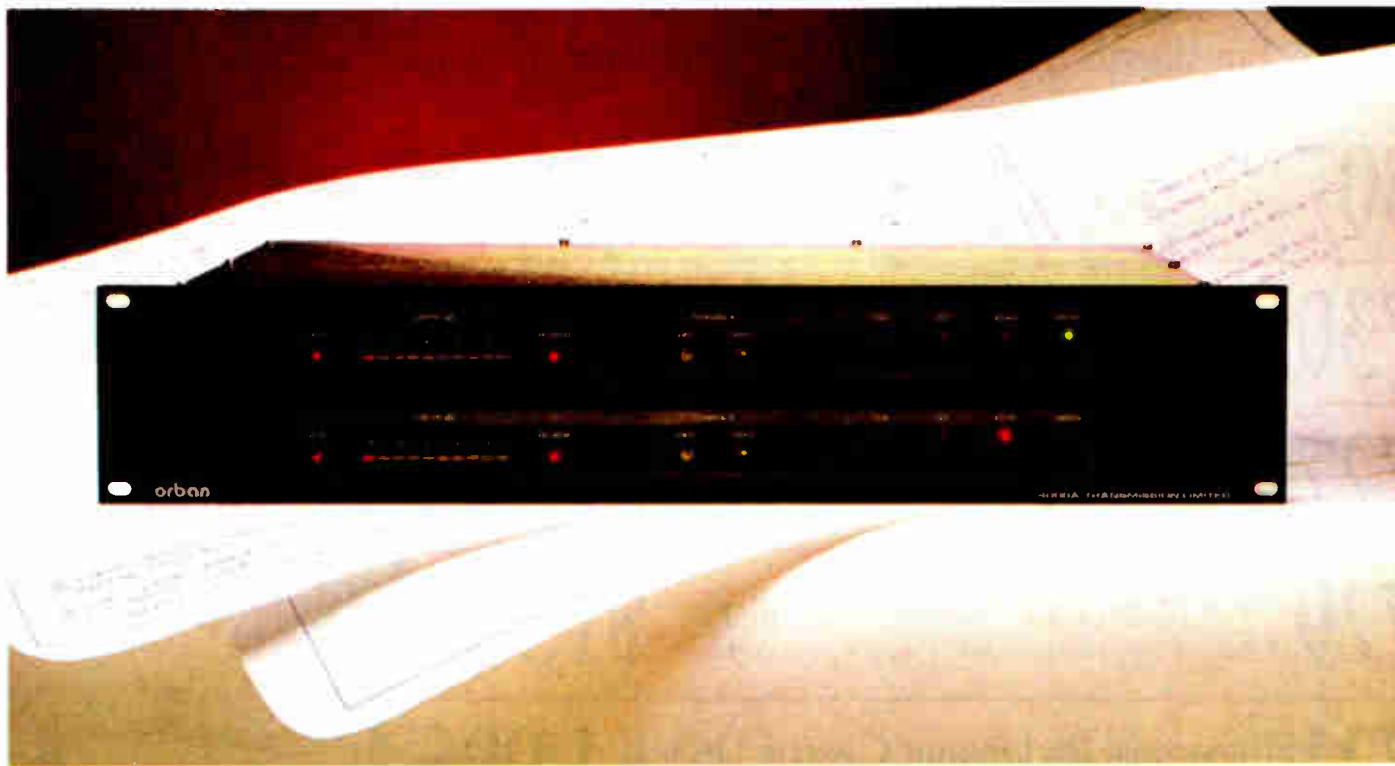
And then there are the listeners themselves. Hirschman presides with an iron hand over periodic "speak out" segments when listeners for and against the war have their way.

"One of the reasons people are so galvanized is the technology is totally new in this war," Hirschman said. "The technology we are using to fight the war and the technology we are using to report it. All the old rules don't hold."

Born out of necessity

KCRW's "War Watch" programming was not exactly planned, Hirschman said.

"We had been doing this story since August 12, not January 16. We started by dealing with background, analysis and opinion," she said. "We did not understand that if we went to war we would preempt regular programming. We did not make



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KCRW's GM, Ruth Hirschman, sits in the station's interview studio.

that decision until the war happened."

KCRW began with 24-hour-a-day war coverage and then settled in at 15 hours a day as the war progressed. The 12-member staff and dozens of volunteers were mobilized for the production.

"Today's technology makes this effort feasible, even for a small public station like KCRW," Hirschman told her listeners. "Our cutting edge lay in the fact that we had been working on this story for five months.

A smooth-running system

"At any given time, there are about four staff members listening, looking and pulling wire copy," Hirschman continued. "By now the rhythm between us is finely tuned. I'm watching one channel, someone else is listening to a (BBC) World Service report, a third person is running in AP wire copy, a fourth is jumping from one TV channel to another. Our board operator sits like a Buddha in the center of all this and controls what goes out on the air."

To finance the effort, Hirschman has called upon KCRW's listeners to contribute to a war coverage fund. Ten percent of the money raised will be donated to National Public Radio (NPR) to help finance its war coverage.

KCRW is a 6,900 W Class B station with a tower in the Hollywood hills and a string of translators over Southern California. It reaches a potential of 11 million listeners, which may result in the station contributing as much as \$100,000 to the NPR war fund.

KCRW's war coverage has brought the station national attention.

Hirschman told KCRW listeners during one recent broadcast, "We are here in the basement, with the world literally at our fingertips. You, somewhere out there listening in your home, in your car, in your office, to the heart-stopping moments that we share together."

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How Radio Is Covering the Gulf

by John Gatski

WASHINGTON When the Persian Gulf War between the Allied forces and Iraq started Jan. 16, most of America got its initial news from radio coverage as they were driving home from work.

Radio has continued providing as much news as possible since the initial days of the war as networks and local stations have adapted to demands of increased coverage.

All three of the major networks, CNN, NPR and the news services have put more resources into war coverage, despite a general belt tightening that has hit the newsrooms in recent years.

CNN has garnered praise for its TV and radio coverage because of its ability to provide exclusive live audio coverage from Baghdad during the first day.

The other networks were not as fortunate because CNN had arranged with the Iraqi government to allow it to use a private four-wire phone line. The line did not go through an Iraqi switching station that eventually was knocked out by the Allied bombing runs.

Four-wire advantage

CNN Radio Network, like its TV service, was able to take advantage of the exclusive audio from the four-wire.

"We often go with a four-wire when we know we'll be in a location where the telephone system is less than 100 percent reliable," said CNN Newsbeam Managing Director Charles Hoff. "And the Iraqi phone system is certainly not AT&T. We knew that even without the bombing, it was not entirely dependable."

"The four-wire was incredibly cheap, safe insurance and it paid off big,"

he added.

CNN Radio Service News Director Lynn King said the exclusive broadcast from Baghdad was "incredible radio."

CNN was able to keep the four-wire link alive until the next day when Iraqi officials ordered it shut down. The link was reactivated twice in the following two days, but only material approved by Iraqi censors was allowed to be transmitted.

At press time, CNN audio from Bagh-

Although the other networks did not get a private phone line out of Baghdad, they had long planned their war coverage and provided their reports from Saudi Arabia and other Middle East countries via satellite uplinks.

Westwood One has provided coverage for both NBC and Mutual Broadcasting Service, according to Westwood One News VP Bart Tessler.

The group was fortunate to have been selected for radio pool coverage of the

cording to Leslie Halpern an ABC spokeswoman.

Five correspondents are covering the war for ABC and the network broadcasts six update "status" reports each hour.

Technical concerns

CBS has uplinked its coverage back to New York via an audio subcarrier on its television satellite link. The network also has the capacity to link Persian Gulf coverage to its NewStar newsroom com-

GIs Radio Home

ROCHESTER, N.Y. U.S. Armed Forces personnel stationed in the the Middle East are getting messages home to their families courtesy of civilian volunteer MARS operators and radio equipment loaned by Harris Corporation.

Harris RF Communications Group in Rochester is the home of a new communications link that allows Desert Storm personnel to send messages free of charge via the Military Affiliate Radio System (MARS). According to Harris Corporation, several thousand personal "MARS-grams" were delivered through the Rochester link during the holiday season.

On loan to the Army from Harris are state-of-the-art antennas, transmitters and receivers for the MARS link. Similar equipment in Rochester is used to receive messages from Saudi Arabia.

Soldiers deliver written messages to MARS operators, who type the messages into computers linked to the radio



gear. The messages are compressed and transmitted via direct radio channels to the Rochester or other designated MARS operation center.

In the photo above, licensed Navy MARS operator Steve Sykes (left) and Army MARS operator Jim Lill man the MARS gateway station at Rochester.

dad was getting out on INMARSAT satellite; audio/video was on INTELSAT.

New stations

Currently, the CNN Radio Service gives Persian Gulf War updates three times an hour and can switch to continuous coverage if necessary, King said.

war January through March, Tessler said, which meant it supplied information to the others during that period. Pool coverage was provided on ABC's satellite space, using an audio subcarrier.

Via satellite

Tessler said Mutual and NBC have been using feeds from three Middle East correspondents and continue to provide four hourly updates on the conflict. Initial on-air coverage was continuous for 48 hours, he added.

AP Network News Station Services Director Evelyn Cassidy said AP broadcasted 29 hours straight when the war began. The network continues to update the war with top-of-the-hour and bottom-of-the-hour updates and four-times-an-hour updates during drive time.

AP Network News also is the top-of-the-hour news broadcast to the servicemen and women on the Armed Forces Radio Network, Cassidy said.

Capital Cities/ABC actually broke the story that Baghdad was under attack during an update Jan. 16, and the network's coverage has remained strong, ac-

puter system, also in New York.

CBS has three full-time correspondents in the Persian Gulf as well as several stringers, according to the network news division.

NPR has seven correspondents in the Gulf.

According to the networks, most of the correspondents are their own technicians and worked numerous hours during the first few weeks of the war.

AP's Halpern said sand has played havoc with the network's equipment—especially the tape recorders. Other network officials have reported similar problems.

Besides the regular war coverage, most of the networks have provided direct "custom" calls from correspondents to affiliates, which allows stations more direct contact. However, the demand for these calls means that it might take awhile for stations to get their turn.

Some U.S. local stations have their own correspondents and satellite link from the Persian Gulf, but most believe the networks have the resources to do the better job, several station news directors said.

Canada's War Effort

by James Careless

HALIFAX, Nova Scotia When three Canadian warships sailed for the Persian Gulf a few months ago, the crews left everything behind at their base here.

Everything, that is, except their local radio stations.

Although they are now based at Bahrain, Canadian soldiers still wake up to local Halifax-Dartmouth radio. That's because stations like C100-FM, CFDR, and CHNS are supplying the troops with program dubs, which are played on the ships' PA systems.

This "radio airlift" is intended to help the troops stay in touch with their home lives, CHNS Program Director Morrissey Dunn said. "They were getting some mail and what not from a variety of sources, but they did not have any direct element that made them feel they were closer to home. So we started to record our morning shows in their entirety, and sent the tapes over on a daily basis . . . so (now) they get their news and they get their weather conditions from back home."

This is not all that CHNS has done for the troops. At Christmas, it sent its morning team of "Cranston and the General" to Bahrain for a week-long morale booster. It was "like a Bob Hope show," said Dunn.

The team also relayed the show to Halifax live from the Gulf, which allowed the sailors to talk to their families by telephone over the airwaves.

As well, an electronics merchant donated 1,000 Sony Walkmans, which were packed with other goodies into Christmas stockings. Each stocking was individually labeled, because each machine contained a personalized message cassette from the recipient's family and friends.

"Needless to say," Dunn said, "when the soldier came up and got his stocking, the first thing he did was put on the Sony Walkman. And you can just imagine what happened after that . . . (the troops) say that was absolutely the most emotional moment they have ever experienced."

Although it is one of the most active, CHNS is not the only local station taking an interest in the Gulf. For example, C100-FM has sent its own correspondent to Bahrain—something that is not usually done by this country's radio industry. Many Halifax stations also have banded together in a "Tie a Yellow Ribbon" campaign.

In short, Nova Scotia stations are not merely talking about the troops in the Gulf. They are doing something to help them and their families at home.

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Circle 29 On Reader Service Card

Plan for Equipment Deliveries

by Barry Mishkind

TUCSON, Ariz. Well, it's finally happened. Your budgetary requests have been approved by the big guy.

Excitement builds in anticipation of the new gear. Actually getting on the phone and ordering it—why, it's like being in a toy store.

And then, it seems everything starts downhill, sometimes almost to the point

that you wish you'd never gotten started with the whole project.

A poor start

In many cases, something somewhere in the planning process broke down, resulting in frustrating delays or missing equipment. Yet, even proper planning can't always prepare one for the myriad of things that can go wrong from conception to completion of a project.

Radio people are basically an impatient bunch, possibly from the constant tension of being "tight and right" on the air. And with the need to get everything done between books, stations sometimes forget necessary lead times in ordering equipment.

For example, one of the most horrifying moments of my career came when a new 25 kW transmitter I'd requested was finally approved for purchase.

Called to the GM's office, I was pretty happy until I began listening to the end of the speakerphone conversation in progress with the manufacturer. The GM had apparently decided to enter the toy store himself.

"So then," he said, "we'll expect the transmitter in a week or so. That will be plenty of time to get it on *before the book*. We'll let you know how things go when we plug it in."

Do I have to tell you that my heart just slid into my boots? Plug it in? I even heard the gasp over the phone from the salesman.

As soon as the conversation was ended, it fell to me to explain to the GM a few facts, such as the need to provide adequate electrical service, exhaust ducting and air conditioning for the new transmitter, transmission lines, coax switches, dummy load, etc.

Then there was the matter of getting the transmitter into a building where the previous transmitter had been installed only after cutting a hole through the wall.

At least I got through. The GM sighed, "Well, how long will it take to get it on? We need it for the spring book."

The grind began.

Plan before it arrives

Considering whether it might not be wiser to resign right then, I began the process of scheduling the installation of the transmitter.

ECLECTIC ENGINEER

Fortunately (?) for me, the transmitter wasn't coming the next week. It wouldn't even come the next month. That wasn't due to any failure on the manufacturer's part. No, it takes time to build and test a transmitter.

So, it now was time to quickly do the planning that the GM had forgotten actually, never even thought about—before placing the order. (At least he hadn't tried to press the manufacturer with the old "it's an emergency, we need it now" ploy).

While the lead time was reduced, I was fortunate to find contractors able to fit the schedule. Unfortunately, the GM continued to create havoc by trying to make "deals," like the cheap eight-ton air unit he traded out. More on that later.

The peripheral RF gear was mostly in stock from the usual suppliers, within the seven- to 10-week time frame I knew the project would take.

By the way, it might be worthwhile to reflect on the term "in stock." Few companies today stock equipment or parts as deeply as in past years. It's not unusual to take 12 weeks to get something in stock.

And if you're waiting on imported equipment or parts, "We're waiting on a shipment" takes on a whole new meaning. Those ships just don't get from the Far East to the U.S. overnight.

Making the checklist

Still, most important is being sure that *everything* you will need has been thought out and scheduled properly. This is best not done in isolation.

That's because the building trades have different needs and scheduling. Getting them in the proper order prevents wasted work or, worse, delays when one crew has to stop

(continued on page 18)

Who's Setting The Pace For FM Transmitter Technology?

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

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Circle 70 On Reader Service Card

World Radio History

Serial-Capable DAT Moves In

by Mel Lambert

Part I of II

STUDIO CITY, Calif. While preparing a recent marketing report for a leading hardware manufacturer, I reviewed the fundamental ways in which radio stations differ from other users of recording and replay equipment.

Unlike conventional recording studios and post-production facilities, AM and FM broadcasters need to initiate the replay of sound sources in a virtually ever-changing sequence. In essence, flexible radio programming relies upon this ability to accurately trigger the real-time or automated playback of any one of literally thousands of music cuts, commercials, jingles, station IDs, news cuts, PSAs, etc.

All of which explains why an increasing number of broadcasters are carefully evaluating the potential of hard disk-based, random-access systems for both local programming as well as augmenting an existing satellite delivery service.

Limitless potential

There can be no denying that the virtually limitless potential of flexible programming, and instant-start playback offered by disk-based systems has a great deal to say for itself. But the often limited storage capacity of hard disk systems, and the time taken to inload new material—plus their relatively high cost and complexity per installation—may leave some broadcasters searching for an alternative solution.

In terms of cost per megabyte of storage, reliability and other practical considerations, the newer generation of DAT machines now present a viable alternative to both analog (reel-to-reel or NAB cart) and hard-disk systems.

In particular, for automating music playback of longer cuts in the air studio, and a variety of tasks around the production room, an array of remote-controlled DAT transports can provide a degree of cost-effective digital record and playback flexibility unrivaled by other storage media.

Five DAT applications

There are a five types of routine applications for which programmable DAT machines are most appropriate. First is automated random-access to DAT libraries of music, commercials, jingles, station IDs, PSAs, etc. These customarily include up to 120 minutes of stereo digital material stored on multiple machines in both automated and operator-assist facilities.

Under external computer control—either from an existing automation system or a stand-alone PC—software menus of available titles might be accessed via a small CRT, touch panel or keypad, and used to generate a customized play list. Such sequences then could be set up to replay continuously, triggered as individual events against a master clock, or initiated as short sequences from the DJ or operator's position.

The second routine application involves streamlining the programmed replay of music tracks and linking voice messages stored on libraries of DAT

tapes at the originating studios of satellite-delivery systems. This also includes replaying commercials and other audio segments, including news bulletins and so on.

Third is automated duplication of syndicated material recorded to DAT, with integrated master/slave control of several dozen machines, including monitoring of system parameters during the analog/digital transfer process.

In addition, during the delivery of syndicated material via satellite, all start/stop functions of the various DAT machines at each download/recording site can be controlled automatically, including the accurate monitoring of machine status, record levels and error rates.

DIGITAL DOMAIN

A fourth application is integrated control of routine inload to and archive from digital audio workstations, including full remote control of all DAT record/replay functions during the inputting and mastering of stereo music, voice-over, effects and related sound elements.

Finally, full remote control of record/replay functions can be had during the production of radio commercials, PSAs, jingles, etc., to allow overdubbing of voice-overs, intros and outros against libraries of music beds and effects tracks, for example, or to provide duplicate copies of a completed production.

Requirement for full remote control

Fundamental to these and other applications would be the requirement that all DAT transport and system functions should be capable of being controlled from an external computer or controller system.

Until now, most DAT machines have

featured relatively basic parallel control of primary transport modes, or wired/IR hand-held remotes that provide push-button control of a majority of functions. Both of these types of remote lack one fundamental capability: They do not provide information from the DAT machine.

Such data can be extremely useful during the automated control of multiple DAT machines in an average radio facility. The information might be used to verify that the issued command(s) had been received by the target deck, and are now being acted upon; to determine a variety of diagnostic functions, such as transport mode, off-tape replay levels and interpolated error rates; or to cause a designated transport to output the current Program Number position and Absolute Time Location.

As will be readily apparent, the inclusion of bidirectional serial ports on newer generation DAT transports opens up the opportunity for virtually limitless creativity. In addition, individual DAT machines can easily be removed or added to a networked array of serial-capable transports, either to accommodate changing programming needs, or for routine maintenance and other functions.

Several new DAT machines now are available that can satisfy these and other requirements. In fact, I might go as far as stating that, for a variety of roles around a radio station, the majority of a DAT machine's front-panel transport and system controls are redundant. (Apart, that is, from the ubiquitous Open/Close button necessary to remove a DAT tape).

The real potential of DAT as a reliable, cost-effective, fast-access record/replay medium, I would hazard to guess, can only be fully achieved within the radio environment using remote-controllable transports.

In Part two, I'll conclude my discussion of bidirectional serial control for DAT machines and provide an overview of two important interface schemes and command protocols that provide integrated control between multiple decks, controllers and editors.

■ ■ ■

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

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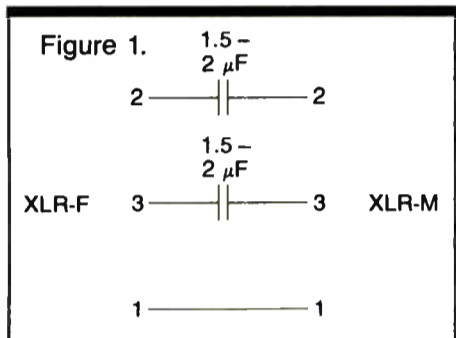
Simple Circuits Solve Mic Woes

by Bruce Bartlett and Jenny Bartlett

ELKHART, Ind. Is your audio plagued by rumble, distortion and phase cancellations? Does your mixer lack enough inputs for a big live recording job?

LINE OUT

Worry no more. With a few minutes of your time, you can solve these audio problems by building some simple circuits: a microphone highpass filter, splitter, combiner, pad, polarity reverser and pro/semi-



pro level matcher.

The circuit in Figure 1 is designed to be used in-line with a low-impedance dynamic microphone. It helps clean up the

sound by filtering out low-frequency rumble from trucks, air conditioning, etc.

The series capacitors act as a high impedance at low frequencies, attenuating the signal by 3.5 dB at 100 Hz and 15 dB at 20 Hz. If you want more low cut, reduce the value of the capacitors. Match them within one percent to maintain a balanced line.

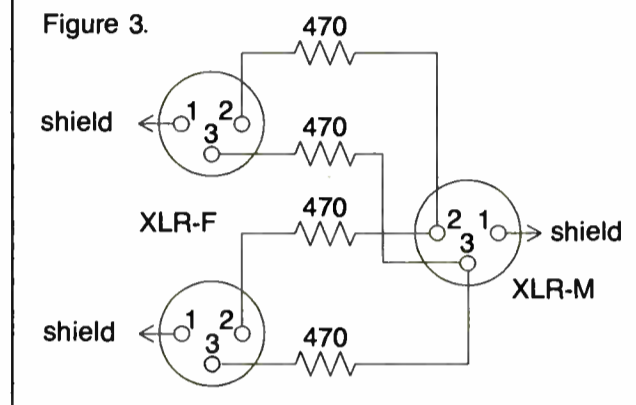
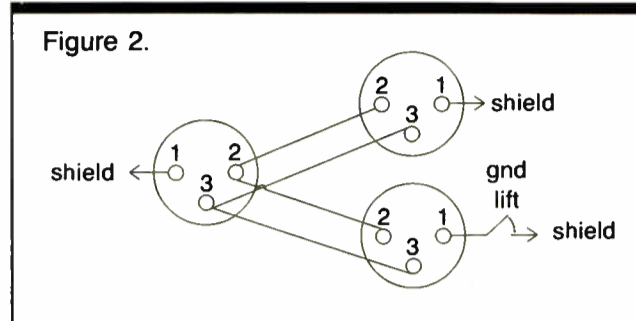
Whenever you broadcast an event that is amplified by a sound-reinforcement system, at least two mixers will be used: the house mixer and your broadcast mixer. You need a way to get microphone signals to both mixers, but it's clumsy to double the number of mics on stage.

A better solution is to split the signal of each mic two ways: to the house stage box and to your broadcast stage box. (A stage box is a chassis full of mic connectors wired to a multiconductor cable, or "snake.")

The circuit shown in Figure 2 uses one female XLR connector feeding two male XLR connectors in parallel, forming a Y-adaptor. Note the ground-lift switch in one leg of the Y. This is to prevent ground loops that can occur if the two mixers are at different ground potentials. With the ground switch lifted or open, any hum picked up on the cable shield is drained to one mixer's ground, but the grounds of the two mixers are not tied together.

A ground loop can happen when the two mixers are plugged into widely separated

AC outlets. One way to prevent this ground loop is to run a long power extension cable from the house-mixer power



feed back to your broadcast mixer. Connected to the same AC outlet, the mixers are more likely to be at the same ground potential.

If you have more microphones than inputs, the combiner shown in Figure 3 can help. You might be using several mics to pick up a choir or string section. By combining every two mics to a common input channel on your mixer, you can employ several microphones, but half the number of inputs required.

Note the resistors in the combiner. If they were omitted, each microphone would see the output impedance of the other microphone—150 to 250 ohms. This low-impedance load can degrade low-frequency response in a dynamic mic, or can create distortion in a condenser mic. The 470-ohm resistors present a minimum load of 940 ohms to each microphone, so that each mic is unloaded.

If you've ever recorded a loud sound source into a tape recorder, chances are

you've experienced input-overload distortion. For example, somebody yells into a microphone, and the recorded signal is distorted even though you didn't exceed a 0 VU recording level.

Here's what's happening: the louder the sound, the higher the output voltage of the microphone. If the sound is loud

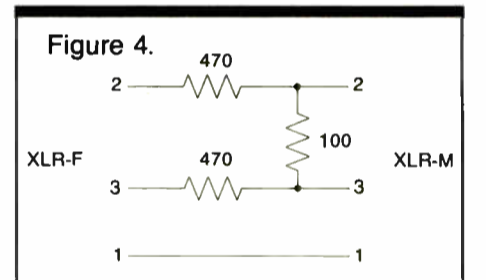
enough, the microphone can generate a really hot signal—near line level—which overloads the mic preamp in the tape recorder. The record level control follows the mic preamp, so it can't prevent input overload.

The microphone pad shown in Figure 4 cuts the level of the mic signal by 20 dB, preventing input-overload distortion. For more loss, decrease the value of the 100-ohm resistor and vice versa.

You may encounter a microphone or a mic cable that is wired in opposite polarity with all your other mics. You'll hear the problem when you mix two microphones that are picking

up the same sound source. If the mics are wired in opposite polarity, the low frequencies cancel out (in mono) or the stereo image becomes vague (in stereo).

To prevent this, you can build a polarity reverser using a male XLR and



female XLR. Wire them in parallel but reverse the connections to pins 2 and 3 in one connector.

Sometimes an opposite-polarity combination works to your advantage as a noise canceller. In a remote broadcast I

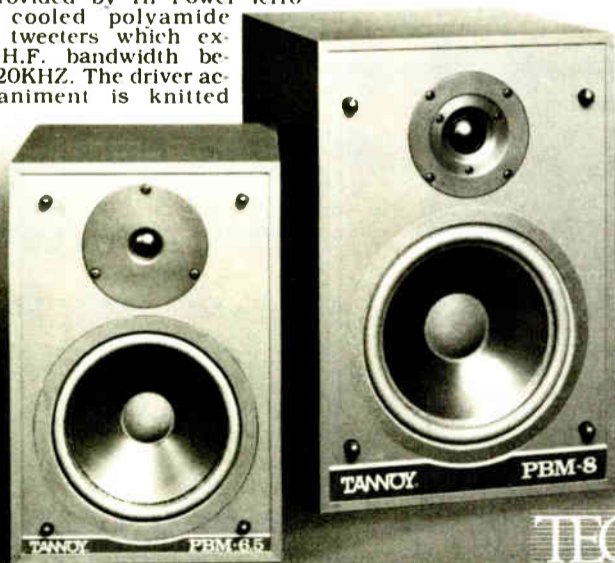
(continued on page 18)

It's Not Just A Phase We're Going Through.

The tremendous success of the Tannoy PBM series of reference monitors is by no means coincidental. Since the introduction of the world renowned NFM-8 nearfield monitor, much time and effort has been spent on discerning the needs of the mixing engineer and the applied requirements of "playback monitors". The PBM Line exemplifies this commitment to excellence in reference studio monitoring. These compact loudspeakers sport robust poly cone mid-bass transducers utilizing efficient long-throw, high power voice coils. The low frequencies are carefully controlled by optimally tuned ports located on the rear of the loudspeakers. Hi frequencies are provided by Hi Power ferro fluid cooled polyamide dome tweeters which extend H.F. bandwidth beyond 20KHZ. The driver accompaniment is knitted

together by means of a precision hardwired crossover unit, utilizing robust low loss components, and heavy-duty input terminals which will accept standard 3/4" spaced banana plugs and the majority of high quality, specialist audio cables. Transducers and crossover assemblies are neatly housed in a stylish, high density, partial wrap cabinet, specially designed to minimize unwanted cabinet resonance, and high frequency reflection. In summarizing, we have left the best feature of all for last "price versus performance."

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- 007 029 051 073 095 117 139
- 008 030 052 074 096 118 140
- 009 031 053 075 097 119 141
- 010 032 054 076 098 120 142
- 011 033 055 077 099 121 143
- 012 034 056 078 100 122 144
- 013 035 057 079 101 123 145
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Circle 26 On Reader Service Card

World Radio History

Simple Mic Circuits

(continued from page 16)

worked on, two announcers wore lavalier mics. Unfortunately, a nearby gasoline-powered generator was making a racket. Wiring one mic in opposite polarity and mixing the two mics together caused the generator noise to vanish.

The generator noise was cancelled because it was common to both mic channels and in opposite polarity. But the lavalier mics sounded normal because their signals were not common to both channels.

Often you need to combine professional and semipro equipment. For example, you might be using a professional mixer with +4 dBm output level driving a consumer-

type DAT recorder with -10 dBV nominal level.

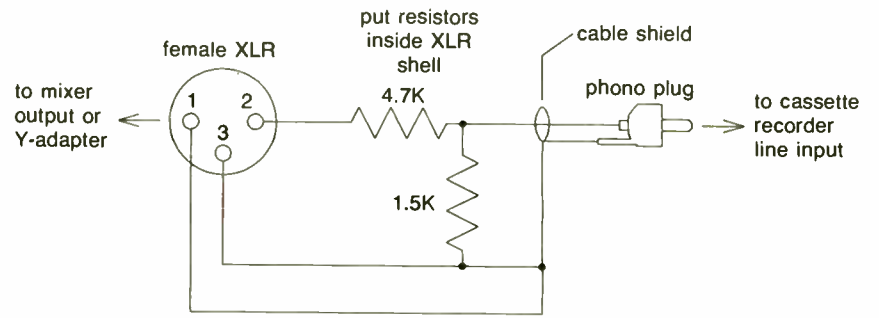
There's a 12 dB difference between those two signal levels, so the mixer can easily overdrive the recorder. The 12 dB pad shown in Figure 5 attenuates the +4 level down to -10, preventing distortion in the recorder.

We hope all these gizmos provide some quick fixes for you in difficult situations.

■ ■ ■

Bruce Bartlett is a microphone design engineer and technical writer for Crown International. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388. Don't mess with Jenny.

Figure 5.



Equipment Deliveries

(continued from page 14)

work to wait for another contractor to show up.

For example, the air conditioning contractor can't install the ductwork until the new room is built. The interior can't be finished until the electrical is installed, which can't happen until the walls are up. And so on.

So, proper planning involves a lot of careful coordination with all the local contractors.

But don't forget that coordination is not the only thing necessary. Clear instructions have to be issued ahead of time or the contractors may not have the needed parts.

Another potential bottleneck is that changing transmitters—especially adding a second unit or a larger one—usually creates a need for greater electrical service. This is no place to cut corners or run close to the maximum current rating. Hot breakers

are tripped breakers. That produces a lot of dead air.

When planning, don't forget the additional current load required by the air conditioning system. Often you will need to get a larger breaker box, especially when you factor in the demands of two transmitters running simultaneously, a dummy load and sufficient air conditioning.

And don't let anyone tell you a single unit is sufficient air conditioning, regardless of size. Put it this way: What happens to the transmitter if the fan or compressor goes? Right. A full capacity backup is essential.

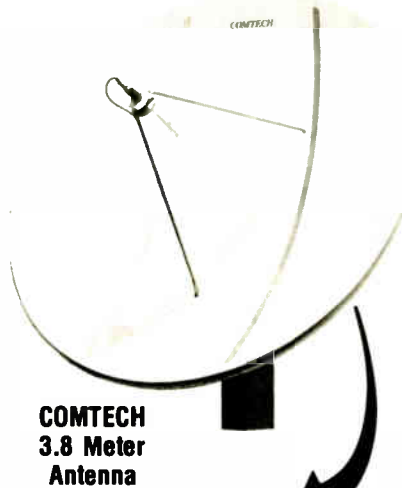
Meanwhile, where is the transmitter and when is it arriving? We'll deal with that issue in our next installment.

■ ■ ■

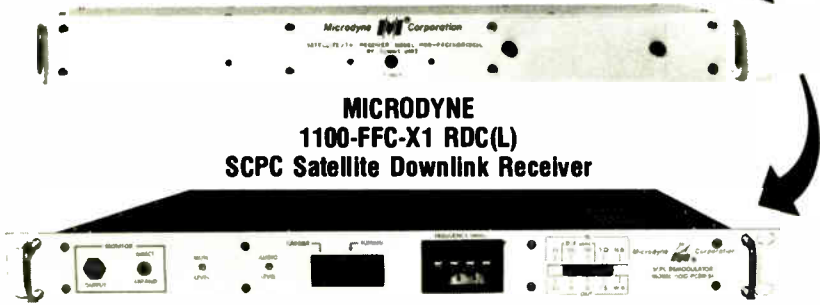
Barry Mishkind, aka RW's "Eclectic Engineer," is a consultant and contract engineer in Tucson. He can be reached at 602-296-3797, or on FidoNet 1:300/11.



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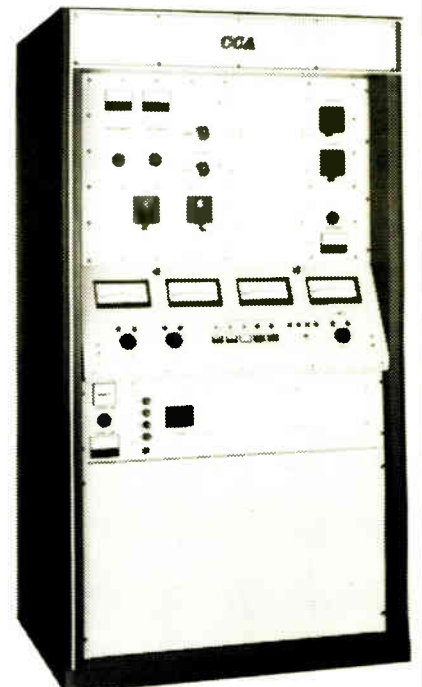
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Circle 119 On Reader Service Card

Why do more stations rely on the 528 Voice Processor?

- ▼ The power of five processors—mic pre-amp, de-esser, expander, compressor/limiter, 3-band parametric EQ—in one rack space.
- ▼ Straightforward controls make it easy to “dial in” *your* sound.
- ▼ Easy installation—mic level (XLR) and rear panel line level (barrier strip) inputs and outputs (balanced or unbalanced), facilitate patch bay connection.
- ▼ Each processor stage can be used separately with rear panel barrier strip patching connections.

Where does your signal chain need help?

In the on-air studio, the 528 turns good voices into great voices with a combination of flexible signal processing power and outstanding audio quality. The 528's powerful, easy-to-use controls give you total command of your sound.

In the production studio, one Voice Processor can smooth out copy reads, add extra “oomph” to sound effects and “tweak” samples. With a stacked pair of 528's, you can EQ and compress stereo music beds, brighten up dull-sounding agency dubs and clean up background noise on final dubs for on-air playback.

In the newsroom, the 528 gives you an assortment of tools to clean up actualities. If unnatural high frequencies are a problem, use the de-esser. If background noise is intrusive, the expander will push it out of the way. If the feed sounds dull the parametric EQ can even out the frequency response. Is hum or interference a problem? Notch it out with the parametric.

On live remotes where you're using a P.A., you can notch out feedback with the parametric. The combination of expander and compressor allows you to “punch up” the vocal mic without feedback.

Proven reliability

The 528 Voice Processor, like all Symetrix products, is designed and built for non-stop, no-slowng-down professional applications. We use double sided, plated-through glass PC boards, top-quality pots and heavy-duty connectors. Fully regulated ± 15 V bi-polar power supplies maximize available headroom (the 528's outputs are capable of +24 dBm). Hundreds of stations around the country know they can count on their 528s to perform flawlessly—any time and every time.

Broadcaster-designed features

The blueprint for the 528 grew out of long talks with radio people. For instance, we learned that more and more stations are turning to top of the line condenser mics. So the 528 has switchable phantom power built in. Production directors emphasized that every voice is unique: the “one size fits all” type of signal processing doesn't work. That's why the 528 gives you total control of gain, tonal balance, and dynamic range (including noise reducing downward expansion).

528 On-Air Set-Ups

Mix and match the EQ, dynamics and de-esser settings to get the right sound for your format.

- “Presence” EQ
- That “big round sound”
- “Filter mic” telephone simulation
- Gentle dynamic control for “smooth talkers”
- Tight dynamic control for “screamers”
- Heavy de-essing at 8 kHz gets rid of excessive sibilance
- Mild de-essing at 2 kHz softens over-emphasized fricatives

Production Power with the 528

For maximum flexibility in production, you can access each section of the 528 separately through the rear panel barrier-strip terminals. There are also compressor side chain, effects send/return and stacking connections for even more possibilities.

- Low frequency shelving EQ gets rid of “thump” from third-generation tape dubs
- Loudness compensation makes music beds sound full under voiceovers
- With a high Threshold, the expander makes sound effects even more dramatic

- With high Threshold and Ratio settings the compressor becomes a limiter.
- A combination of high frequency shelving EQ and expansion gives you single-ended noise reduction unit. By patching the equalizer's output into the side chain input, you can make the expander especially sensitive to the high frequencies. Use a stacked pair to clean up the final mix.

Cleaning up news feeds with the 528

- 60 Hz hum filter with the parametric
- 15,750 sync leakage filter using parametric
- A gentle high-frequency boost can often enhance intelligibility
- De-essing gets rid of HF “garbage” from phone lines and remote feeds
- Combine compression and expansion to “tighten up” the dynamic range without increasing background noise
- Live remotes run more smoothly with the 528
- Parametric EQ gives you three separate notch filters to tame PA feedback
- Compression plus expansion lets you “tighten up” the jock's monitor without risking feedback

We only have room here for a few of the ways broadcasters are using the 528 to improve sound quality everywhere in the station. But now that you know some of the possibilities, what are you waiting for? Contact your broadcast distributor. Or call Symetrix toll-free at 800-288-8855—we'll be happy to send you our 528 applications note and tell you about our other dynamics processors, headphone amplifiers, mic preamps, telephone interfaces, precision meters, noise reduction and automatic level controllers.

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(and for whimpy sound effects,

lumpy music beds, mushy

agency dubs...)

FCC Decides Policy for RITOE

by Lex Felker

WASHINGTON RITOE is not an Italian gastronomical delight. It's an acronym coined by consulting engineer Dan Rieder for "receiver-induced, third-order intermodulation effect"—a particularly troublesome type of interference that can plague FM broadcasters.

The FCC has been wrestling with RITOE problems on an ad hoc basis since a severe case broke out in Minneapolis several years ago. Following an incident decided in January, the agency articulated a RITOE policy.

The Commission has had rules on the books for years addressing so-called "blanketing" interference that can arise when a "victim" receiver is so close to a broadcast transmitter that it makes reception of other stations impossible.

FELKER'S FORUM

RITOE is a little different, however. The Commission has described it as occurring "when the signals of two stations interact within a receiver to generate a third signal which disrupts the reception of any station operating on the same frequency as the receiver-generated signal." (whew!)

These spurious signals are generated in a receiver's mixer. Although the typical case involves two interacting signals, it also is quite possible for three fundamental signals to mix together to produce a fourth. In either case, the interfering signals are called "third order" products because they are described by the cubed term in the power expansion of the mixer's transfer function.

Minneapolis overload

The existence of this type of interference came to the Commission's attention several years ago when five commercial FM stations in Minneapolis co-located their transmitters. The resulting receiver intermod caused severe interference to other stations situated elsewhere in the city. The Commission resolved these problems by ordering the commercial stations to reduce their power by 50 percent.

Since that case, the Commission has asked broadcast applicants whether any FM or TV stations exist in the vicinity of the proposed broadcast site that could create receiver intermod. The FCC staff also has been routinely conducting intermod analyses and advising applicants with potential problems that they bear responsibility for resolving interference complaints.

In January, an appeal of one of the staff's actions finally worked its way to the full Commission. As a result, the agency established a formal RITOE policy.

Significantly, the Commission declared that service disruptions due to receiver characteristics are not necessarily modifications of a broadcaster's license. Therefore, the hearing provisions of the Communications Act will not apply in cases involving RITOE.

The Commission did find, however, that in situations where reception

difficulties develop after stations begin operation, the new broadcasters may be required to resolve individual complaints. This decision is in keeping with the agency's longstanding "newcomer" policy, which has been applied in a variety of different types of interference cases.

Under the policy, new stations are required to make "reasonable efforts" to alleviate interference developing after the start of operations.

Finally, the Commission declared that licensees' efforts would be judged as reasonable if RITOE to non-mobile receivers is resolved on a complaint-

by-complaint basis. In addition to relieving newcomers of any obligation to fix interference to car radios, this finding allows complaints to be addressed individually.

Need not relocate

Thus, licensees need not cure a class of interference by relocating their transmitting site, for example.

Although the Commission has not made receiver intermod a part of its FM allocation standards, hopefully, this order will reduce the extent of RITOE by establishing who is responsible for resolving complaints of interference,

and the extent of that responsibility.

Make no mistake, however, that even within the Commission's limits, RITOE can be difficult to cure and listeners don't appreciate it. It can be a heck of a lot easier to avoid these interference problems than it is to fix them later.

Therefore, FM broadcasters considering a new transmitter site—especially so-called "master antenna" sites—may want to study the potential for receiver intermod before an application is filed. In this case, an ounce of prevention can be worth a pound (and lots of dB) of cure.

■ ■ ■

Lex Felker is a technology/engineering consultant with the law firm of Wiley, Rein & Fielding in Washington, and formerly chief of the FCC's Mass Media Bureau.

“Wolf!”

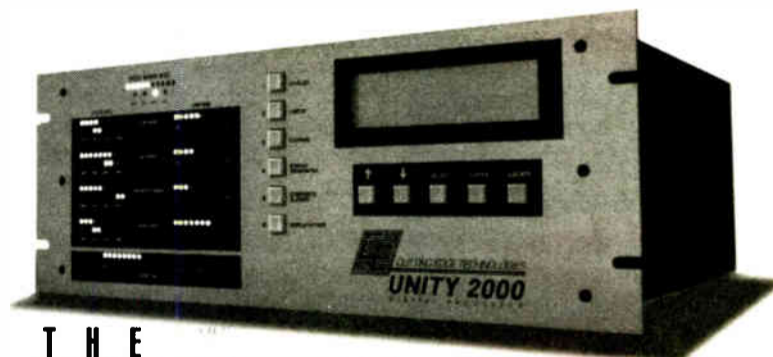
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WORKBENCH

Hot Newsroom and Studio Tips

by John Bisset

FAIRFAX, Va. As computers invade the broadcast newsroom, the AP line is typically connected to a computer with the printer being driven from the computer's parallel port.

In the case of the versatile HP Laserjet printer, making up an adapter plug to permit connection of the printer directly to the output of the AP modem will save your newsman should the computer fail.

The jumper cable connects directly into the serial port. Printer reconfiguration instructions can be taped to a laminated card tied to the cable end. A bit more elaborate effort would be the purchase of an A-B switchbox, which would permit feeding either the printer directly or the computer.

Again, the printer must be reconfigured to switch over to the serial port, but the procedure is straightforward.

★★★

Jim Wenstrom, CE for Wynne Broadcasting in Oregon, offers the following tip for owners of the Harris FM-20K: If all of a sudden you get strange voltage readings, the first things you want to check are the large wire-wound resistors

inside the transmitter cabinet.

These resistors range from 100 W to 160 W. Jim has experienced these resistors opening up, resulting in the strange voltage readings; the transmitter, however, will still stay on the air. In seven



The Automute mercury switch from Miwltrionics.

years, Jim reports losing one or another of these resistors three different times. Jim can be reached in Klamath Falls, Ore., at 503-882-4656.

★★★

Every so often, a company comes up

with a product that we wonder how we ever lived without. One that fits such a category is being distributed by the Broadcaster's General Store and is manufactured by Miwltrionics. It's called an Automute and is an encapsulated mercury switch that quietly silences telephone handsets.

How many times have you been on the phone, only to be interrupted by someone with an urgent question you must answer *now*? Install an Automute and simply raise the receiver mouthpiece higher than the earpiece. The receiver microphone is auto-

matically and silently muted.

For recording in the newsroom, simply lay the receiver face down to mute. Muting does not occur if the receiver is laid on its side. The Automute does away with costly push-to-talk handsets or rubber bands used to force the receiver pushbutton "on."

Priced less than \$50, this little device is truly a "best buy." For more information on the Automute, circle Reader Service 74. To order the Automute, call Dave Kerstin at 708-231-7120. See the Automute in action at NAB booth 2223.

★★★

Planning an STL? Andrew Corp. can help. It is offering several application bulletins on its STL products. Primarily directed at the changes facing the tele-

vision industry, portions of the notes can be used for AM/FM broadcast.

Of particular interest is a System Planner, which outlines the equipment you'll need beyond your STL transmitter or receiver. Pricing and part number columns make budgeting for these items a breeze,

and insure that nothing will be forgotten. The price can't be beat—it's free and can be yours by circling Reader Service 31. If you're attending the NAB, drop by the Andrew booth (5533) and request a copy.

★★★

We'll wrap up this issue with a comment from Al Lapides of the Leo Burnett Ad Agency in Los Angeles. Al called to comment on the problem with the MCI photocell (*Workbench*, RW, January 1991). Seems his agency's studio had a similar problem involving an NEC tuner that was always tuned to channel 13, whether you wanted it there or not.

Al traced the problem to the track lighting, which was on a dimmer. As you increased the intensity of the lights, a point was reached that triggered the remote sensor, causing the channel selector to run all the way up to 13. Al solved the problem using a strip of phototape to cover the sensor. Some fixes are just too simple.

Got a tip or a modification that's made your life easier? Share it with your fellow engineers. Jot it down in rough form and fax it to 703-998-2966.

■■■

John Bisset recently left Delta Electronics to concentrate on Multiphase Consulting, a contract engineering company. He can be reached at 703-379-1665.

TTC

Spring 1991

TTC's Open Letter to all Broadcasters:

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Circle 55 On Reader Service Card

Designing for Versatility

by John "Q" Shepler

ROCKFORD, III. Picture yourself at 5:45 a.m., eyes puffy, hair dripping, brain numb. You're defeated. Sign-on is a scant 15 minutes away and the main control board is stone cold silent. The program director peers through the studio window with a hopeful look. You reply with a don't-waste-your-time stare. The message is received.

Alone with the remains of the power supply on the floor, you strain for an alternate plan. Rebuilding the fried supply is going to take hours—endless hours with management breathing down your neck. You need to buy time to think and work. There is only one way to buy that time. Get something, anything, on the air *now*.

Q-TIPS

As you stand in the clutter rubbing your earlobe, a plan starts to materialize. You could put the morning announcer in the production studio and at least get on the air. That's not so good, though. There are only two cart machines and no input for the news studio. It's also really cramped in there. No, you need a better plan.

How can you get the main studio on the air? You need a power supply. Production studio? No, different kind of board. News studio? That's it. The main studio and news studio have the same make of board. It's a smaller board, but the supply might be OK.

Now you're in motion. Round up the newscaster and the program director. They agree. News moves into production. You grab the supply cards and transformer from the news board. Into the main studio. Old cards and transformer out. New ones in. Power on. Bam! The breaker blows. Still out of action.

OK, think now. Isolate that supply. Pull all the cards and reset the breaker. Power on again. This time it holds. Whew! At least the supply wasn't destroyed.

One by one

Now insert the cards again, one by one. Wait a minute. This line driver smells burnt. Set it aside for the moment. The other cards are in and the supply is holding.

Back to the news studio. Grab a line card. Into the main board. The meters jump. Open the network pot and up comes stereo program. Mic 1 is OK. Mic 2 is OK. Grab a cart and run it a few seconds on each machine. Carts one, two, three and four are just fine.

What's that frying sound in the left side of the board? Bam! Breaker went again.

Now you are really starting to perspire. Just when it looked good. Rats, everything's down the tubes again.

Pause for a second and think this through. Maybe more of these cards are going. Yank 'em all. Now put in all the cards from the news board. You still need a couple of line inputs because the main board is larger. Pick the two that look the best and insert those. Now flick that breaker again. It's holding. Great.

You have five minutes. Get that pile of boards and tools out. Have the sign-on

announcer try the channels again before turning on the transmitter plates. Still OK. Your luck seems to have turned.

Six o'clock. Plates on. Sign-on cart start. National anthem on the air.

Go get some coffee in the lounge. You've earned it.

Set up for easy substitutions

You can readily see the advantage of having the same make and model of control board in all your studios. Not only is servicing easier because there is only one design to learn, but when disaster strikes you generally can gather up enough working components to get at

least one board running.

The same is true of transmitters, cart machines, tape decks, CD players, computers and just about everything else that you have more than one of.

This is the ideal. Reality for most stations is that equipment is purchased a piece at a time over many years. The best shot at getting a consistent physical plant comes when a new station is being built or when a major remodeling is underway. But what about the rest of the time?

If you can't get commonality of equipment, at least work toward being able to substitute one piece of gear for another. The idea is to get a minimum

system on the air, so you have time to deal with the problems without the added pressure of the station losing revenue and audience.

In our story, the production studio could have been pressed into an air studio if it had been set up for this. It's a good idea to set up your studios so that they can be AM, FM, news or production. You don't have to buy extra tape equipment. Just be sure to have inputs and connectors ready so you can plug in an extra cart player at a moment's notice.

Connections are the key to versatility. Fortunately, wire is relatively cheap. Run program outputs from all boards to a patch panel in the transmitter room. Also, direct program outputs from each board to aux inputs on the other boards. This makes the switchovers easy.

(continued on page 29)

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Why Was The Blue Book Blue?

A Look Back at the FCC's Study of "Public Service Responsibility of Broadcast Licensees"

by George Riggins

LONG BEACH, Calif. John Dehnel, CE of KSL in Salt Lake City, Utah, has taken me to task for comments about Blaw Knox Towers. John states that KSL has a Blaw Knox Tower, so what makes them so special?

The next time I'm in Salt Lake City, I will make arrangements to take a tour of the KSL facilities. A report is forth-

coming on its tower and the center insulator. John says the center insulator has a strap placed across it. The report will explain the reasons for a center insulator.

The difference between a standard self-supporting tower and the towers in use by WLW and WSM is the method of construction. Take two self-supporting windmill towers of 500 feet or more and place one point down on

the ground. Stand the second tower on top of the first one, guy the mass only at the bustle, and you have a picture of the towers that are in service at WLW and WSM.

We have some tall towers in the Sacramento-San Joaquin River delta region of California, but they are of the tall slender type with many levels of guys. The delta towers are in the 1,800-foot class, tall enough to stick out above the fog we have here in the west. The delta towers serve as navigational aids to aerial navigation when fog and low clouds are covering the area.

One of the taller towers in the Los Angeles basin belongs to KFI—the Idelco tower has a height of 755 feet. At one time the KFI tower was considered out in the country, but now is completely surrounded by suburbia.

nomer. The report received the connotation because it was bound in a blue folder. At the time, the government printing office had the choice of two colors—blue or red.

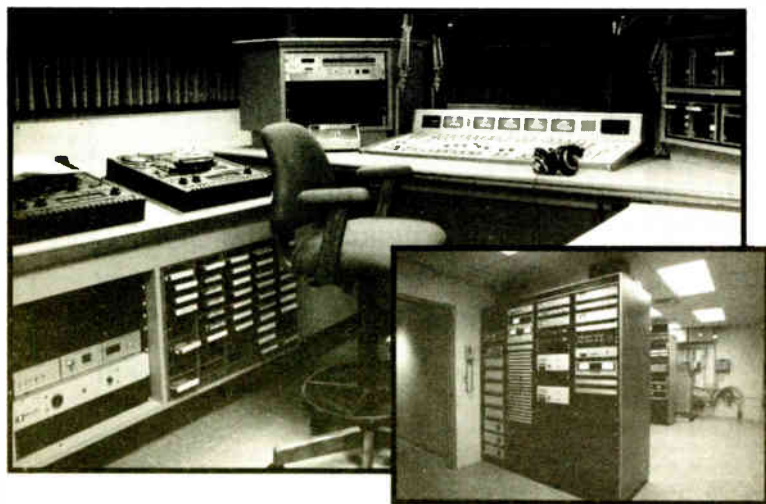


One of the early concepts of radio was that there would be no commercials as we know them today. Rather, the programs would be uplifting, educational, informative and intellectually stimulating.

The Blue Book report dealt primarily with the station owner's programming



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One of the early concepts of radio was that there would be no commercials. Rather, the programs would be uplifting, educational, informative and intellectually stimulating.

To me, there is a difference between a tall tower and the mass that is displayed by the two self-supporting towers melded into one huge structure.

About The Blue Book

Among the first major studies to be conducted by the FCC was "The Blue Book," known as the "Blue Laws" in 1946. The term Blue Book was applied to the study by the FCC of "Public Service Responsibility of Broadcast Licensees," United States Printing Office, 1946.

The name "Blue Laws" really is a mis-

responsibilities and promises versus actual performance. The first major study concentrated on Chain Broadcasting and the seemingly increasing control of stations by NBC and CBS, and to a lesser extent by the Mutual Broadcasting System.

A complicated yet influential factor in the study was the entry into broadcasting by absentee owners. The term more appropriately was used to denote corporate ownership that had not applied for an original station license, but instead had purchased an ongoing operation as an investment.

The first absentee owner to bring controversy to the issue was AVCO, Aviation Corp., a holding company with interests in manufacturing products as diverse as aircraft engines, ships, boilers, heaters, kitchen sinks, bombers, jeep bodies and operating airlines, oil fields, a stock brokerage firm and a public utility.

AVCO's interest in broadcasting came out of the \$22 million purchase of prominent businessman Powell Crosley, Jr.'s empire, which included 23 radio licenses—AM, FM, facsimile and short wave—and Crosley's line of radios, refrigerators, automotive accessories and other products.

During the FCC hearings into the proposed sale, AVCO officials admitted that

(continued on next page)

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(continued from previous page)

the company thought of the stations only as "part" of the package. The AVCO chairman also said that the corporation knew nothing about broadcasting, the background of broadcasting or any of the FCC requirements. AVCO had no inkling of the real value of the stations. Broadcasting was looked upon as a romance business.

The transfer of the station licenses was approved by a four to three vote. The transfer of these stations brought forth another study known as the "AVCO Rule." It's on the books, but never really was implemented.

Complete in a month

The Blue Book study was done under the direction of FCC Chairman Paul Porter. The actual preparation of the report was assigned to Edward Brecher, with the requirement that the report be completed within a month.

Enlisted to help prepare the study was Charles Siepmann, who had lectured at Harvard on the social impact of broadcasting. He did a study on wartime propaganda and wrote a booklet, "Radio in Wartime." The fact that Siepmann was British and worked for the BBC before coming to the U.S. helped fuel the controversy that eventually surrounded the study.

An interesting fact connected with the study was the total amount of expenses claimed by Siepmann while working as a consultant for the FCC—for 21 days including salary and travel expenses: \$839.67.

The Blue Book study was completed on schedule; after review and revisions, the 80-page document was released in March 1946.



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

61 YEARS AGO

Reprinted from Radio World February 22, 1930. Editor's note: The RW of old, printed for a time in the 1920s and 1930s and today's RW are unrelated except in name.

**THIEF OF TIME
ON AIR, CHARGE
AGAINST MAN**

Washington
The Federal authorities in St. Louis, Mo., have arrested George W. Fellowes upon a warrant issued under the provisions of the national radio act, charging operation of a broadcasting station without license and interference with interstate commerce, it has been stated by the Department of Justice. The statement of the department follows:

Information has been received at the Department of Justice of a case brought under the penal provisions of the national radio act, involving one George W. Fellowes, at St. Louis, Mo. Fellowes was arrested on a warrant charging operation of a station without a license and interference with interstate commerce by interfering with the broadcasting of other stations. The radio inspectors of the Department of Commerce made the charge that operation of a broadcasting station by Mr. Fellowes was interfering with programs issued by licensed stations.

Investigation was made by officials of Department of Justice which disclosed that Mr. Fellowes would, by means of his apparatus, re-broadcast over his station a program being broadcast from one of the other stations. In this way it was alleged that he was "stealing a program."

Through arrangements perfected with a licensed station, the operations of Mr. Fellowes were disclosed and a search warrant was issued and some of the apparatus in connection with his station, employed in ascertaining the wave length, was seized.

The facts in connection with the case are shortly to be presented to the Federal grand jury in St. Louis. The offenses enumerated in the radio act are felonies, with a maximum punishment of five years or fine of \$5,000, or both.

**JOB ASPIRANTS
FOUND LACKING
IN KNOWLEDGE**

By RUDOLPH L. DUNCAN

It's about time that the myth of easy radio men be exploded. The idea that mere radio knowledge immediately qualifies one for a position of wealth and affluence is just as foolish as expecting the graduate of the law, engineering, medical or journalistic school to attain fame and fortune overnight. Education is only the first, albeit very necessary step; hard work, constant application, and a specialized training, constitute the second and decisive step.

Radio and allied industries are more anxious than ever before to obtain qualified radio trained men. But it is well to note that they are looking for men with qualifications other than ability to handle soldering iron and pliers, or again the ability to handle a simple home-made radio set.

No Longer an Experiment

Radio today is no longer an experiment: it is a serious industry. With business running into hundreds of millions; with millions of sets to be produced each year; with hundreds of millions of capital and hundreds of thousands of workers, radio no longer can tolerate the handy man of pioneers memories.

Recently I had an opportunity of looking over the calibre of men applying for radio positions of trust. It is appalling to note how few men really know radio.

Operators Deficient, Too

Even radio operators who have been at sea for years, with many hours of leisure time each day in which to study, show a woeful lack of modern radio knowledge. Many cannot answer simple questions readily answered by our young students. Rather than bemoan the lack of good positions, many of our so-called radio men would do well to take stock of their radio knowledge.

**'SCHOOL OF AIR'
TEST IS BEGUN**

Washington.

The United States Office of Education is encouraging the educational broadcasting experiment of "The American School of the Air," which opened the first of a series of programs under the auspices of the Grigsby-Grunow Company in co-operation with the Columbia Broadcasting System, the Commissioner of Education, William John Cooper, stated.

As a member of the advisory council of the School of the Air, of which the Secretary of the Interior, Dr. Ray Lyman Wilbur, and the Assistant Secretary of Commerce, Julius Klein, are members, Dr. Cooper pointed out that this experiment will be watched to ascertain the possibilities of radio in education.

Dr. William C. Bagley, professor of education, Teachers' College, Columbia University, heads the advisory faculty of the school, which consists of educators in different branches of learning.

The American School of the Air will broadcast programs twice a week for 15 weeks. The program is to broadcast every Tuesday and Thursday at 2:30, Eastern Standard Time, and continue one-half hour. The Tuesday broadcast will deal with American history and that on Thursday will deal with literature, civics, art, music, health, nature study, and international good will.

The first program was opened by the chairman of the Federal Radio Commission, Ira E. Robinson. After the formal opening Columbus was the topic of discussion.

It has been estimated that this experiment reached more than 6,000,000 school children through approximately 150,000 receiving sets.

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WTMI 25 kW (2)
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WJYO 55 kW
WOCL 55 kW

LOADSTAR TOWER PROJECT
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WFYV 27.5 kW
WQIK 35 kW

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WBAM 35 kW
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WLWI 35 kW
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WSPB 50 kW

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RF: How Close Really Is Safe?

by Harold Hallikainen

SAN LUIS OBISPO, Calif. For the last several months, we've been discussing the FCC limits on public and occupational RF exposure. The FCC is using the American National Standards Institute (ANSI) C95.1-1982 Standard Safety Levels.

Stations can determine compliance with the standard through measurement of the electric and magnetic fields at all locations people are to occupy or by making predictions.

Some prediction methods are available in the FCC Office of Science and Technology Bulletin 65 (available from NTIS as

publication PB#86-127081; call 800-336-4700 to order). The predictions in OST65 are worst case, so it is possible for a station to have predicted fields above the ANSI limits but still actually be within the limits. In cases where the predictions show possible exposure above the limits, measurements should be made.

A suggested procedure

I've listed a suggested procedure to comply with these requirements and will gladly accept comment. As part of station license renewal, each station must certify that it does not impose a significant environmental impact (FCC Form

303-S, question 7) or submit an environmental assessment. Consultants I've spoken with have suggested doing whatever is possible to meet the ANSI spec so that an environmental assessment need not be submitted.

OST65 should be reviewed. The appropriate calculations should be made to determine where the areas of predicted excess fields are. These locations should be fenced off (with a non-conductive fence to avoid reradiation) and appropriate signs posted. Based on OST65, these locations will be around the bases of AM and FM towers.

A report should be written demonstrating the method used to determine compliance and the location of the restricted areas. I'd probably answer the renewal form question 7 something like this: "Using the methods contained in FCC OST65, it has been determined that the station complies with FCC specified guidelines for human exposure to radio frequency radiation. A copy of the analysis is available on request."

The report should carefully document the procedures used to determine compliance and what measures are taken to limit public and worker access to areas of excessive fields.

Restricted access

There are going to be some areas where radiation is above the FCC specified limits. For FM stations, this may be an area at the base of the tower or an area on the tower above a certain height.

Besides signs on fences intending to limit public access, warning signs should be posted in the transmitter building for workers. These signs should point out the limited access area and what should be done to gain access. For FM stations, I do not see any reason to allow worker access to a high radiation area.

If a worker is to do work on a tower, the transmitter power should be reduced (possibly to 0 percent) so the predicted or measured field complies with the limit. It is not necessary (as far as I can tell) to work

on a hot FM antenna.

If work needs to be done near an antenna, reduce power or shut down. The power reduction should not be an arbitrary amount, but should be based on actual measurements or predictions (again, possibly using OST65). These power reductions should be on the transmitter site warning signs. The derivation of these power reductions should be in the compliance report that is on file.

AM stations often must allow worker access to areas above the radiation limits (typically for reading tower base currents). It is possible to do this and still comply with the specifications by limiting the exposure time. The ANSI specifications do not limit "peak" exposure, but instead limit the exposure as averaged or integrated over a six-minute period.

It would be permissible to go to six times the limit for a one-minute period if there were no exposure for the six minutes immediately surrounding the exposure (such as 2.5 minutes before and 2.5 minutes after).

INSIGHT ON RULES

If there is continuous but varying exposure (such as when the worker walks up to the tower base, takes the reading, then leaves), the level should be determined at frequent intervals in the six-minute period (ideally, the interval size approaches zero), and the average exposure determined.

Close-in field

Consulting Figures 1 through 3 of OST65, it appears that the close-in field (magnetic or electric) doubles each time the distance to the tower is halved (which would be the case for an isotropic radiator). Based on this, we could estimate that a worker would be exposed to twice the ANSI limit at 2.5 meters from the tower base (using this "doubling" concept and table 1) of a 5 kW station; 1.25 meters from the base, the worker would be exposed to four times the limit.

Using such an approach (or better yet, actual measurements), the compliance report should include details as to how these base current measurements are going to be made while continuing to comply. Instruction on reading base currents, including time limits, should be posted at the transmitter site for other engineers who may not be familiar with the details of your station (such as an FCC inspector).

Research is being done into safe RF current levels in a human body. These currents are induced when someone climbs a hot tower. Substantial currents also are induced when someone climbs a floating tower of a DA when other towers are driven. At this point, it is suggested that climbing hot AM towers not be permitted. Climbing of FM towers while the transmitter is on may be permitted, depending upon the distance from the antenna, the antenna pattern and power.

Anyone hurt?

People have been working in high RF fields for many years with minimal documented effects. This is especially the case for AM stations, where it has been standard practice to climb the towers hot, then spend many hours painting them.

I have, however, received a call from

(continued on page 29)

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Circle 5 On Reader Service Card

World Radio History

WRXL's Great Crane Caper

by Dee McVicker

RICHMOND, Va. What's an engineer to do when he needs a temporary tower? Use a crane, of course.

OFFBEAT RADIO

That's exactly what contract engineer John Heimerl of Heimerl and Associates did the night of Dec. 16, 1990. With the threat of sleet and rain, Heimerl and a tower crew raised the boom on a 300-ton truck crane and threw the switch. WRXL-FM of Richmond, Va. was back on the air for the second time in less than a week.

It began at noon the previous Friday, just two days after ratings, when the station's 140,000 W signal suddenly disappeared from the dial. Heimerl and station engineer George Oberto went out to the tower site to investigate. The transmission cable, at the top 90 degree elbow, was badly charred. By 8 p.m., a crew from L&R Tower Co. had cut into the line. The damage was severe: Char and soot were everywhere.

Related Heimerl, "We came down 20-foot sections at a time until we were 80 feet down from the feed of the antenna, and we still had trash." The 32-year-old, 51.5 ohm line had gone south, probably due to temperature fluctuations in the

early part of December.

"At that point," recounted Heimerl, "we looked at the weather forecast, saw freezing rain headed our way and decided that we weren't going to do anything with this burnt line anymore."

WRXL needed a new transmission line.

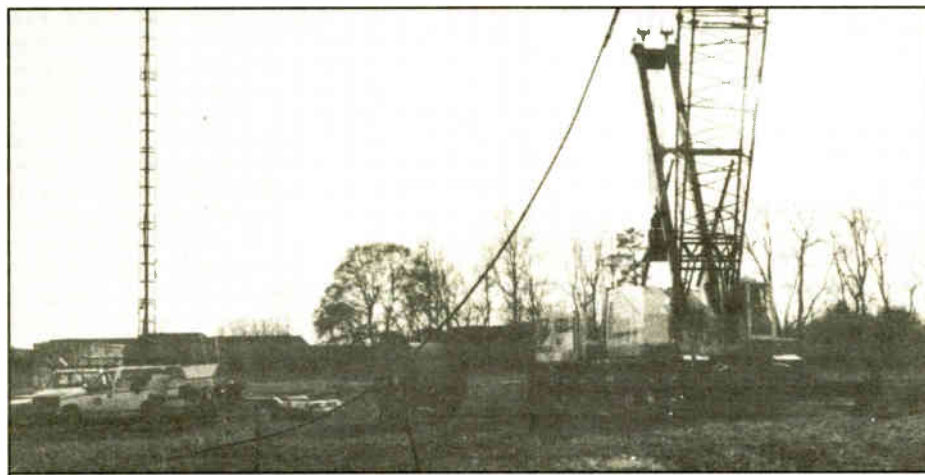
Spool sitting idle

Fortunately, a 600-foot spool of transmission cable had been sitting idle in the station's studios, waiting for such an occasion. It had been ordered the previous

merl and Oberto decided to rent a small crane and winch to hoist the cable to the top of the tower.

The temporary cable, now trailing down the side of the tower, provided relief while Heimerl and Oberto collected their thoughts. Foremost on their minds was WRNL-AM.

Grandfathered to WRNL-AM in 1958, WRXL's 308-foot tower and rigid line were part of the AM's directional system. Bypassing the old line had necessitated a greatly reduced AM signal, and with



This 300-ton Link-Belt HC-268 crane (right) acted as WRXL's impromptu antenna tower.

year, on the off chance that WRXL's line would give out. Now, as the chance of bad weather hung in the air less than 14 hours after the station went dark, Hei-

merl and Oberto decided to rent a small crane and winch to hoist the cable to the top of the tower, any thoughts of leaving a new line on the outside quickly were squelched.

Explained Heimerl, "The AM is a three-tower array, and the FM antenna system is hung on the side of one of those towers, none of which are strong enough to support an aux FM antenna. So the AM acted as somewhat of a cata-

lyst in the final decision on how to repair the FM."

Several stations in the Richmond area offered their auxiliary towers. Although grateful, station management couldn't take advantage of the offers. The reduced coverage that these sites offered would greatly impact advertising billing—a loss that WRXL's insurance wouldn't cover.

Also nagging at Heimerl and Oberto was the 750-foot tower that the station had hoped to erect in the near future. It was scheduled to replace the aging Stainless in less than a year. The project, however, would require at least 90 days lead time to get the steel on site. Heimerl and Oberto were forced to scratch this from the list of immediate solutions.

WRXL needed a temporary tower, and fast. "We were making this decision, knowing that it was December and the weather could go left or right on us at any time. Knowing that if the tower iced up or had high winds, it was probably coming down," Heimerl said.

Acting quickly, Heimerl and Oberto rented another crane, flew in an ERI rental antenna, and rented more cable.

Coverage was astonishing

Strapping the rented coaxial to the boom of the 300-ton crane—which had been hauled in by seven tractor trailers—the crew attached a small pole to the top of the crane, for an antenna. Instead of WRXL's customary 140 kW with 10 bays and a center of radiation at 260 feet, the crane offered a temporary signal of almost 12 kW with one bay and a center of radiation at 290 feet.

The coverage was astonishing. Signal strength readings indicated that the crane tower was servicing more than 85 percent of the station's listening audience.

But Heimerl and Oberto had little time to thank their good fortune. The meter



WRXL station engineer George Oberto stands by an antenna bay as it is repaired.

was running on the crane rental, at \$300 an hour, and weather still was threatening to slow down progress.

With bad weather turning on and off, the crew worked in half-day shifts. "We brought the entire antenna assembly to the ground and cleaned it from top to bottom. Got all the soot out of it, got it all back up and installed the new line—four days before ratings resumed," said Heimerl.

On Dec. 31, well past the Christmas holiday and with a new year only hours away, the old Stainless was powered up with WRXL's 140 kW signal and Heimerl, Oberto and the crew went home to catch some badly needed sleep.

More steel needed

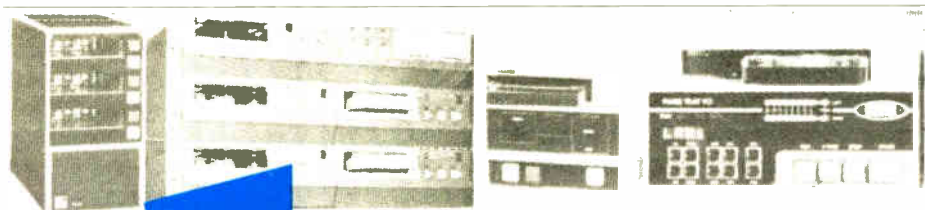
Everyone agreed that WRXL needed a temporary tower while the old line and the temporary line were dismantled, and the Stainless was reassembled with a new

lyst in the final decision on how to repair the FM."

Managing to at least save the FM station's weekend billing with the temporary cable, Heimerl and Oberto were haunted by another thought: Would the weight of the temporary 12,000-pound cable collapse the old, 1950s-vintage Stainless tower?

The following Monday, their suspicions were confirmed. Inspectors from WRXL's insurance company and those at Stainless cautioned that the tower could topple under the stress. Don't send anyone up in a high wind, Heimerl was told.

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



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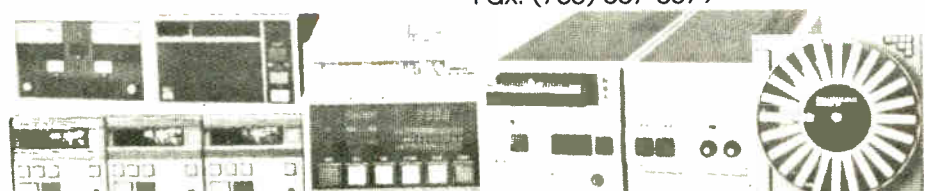


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Circle 52 On Reader Service Card

How Close You Can Get

(continued from page 26)

a station engineer who tells of severe discomfort when wearing contact lenses at a 5 kW AM station transmitter site. This may be due to the RF increasing the temperature of water on the eye, increasing the evaporation rate. With the contact lens, the water on the eye is not replaced, resulting in injury to the eye. I have not heard of any other adverse effects due to AM radiation.

I've been told that an FM station has been fined (perhaps by OSHA) for allowing a worker on the tower in the immediate vicinity of a radiating FM antenna. The worker complained of feeling sick. It's quite possible that there was significant internal heating before the worker felt the effects of

the heating, possibly causing damage to internal tissue.

There may be effects of electromagnetic radiation, in addition to heating, that may adversely affect health. At this point, however, it is subject to considerable research. Stations must comply with the current ANSI specification (or submit an environmental assessment).

Although OST65 outlines

some prediction methods for determining safe distances from antennas, it may be overly conservative (as it should, being a worst case analysis).

In addition, it does not predict radiation from other sources (transmitters, antenna phasing units, etc.), nor does it predict the high field immediately outside the antenna

tuning unit at the base of an AM tower (where the base current meter is). For these reasons, it is suggested that measurements be made. These near field measurements cannot be made with the field strength meter directional stations have.

These meters are designed for far field measurements. Most such meters actually measure the magnetic field (using a loop) and calculate what the electric field (in V/ meter) would be in the far field based on the measured magnetic field and the in-

trinsic impedance of free space. Special meters are available to independently measure the electric and magnetic fields. These are available from Holiday Industries and other companies.

■ ■ ■

Harold Hallikainen is president of Hallikainen and Friends, a manufacturer of transmitter control and telemetry systems. He also teaches electronics at Cuesta College, San Luis Obispo. He can be reached at 805-541-0200, or on Internet at HHallikainen@vax.seng.CalPoly.edu.

Versatile Systems

(continued from page 23)

Run the network and remote lines to each studio. If you need talkback for your RPU van, run that too.

Hook up extra inputs on each board to connectors appropriate for cart machines and DAT or CD players. Tuck them away behind the board until needed. And don't forget monitors. You need air, two-way and intercom. Make sure to have both AM and FM air monitors to each board.

Useful for interconnecting

Distribution amplifiers are useful for all of this interconnecting. If you can't afford DAs, use bridging terminations at each of the loads. A 10K input impedance each from 10 loads is still OK for a 600 ohm output drive.

Another important consideration is control lines. You want the same automation remote control in each of your studios. If that's too expensive, at least run cables so you can quickly move the control head or PC. The same is true for studio computers, outdoor thermometers and timers. Have extras or run wires and connectors so you can quickly vacate one studio and set up in the next.

One final consideration is elbow room. If you have a choice, make every studio a decent size. Your selling point to station ownership is that the extra room means versatility. Versatility is what will keep them on the air despite lightning strikes and general equipment failures.

■ ■ ■

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

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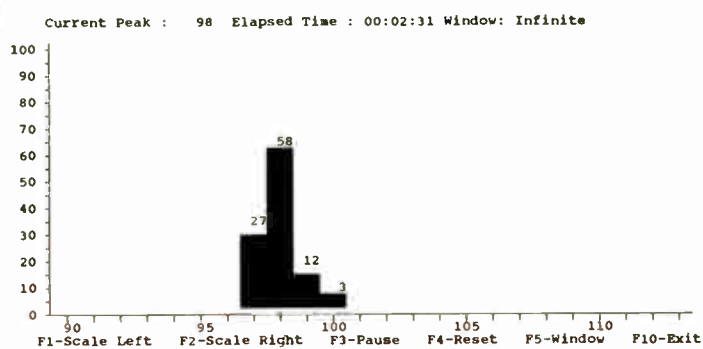
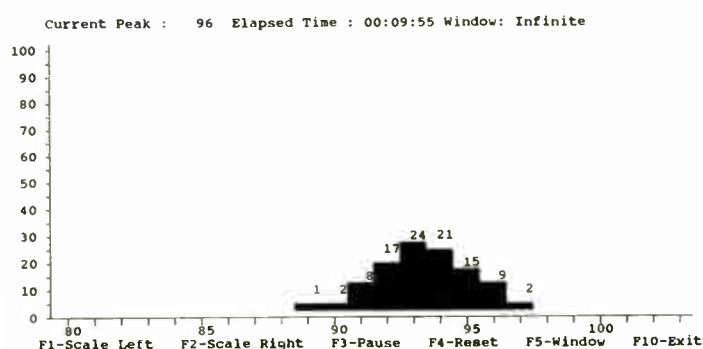
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- Optional FM precision demodulator that will remotely self calibrate
- One rack height panel space—including precision demodulator

Sample PC Output



Communications Options Plot Help Exit

Elapsed Time : 00:04:12 Window : Infinite

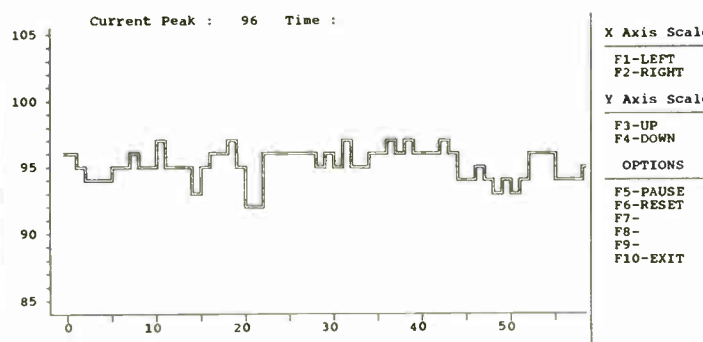
F1-Scale Left F2-Scale Right F3-Pause F4-Reset F5-Window

Remote Display

Peak Modulation: [] [] [] []

Menu: 75.0 - KHZ DEV

P6 - Menu Left F7 - Menu Right F8 - PARAM UP F9 - PARAM DOWN



Sample Setup Menus

SELF CALIBRATION

SAVE CONFIG

BLANK - ON

TIME MODE - REAL

DEV 75.0 KHZ

HOLD 1.0 SEC

PEAK MOD 100.0 %

REMOTE - OFF

INFINITE - ON

PILOT INJ 9.0 %

SCA INJ 10.0 %

PK WEIGHT - OFF

RES - 1.0 PERCENT

PPM THRESH 10

PPM COUNT 10

SENTRY 10.0 %

SENTRY 30.0 SEC

MOD ADJ - 0.5 %

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AMPLIFIERS

Want to Sell

Marti PGM-20 line amp, \$50; Spotmaster 1x5 mono DA, \$50. P Wells, KJQY, San Diego. 619-238-1037.

Audiometrics stereo dist amp, 2 in 16 out, new w/manual, \$250. B Burnham, WCAR, 32500 Park Ln, Garden City MI 48135. 313-525-1111.

Crown DC-150 w/o IOC, \$200 ea; Soundcraftsman 5002 power amp, 500 Wchnl, \$500. B Wilson, 212 Southside, Campbellsville KY 42718. 502-789-1505.

Dynaco Mark 3 mono, tube-type power amp, gd cond, BO/trade. E O'Brien, Imperial Sound, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

ANTENNAS & TOWERS

Want to Sell

Utility Tower 300' + AM tower, 24" face w/all appendages, guys, lights w/beacon, jony balls, flasher unit, etc plus transformer; ATU in metal housing, BO. H McDonald, Broadcast Associates, POB 807, Veradale WA 99037. 509-924-8298.

Potomac Instruments AM-19 2-tower antenna monitor, avail in late January, \$3500. J Bisset, Multiphase Consulting, 703-379-1665.

Harris/ERI FML 1E 1 bay, CP FM, tuned to 92.1 w/transformer, 1/4 wave stub & brackets, pre 1981 mdl, \$1000; Harris/ERI FML 3E 3 bay, CP FM, tuned to 92.1 w/transformer & (2) interbay lines, post 1981 mdl, \$3000; Cablewave 200' & 7/8" foam heliast cable w/type N female connectors w/split kit, \$250. J Fellows, KCMA, 2021 S Lewis Ste 760, Tulsa OK 74104. 918-747-9999.

Tower, 330', 24" face. J Stevens, WLAU, 56 Wansley, Laurel MS 39440. 601-649-1840.

Micro Communications 90063 6 bay FM panel antenna tuned to 92.3 MHz, just removed from operation, BO. J Bennett, Great Trails, 717 E David, Dayton OH 45429. 513-294-3333.

RF switch, Andrew 4 port motorized, (2) 3-1/8", (1) 6", excel cond. Goodrich Ent, 11435 Manderson, Omaha NE 68164. 402-493-1886.

Gates 1 kW 2 tower phasor complete w/new coils & capacitors, excel cond, BO. D Barton, KMTI, POB K, Manti UT 84642. 801-835-7301.

50 kW phasor & 4-tower ATU's w/(4) 200' G-17 towers, contain Delta metering & sampling toroids, vacuum caps, high current coils, avail early 1991, BO. J Bisset, Multiphase Consulting, 703-379-1665.

280' 24" face tower in gd cond, w/lights, you remove, BO. S Newberry, WHHT, Box 457, Glasgow KY 42142. 502-651-6050.

Shively 6810-4D 4-bay high pwr 40 kW tuned to 100.7 MHz, has de-icers, \$5000/BO; Cablewave 3-1/8" heliast 300' w/EIA flanges, \$3000/BO. B Hansen, WMXR, 224 North Ave, Pittsburgh PA 15209. 412-821-6140.

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Scala HDCA-10 (2) 10 element yagis w/stacking harness, cut to 185.9 MHz; Scala HDCA-5 (2) 5 element yagis w/stacking harness, cut to 99.3 MHz. P Lierman, KCSP, 601 W Collins Dr, Casper WY 82601. 307-265-5414.

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Andrew HJ12-50J, 780' run of 2.25" air dielectric, never used, on original reel, includes 3-1/8" EIA flanges. B Dean, KXKT, 1108 Douglas, Omaha NE 68002. 800-736-3835.

Cablewave HCC158-50J 310' of 1-5/8" Heliast air dielectric, EIA connector both ends, one gas pass on gas barrier, \$2500 plus shpg. F Anderson, WSCQ, 1440 Knox Abbott, W Columbia SC 29169. 803-791-1653.

Windcharger, 120' on ground w/guys, \$500 FOB Duluth MN. J Stromquist, WNCB, 2828 Piedmont, Duluth MN 55811. 218-722-3017.

Shively 6810, 6-bays w/deicers, 103.3 MHz, \$750. D Hainer, WCRF, 9756 Barr Rd, Cleveland OH 44141. 216-526-1111.

Rohn 65, (2) sections, 18" face solid rod, 20' sections, \$300 ea; Rohn 80 (10) 20' sections, 42" face, \$400; 6" coax, one 130' section, one 120' section, BO. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Belden cable, various lengths, 8449, 8447, 8790, 6422, 9750, 8448, 8663, 8627, below wholesale, you ship; Andrew 78ARF (4) 3-1/8" EIA flange connectors, brand new, \$300 ea or \$1100 for all plus shipping. R Kerbawy, WTNJ, Box 1127, Beckley WV 25802. 304-877-5592.

Rohn 90' tower, land & building in Springdale AR, gd tower site. J Richardson, KXIO, POB 37, Clarksville AR 72830. 501-754-2076.

Phelps-Dodge CFM-2P CP 2-bay at 107.1 MHz, \$475. P Wells, KJQY, San Diego. 619-238-1037.

Phelps Dodge CFM LP8 8 bay FM tuned to 94.3, excel cond, \$5000/BO. B Anderson, WTYG, POB 9, Charleston MS 38921. 601-647-5600.

Utility tower G480, 445' high, all but 2 sections in gd cond, w/new guy wires & insulators, base insulator, side lights & beacon, on ground in 20' sections, 30" face. D Loughry, WFRB, POB 430, Frostburg MD 21532. 301-689-8871.

Dielectric coax switch, 1-5/8", 4-port motorized w/interlocks, new wiper & contact stock, recently rebuilt in vgc, \$1500; MCI coax switch, 1-5/8" 4-port motorized w/interlocks, recently rebuilt in vgc, \$850; MCI coax switch 3" 4-port w/interlocks, gd cond, \$1700. B Webster, WLIT, 150 N Michigan, Chicago IL 60615. 312-329-9002.

LDF 5-50A heliast, 450', new; Jampro 3-bay antenna HV, 100.5 MHz. S Delay, 217-498-7339.

ERI unshielded sample loops (3) & iso coils for AM directional monitoring, BO; transformers, chokes, etc from Collins 1 kW AM xmt, 10 V filament xfrms, etc. BO. C Gennaro, WJMS, 222 S Lawrence, Ironwood MI 49938. 906-932-2411.

140' 54" face angle iron tower, ERI 7-bay antenna, 95.3, 175' 1-5/8" heliast, 3-1/8" ridged elbows. 414-743-5320.

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Rigid coax, Andrew or Celwave accepted, 50 pieces 20' 3-1/8", can fax info. E Anderson, WEAS Inc, 2515 Abercorn, Savannah GA 31401. 912-234-7264.

FM CP 3 bay or 6 bay on 100.9 MHz. J Crawley, WLSK, Box 680, Lebanon KY 40033. 502-465-5782.

Air dielectric 1-5/8" coax, need 300'; Rohn tower flasher & photo light switch for 300mm beacon. J Richardson, KXIO, POB 37, Clarksville AR 72830. 501-754-2076.

Air Heliast, 340' of 1 to 1-5/8" for non-profit FM, cash or tax deductible receipt. D Van Zandt, WJLU, 2596 SR 44, New Smyrna FL 32168. 904-427-9000.

AUDIO PRODUCTION

Want to Sell

MEI Digisound, (2) hard drives, remote keyboard configured for 10 kHz, 175 minutes mono, 86 minutes stereo, \$7000/BO. D Greer, WDZZ, Ste 1830 Genesee Twrs, Flint MI 48502. 313-767-0130.

UREI 527A 27 band 1/3 octave graphic EQ's (2), \$600/bo; UREI Cooper time code 14 & 16 MS stereo delay unit, \$300; Maestro rack mount flange doubler delay unit, \$200. J Krepol, RNDL, 6147 Walker St, Philadelphia PA 19135. 215-624-1050.

Fender tube-type reverb, 3 tubes, dwell, mixer, tone controls, pwr switch, input & output; RCA MI-12238-B 6 W 4 tube, mic & crystal type phono inputs, speaker output; RCA BA-4C line amp; Bogen 2120 PA amp; Realistic MPA-90; Int'l Telemeter Mod III UHF input/output; GE BA 5A limiting amp w/pwr supply; Ware Electronics RCM-G-L RF amp; Gates limiter amp, tube-type. K Hart, WIEZ, RD 3 Box 1414, Millintown PA 17059. 717-436-9089.

Digital Audio TC-4 bcdt digital audio processor delay unit w/watch-up card, 4 mos old, excel cond, \$1100. R Sherman, WKBM, 32401 S Rte 53, Wilmington IL 60481. 815-476-5855

Art Smart curve graphic EQ w/monitor & manuals, \$650. D Greer, WDZZ, Ste 1830 Genesee Twrs, Flint MI 48502. 313-767-0130.

Shure SR-107 graphic EQ, excel cond, \$150 plus shpg. B Leslie, Pro Recdng Srvc, 13709 Maple Leaf, Cleveland OH 44125. 216-662-1435.



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Dolby 361 A Type NR (2) ready for SR cards, \$1175/BO. R McMillen, 3235 SE 39th Ave, Portland OR 97202. 503-239-6070.

Altec 15676A tube mixers (3), \$100 ea; Altec 1607A mixer amp (4), \$100 ea/all. J Parsons Sr, 10375 Cannas, N Huntingdon PA 15642. 412-863-9590.

AKG R-25 new remote control for AKG BX-25 reverb unit, long cable, BO/trade. J Roper, Imperial Studios, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

dbx 21 Type II decoder unit for tapes & records w/manual, new cond, BO/trade. E O'Brien, Imperial Sound, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

UREI 529 cut only 27 band EQ terminal connection in & outs, \$350 ea or \$600/p; Technic S1200 MK 3 TT, \$200; dbx 3PX expander, \$200. B Wilson, 212 Southside, Campbellsville KY 42718. 502-789-1505.

Burwen TNE 7000A transient noise eliminator (2), like new cond, \$175 ea plus \$10 shipping. M Gollub, WMJS, POB 547, Prince Frederick MD 20678. 301-535-2201.

Audio Digital TC2 2.25 sec, 18 kHz digital delay & effects unit, direct millisecond readout, \$575. R McMillen, 3235 SE 39th Ave, Portland OR 97202. 503-239-6070.

Fairchild 659A Reverbertron (2), \$100 ea/BO; Dolby A301 type A NR, 2 chnl (2), \$300 ea/BO. R Rhodes, POB 1550, NY NY 10101. 212-245-5045.

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Howe Audio 2100 Phase Chaser, excel cond, \$1200/BO. G Fullhart, WVKK, 4665 W Bancroft, Toledo OH 43615. 419-531-1681.

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Satellite service automation system, full day walk-a-way time, 5 yrs old, SMC MSP-1 w/2 liner carts & RTTR ad playback. \$5600. D Doelitzsch, WDDD, Marion IL. 618-997-8123.

Sony CDK-006 60-slot CD Player. Good used condition. Ron (612) 733-7715.

Sono-Mag 250 Carousels (3), two work, one for parts; w/72" Schafer rack, \$600/BO. C Edwards, WWJM, 210 S Jackson, New Lexington OH 43764. 614-342-1988.

New 452 stereo bi-directional Carousel, w/MSP-12/system programmer, desk mount control head & CRT display w/SA-1 silence alarm package & racks, (3) Carousels, assume lease payment of \$476.05/mo, complete automation package. J Jemigan, WWAV, 1234 Airport Rd, Destin FL 32541. 904-654-5102.

Satcue 400 switcher by Colorado Magnetics, \$400. H Widsten, KGNB, 1540 Loop 337 North, New Braunfels TX 78130. 512-625-7311.

SMC 250RS mono Carousels (2), vgc, \$600 ea. M Persons, WJUY, Box 706, Brainerd MN 56401. 218-829-1326.

IGM time announcer 382 A's (2) w/manual; Ampex 602 R-R w/manual; (2) SMC 252 Carousels, stripped but few gd parts; SMC 20ARS Carousel, stripped, trays left; (2) Gates RDC 10 remote controls; Gates audio amp. R Pastorik, WCMY, 216 W Lafayette St, Ottawa IL 61350. 815-434-6050.

SMC DP-20 w/(6) SMC 350 mono Carousels, (2) Otari ARS-1000 reels, (2) ITC 750 reels, (2) SMC TS-25 dual tone sensors, (2) SMC drawer type dual mono cart machines, single play cart machine, (5) racks, desk type brain, system capable of 20 stereo inputs, has backfill & network cards; also have (2) SMC R/P cart machines, mono & stereo, many spare cards & all books, BO. G Smith, KORQ, 915-673-2545.

IGM Basic A control system, 3000 event memory, video monitor, log printer, remote control, 13 source cards, EN FSK logging system w/TV terminal, 12 yrs old, will sell as unit or separately, BO; IGM Go-Carts, 42 tray, stereo elect w/mono heads, 12 yrs old, gd cond (2), \$900 ea. D Gander, KDUZ, Box 10, Hutchinson MN 55350. 612-587-2140.

Revov PR-99 play only (2), gd cond, 2 trk stereo, \$1000 ea. C Stalaker, KEZQ, POB 100, Little Rock AR 72203. 501-372-7740.

ITC REPAIR — REFURBISHMENT

Direct Factory Cartidge Machine Repair Service
Upgrades or Refurbishment
All Work Warranted

Call The ITC Technical Service Department
Toll-Free at

(800) 447-0414
(309) 828-1381

International Tapetronics Corporation
2425 South Main Street
Bloomington, IL 61704



Schafer older relay style automation controller in one rack, \$300; Cetec 7000 various source cards, \$450 ea; Schafer Audiofile A2 (2), \$2500 ea. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

MW Persons automation programmer, like new, \$700; Otari ARS-1000 (5), new heads, gd cond, \$750 ea/\$3500 for all. P Wolf, WZCR, 2010 San Carlos Blvd, Ft Myers Bch FL 33931. 813-574-5548.

Automation system w/(6) 350 RS Carousels, (3) 250 RSC Carousels, (6) equip rack, Revov A77, DP-1 programmer, AS 20 switcher & remote control unit, TS 25 tone decoder, plus many more items, \$3000. E Dulaney, KYKK, 619 N Turner, Hobbs NM 88240. 505-397-4969.

MEI Satmaster satellite programmer plus (2) SMC 452 stereo bi-directional Carousels, 5 yrs old, \$8000 plus shipping. R Kerbawy, WTNJ, Box 1127, Beckley WV 25802. 304-877-5592.

Want to Buy

Communication equipment or parts manufacturing company wanted. Write to RAM, 1639 Old Dixie Highway, Vero Beach FL 32960.

CAMERAS (VIDEO)

Want to Sell

Sony BetaCam RVP 3A, Fujinon lens, Nalpak case, Gitzo sticks, O'Connor fluid head, mech excel, cosmetic fair, \$10,000 pkg. TJ Worrell, Multimedia, 7620 W 78th, Minneapolis MN 55439. 612-942-9681.

RCA TK-76 3-plumbicon bdcct camera, just overhauled, excel cond, Canon 20:1 zoom, case, AC, batts, etc, w/BVU-110 cable, \$1800; JVC KY-2000 3-saticon camera, gd cond, 10:1 zoom, AC adaptor, case, etc, \$1600. Ugly George Satellite TV, 314 West 52 St, Nyny 10019. 212-677-2200.

Ikegami ITC-730A, Canon J13 x 9B lens, batteries, charger, AC, case for all manuals, mech excel, cosmetic fair, \$5000 pkg. TJ Worrell, Multimedia, 7620 W 78th, Minneapolis MN 55439. 612-942-9681.

Panasonic AK-30 w/bdct grade 3 plumbicon tubes, batteries, case, cable, gd cond, \$4595. D Brennan, Brennan Custom Video, 3596 Lorna Ridge, Birmingham AL 35216.

RCA TK-76B 3-plumbicon bdcct camera, pwr case, etc, 20:1 zoom, just overhauled, excel cond, \$1200; JVC KY-2000 3-saticon bdcct camera, pwr, gd cond, \$1000. U George, Satellite TV, 314 West 52nd, NY NY 10019. 212-969-0240.

HELP WANTED

Chief Engineer for six station chain in Southeast Alaska. Automation experience a must. Send resume to 3161 Channel Drive, Juneau, Alaska 99801.

BROADCAST AUDIO SALES, CONSOLES
Expanding sales team looking for self motivated individual. Engineer/technician experience in operation/architecture of audio consoles a must. Sales ability, computer operation, and knowledge of manufacturing helpful. Broadcast knowledge required. Send resume to: WHEATSTONE CORPORATION, 6720 VIP Parkway, Dept. E, Syracuse NY 13211 (No calls, please)

GM exper in sales, programming & engineering looking for position in Northeast. B Mooney, 207-942-1108.

Production Director w/lots of writing & engineering exper now available, worked on Network programming & in NY market. B Ranes, 718-526-6501.

Annc/Jock w/4 yrs exper in radio & clubs, will relocate, wants to keep learning. Brian, Rt 2 Box 370, McAlester OK 74501. 918-423-8041.

Announcer/News Director/Engineer w/over 25 yrs exper in all phases of radio seeking position in South Georgia or Florida. Bill Sutton, 803-245-4902 (PM's), 803-245-2411 (days).

Production whiz avail w/lots of network writing & engineering exper. Bruce Ranes, 718-526-6501.

Announcer w/2 yrs non-comm exper seeks FT or PT comm position within driving distance of Philadelphia PA. Milt, 215-533-3773.

Engineer w/20+ yrs in all phases of radio seeking employment, excel references, call Cecil at 817-325-2253.

Traffic Reporter w/dynamic voice & personality seeks FT/PT announcer or entertainment editor position in a major market, ready to relocate. 214-644-2152.

Engineer seeking position, just back from Middle East assignment, high-power AM/FM/shortwave exper, resume avail, will go anywhere. Send responses to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 91-03-01.

EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers, write Radio World, PO Box 1214, Falls Church, VA 22041, Attn:

POSITIONS WANTED

Announcer w/5 yrs non-comm exper seeks comm FT position in St Louis MO or PT in NW GA. Eric, 404-924-7780.

Student engineer w/resume, seeking engrg, prod, air shift employment in PA area, college & some exper, trainable, eager to work & learn, references avail. Askey, RD 3 Box 433, Bernville PA 19506. 215-488-7704.

Metro NY 10-year air personality wishes to stay here, wants to provide listeners w/entertainment, companionship & smiles, will consider production work. Zal, 718-871-5419.

Exper DJ/Sportscaster seeks On-Air position music/sports-baseball, football, PBP/color, will relocate. Phil, 415-587-3426 or 415-948-9250.

Experienced CHR/AC jock w/blazing energy, deep pipes, warm personality & great sense of humor seeks upstate NY FM w/No. 1 goals. Wayne, 716-338-1439.

Annc, Jock, started young, still going strong, AOR, CHR, AC, C&W exper, MD, OP, News, Sports, even cow chip bingo, will relocate to larger market. M Dooyne, 1328 High St Ste 1, Wmspt PA 17701. 717-323-7832.

Notre Dame grad, advanced degree, college baseball/basketball/football play-by-play exper, underwriting/sales, news, PR, 8 yrs exper, seeks university sports or bdcct position, teaching or professional staff. Len, 219-762-3351.

EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$55/column inch. Payment must accompany insert, use your MasterCard or VISA; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

POSITIONS WANTED: Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 3 issues of Radio World. Contact information will be provided, but if a box number is required, there is a \$5 fee which must be paid with the listing (there will be no invoicing). Responses will be forwarded to the listee, unopened.

Mail To: BROADCAST EQUIPMENT EXCHANGE
PO Box 1214, Falls Church, VA 22041

BE 500 DR, mono R/P Spotmaster, \$200. G Sive, Your Video Conn, 31844 Rancho Amigos Rd, Bonsall CA 92003. 619-749-7662.
Audicord Series 100 R/P, gd cond, \$650. G Smith, KTLIC, 915-673-5252.

ITC ELS-IV bulk eraser/splice finder, \$500/BO. G Fullhart, WVKKS, 4665 W Bancroft, Toledo OH 43615. 419-531-1681.

Sparta Century Series stereo, 1 kHz tone decode only, gd cond, \$275. F Anderson, WSCO, 1440 Knox Abbott, W Columbia SC 29169. 803-791-1653.

Gates mono, (5), one for spare parts w/modules, (3) Gates mono, CPD, CDP, cart record amps. Richard Lynn, 615-458-6616.

Tapecaster 700-P PB in great working cond, \$350; Spotmaster TP1-A cart winding w/timer, \$150; UMC 40 H-85 cart motor, \$100. S Dynes, Dynes Comm, 307 S Penn, Wheeling WV 26003. 304-233-8856.

ITC Omega mono (3), PB, R/P like new, \$750 ea play only, \$950 R/P. P Wolf, WZCR, 2010 San Carlos Blvd, Ft Myers Bch FL 33931. 813-574-5548.

RCA RT-7B decks (6); (4) B-7 record amps, gd-poor cond, BO. R Meyers, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

BE 5304 stereo triple decker used as demo, less than 20 hrs use, excel cond, \$2400. B Robinson, Musicworks Inc, 128 Holiday Ct, Franklin TN 37064. 1-800-251-9000.

BE 2100 PS stereo PB (3), like new, \$850 ea/\$2400 all, plus UPS. G Jones, Southwest Mediacast, 110 Sierra, Kerrville TX 78028. 512-367-4587.

ATC mono rack mounts (5), like Criterion 80 Series, works fine, spare modules, \$125 ea; SMC R/P mono in gd cond, \$500. P Wolf, WCRM, 241 NE 10th Ave, Cape Coral FL 33909. 813-574-5548.

Want to Buy

ITC stereo PB's, must be willing to sell cheap. P Lotsol, KAVV, Box 42977, Tucson AZ 85733. 602-889-9797.

Stereo cart machine, only needs to play not record, buy or trade. C Hubbeling, KTEQ, 501 E St Joseph, Rapid City SD 57701. 605-394-2231.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Revox A-77
Rebuilt \$850.00
Working \$450.00
As-Is \$150.00
In stock now
Broadcast Automation, Inc.
4125 Keller Springs #122
Dallas, Texas 75244
(214) 380-6800

Ampex 440 Series stereo PB's w/reproduce electr (5); Scully 280B stereo R/P wall electr in roll around cabinets (2); Crown 700 Series R-R transports (2); ITC 750 Series reproducers (3); Magnecord 1021 w/electr (2); Telex 230 Series 7" R/P w/electr (2). R Lank-

PHONE: 703-998-7600 FAX: 703-998-2966



Call Simone Mullins, Classified Ad Manager, to reserve space in the next issue. Use your credit card to pay, we now accept VISA and MASTERCARD.

RadioWorld®
5827 Columbia Pike, Ste 310
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Ad deadlines are the first Friday of each month for the following month's issue

Select from these categories for best ad positioning:

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| Help Wanted | Consoles | Stations |
| Positions Wanted | Computers | Stereo Generators |
| Amplifiers | Disco-Pro Sound Equip. | Switchers (Video) |
| Antennas & Towers & Cables | Financial Services | Tapes, Carts & Reels |
| Audio Production (Other) | Limiters | Test Equipment |
| Automation Equip. | Microphones | Transmitters |
| Brokers | Miscellaneous | Tubes |
| Cameras (Video) | Monitors | Turntables |
| Cart Machines | Movie Production Equip. | TV Film Equip. |
| Cassette & R-R Recorders | Receivers & Transceivers | Video Production Equip. |
| CATV-MATV Equip. | Remote & Microwave Equip. | Video Tape Recorders |

Classified Advertising Display Rates Effective January 1, 1991

	1x	3x	6x	12x
1-9 col inch (per inch)	\$55	53	50	45
10-19 col inch (per inch)	50	48	45	40
Distributor Directory	90	85	80	75
Professional Card	60	55	50	45
Classified Line Ad	\$150 per word			
Blind Box Ad	\$10 additional			

To compute ad costs: Multiply the number of ad inches (columns x inches) by the desired rate schedule for your per unit cost. Example: a 3" ad at the 1x rate is \$165, at the 3x rate \$159, at the 6x rate \$150, at the 12x rate \$147, etc.

REEL-TO-REEL . . . WTS

Technics RS 1500 US 3 speed isoloop, 1/2 trk stereo R/P, 1/4 trk play 10.5" reels, never used w/full factory warranty, \$899. G Chapkis, Digital Prod, POB 22122, Denver CO 80222. 303-689-9114.

Nagra 4.2 w/single preamp, new xtal sync, leather case, manual, refurbished & set to specs. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Revox B-77 4 trk stereo, 3-3/4 & 7.5 ips, no visible head wear, excel cond, \$600 plus shpg. C Kocsis, PGE Recordings, 2826 Raymond, Falls Church VA 22042. 703-237-2590.

Revox A77 1/2 trk stereo, 3-3/4-7.5 ips, low hrs since factory overhaul w/service manual, \$650. F Ostrander, Ostrander Prod, 5 Grandview, Cornwall/Hud NY 12520. 914-534-4025.

Technics RSB-85, \$199. G Chapkis, Digital Prod, POB 22122, Denver CO 80222. 303-689-9114.

Ampex AG-350 mono 1/4" in console, \$500; Ampex AG-440 mono 1/4" in console, \$500; Sony TC854-S 4 chnl 4 trk w/sync & dbx-154 type I, \$950; Crown SX-701, \$250; Crown 800TX w/4 chnl 4 trk heads & HRI electronics, \$300. J Krepol, RNDL, 6147 Walker, Philadelphia PA 19135. 215-624-1050.

Magnecord 1021R mono relay control, gd cond, \$300; Revox A77 (2), one in gd cond the other in poor cond, \$400/both. B Clark, Bullitt Bldg, Rt 1 Bardstown Rd, Mt Washington KY 40047. 502-538-4784.

Roberts 977 stereo tape deck, stand-up tube type, cond unknown, \$50; Pioneer RT-101L 10" R-R 4 trk stereo in excel cond, \$300; Pioneer RT-707 7" R-R 4 trk stereo w/auto-reverse in excel cond, \$300, plus shipping charges on all items. J Emmel, WWAAX, 509 Third St, Peckville PA 18452. 717-383-1118.

Sony TC854-4 R-R 4 trk, \$100. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Ampex 350 stereo rcd, \$375; (2) Inovonics 370 R/P elect, \$375/pr; MCI JH-110B FT stereo for 14" reels, \$2375. P Wells, KJQY, San Diego CA. 619-238-1037.

Tascam 34 4-trk, 7.5-15 ips, 10" reel capability, like new cond, low hrs, w/manuals & original packing box, \$695. B Osborne, Audio-Visual Assoc, 4760 E 65th, Indianapolis IN 46220. 317-253-8562.

Pioneer RT-901, stereo 1/4 trk, rack mounted, 10" reels, heads gd to fair, overall cond gd, w/manual & NAB hub adaptors, \$150/BO, you ship or pick up. T Adams, New Wisconsin Radio Reading Service, POB 5541, Madison WI 53705.

Tapsonic TRS70, \$300; Teac A7030 & A3300SX2T, \$350 ea; Tascam 34 4 chnl, \$800; Teac A3340SX chnl, \$800; Teac A505 tube type, \$300; Akai 4000D, \$100; Sony TC650D, \$130; Teac A4010, \$100. J Parsons Sr, 10375 Cannas, N Huntingdon PA 15642. 412-863-9590.

SMC 250RS, (2) Carousels, \$400 ea; ITC 760 (2) 2-trk P/B's, \$400 ea; Telex Magnecord 1021 mono R/P, \$100 ea; ITC 750 (2) 2-trk P/B, \$375 ea. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Ampex 601 in custom woodgrain case; (2) Ampex R-R's; (3) Gates mono cart record amps; (5) Gates mono cart machines; Gates mono cart machines. R Lynn, 615-458-6616.

3M 400 2 trk 1/4", will take 10.5" reel, 15 & 7.5 ips, \$800. Katherine, Linden Inc, 229 N Henry, Alexandria VA 22314. 703-549-4424.

HEAD RECONDITIONING

Restore your worn heads to original (new) performance specifications at a fraction of the replacement cost. Our laboratory services include:

- Digital/Optical & Electrical inspection
- Precision recontouring of heads
- Complete digital/optical alignment of assembly
- Exclusive "Audio Magnetic Head Test Report"™ & Data Sheets

We also carry a full line of replacement heads and parts. Our 25 years of experience and reputation are unmatched in the industry.



Circle 73 on Reader Service Card

Akai CR-80D-SS quad & stereo 8 trk recorder & player, gd cond, BO/trade. E O'Brien, Imperial Sound, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

Telex 300, like new cond, w/manuals, BO. D Bisbee, 685 S Roys, Columbus OH 43204.

Fostex MY250R00-31214-D capstan motor, BO. M O'Brien, Imperial Snd, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

Tascam roll around mount for 32 series decks, BO; Tascam 38 8 trk in excel cond, BO; Pioneer 2022 2 trk in excel cond (4), some spare parts. C Larko Prod, 916 Fairfield Ave, Ft Wayne IN 46802. 219-424-2405.

CLEAN PATCH BAYS NO DOWN TIME



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\$34.95 Ea. Please write for additional information and order form today

VERTIGO RECORDING SERVICES
12115 Magnolia Blvd. #116 818-907-5161
North Hollywood, CA 91607 FAX 818-784-3763

Auditronics AV123-4TS 1/4 trk; Infonics RR-1 FT; Infonics RR-2 2 trk, all in gd cond, \$200; Soundscriber audio logging recorder, fair cond, BO. R Meyers, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

Edison Envoy 515 voice writer; Roberts 4 trk photo sync 1057; Advent stereo cassette w/Dolby; Uher CG-320 stereo cassette; Sony TC-353 stereo. Pinetucket Recording, 747 Wire, Auburn AL 36830. 205-826-0390.

Scully 280/280B

Rebuilt	\$1150.00
Working	\$650.00
As-is	\$325.00

Available from stock
Broadcast Automation, Inc.
4125 Keller Springs #122
Dallas, Texas 75244
(214) 380-6800

Ampex 351 1/2 trk transport w/Inovonics RP amps, refurbished. S Delay, 217-498-7339.

Crown BX-800 3-speed, 2 trk deck, tube-type elect, needs heads, BO/trade. M O'Brien, Imperial Snd, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

Sony CCP-100, cassette duplicator, 30 ips, ferrite heads, excel cond, w/manuals, \$300. B Burnham, WCAR, 32500 Park Ln, Garden City MI 48135. 313-525-1111.

Revox A-77 2 reel w/built in 25 Hz detectors, gd cond, \$550. F Anderson, WSCQ, 1440 Knox Abbott, W Columbia SC 29169. 803-791-1653.

Tascam 32-2 R/P, small or large reels, 2-speed, like new, never installed, \$1200. P Brown, KSPI, 905 Preston, Still Water OK 74075. 405-372-7800.

Tascam 32, 10.5" reel capacity, new in factory sealed box, \$1000. C Onan, 51 Crandall St, Glens Falls NY 12801. 518-798-4739 aft 5PM.

Telex RP-85 slow speed logger deck, gd cond, \$800/BO. G Fullhart, WVKs, 4665 W Bancroft, Toledo OH 43615. 419-531-1681.

MCI/Sony JH110-C-8 8 trk, 1", in factory console w/Auto-locator III, gd cond, \$3250. M Leach, Waves, 1956 N Cahuenga, Los Angeles CA 90068. 213-466-6141.

Sony/MCI JH 110-C-8 1" 8 trk, excel cond, w/manual, \$4600. R Leonardi, Voices, 16 E 48th, NY NY 10017. 212-935-9820.

Stellavox SP-7 interal crystal, mono, case, manual, spares & sound sync, \$900. G Give, Your Video Conn, 31844 Rancho Amigos Rd, Bonsall CA 92003. 619-749-7662.

Inovonics 375 record amp for Ampex 350, \$250; Ampex 350 mono w/Ampex record amp, \$350. J McKinley, WJMR, 155 N Main, Fredericktown OH 43019. 614-694-1577.

Otari ARS 1000 w/tone sensor, motor needs bearings but works, gd cond otherwise, \$550. G Smith, KKH, 915-676-9898.

Scully 280-1, some chips, vert mounted, excel cond, \$625; Ampex 400 (2) in excel cond, \$300 ea; Tapsonic mono TRS 70 in gd cond, \$260; Scully 280 4 trk harness & head, like new, \$390; Lang for 350 AG mdls (2), \$185 ea. T Shea, Shea Snd Stds, 973 McKinley, Baldwin NY 11510. 516-223-7291.

Ampex 601 in custom woodgrain cabinet; Ampex AG440B in roll around cabinet; Co-mex Bleepmate 675 program delay 3 or 6 sec delay w/remote switch; (2) Ampex R-R's, mdl unknown. Richard Lynn, 615-458-6616.

Otari ARS 1000 reels w/tone sensor (2), gd cond, \$650 ea; ITC 750 PB only reels (2), gd cond, \$450 ea; SMC TS-25 dual tone sensor, one card needs repair, \$175. G Smith, KTL, 915-673-5252.

Ampex AG 440-2, Altec 21-B mics, Ampex amps, EV mics, lots of misc, call for list, must sell. Bob Lindahl, 10680 S W Wedgewood, Portland OR 97225. 503-644-9643.

Marantz PMD-221 (12), brand new in factory sealed boxes, original warranty, perfect portable for ENG, \$229. Jim, 1-800-366-5770 X1.

Want to Buy

Ampex NAB test tape, 15 ips; pair of RCA ribbon mics. D deForrest, 7441 Wayne, Ste 10-D, Miami Beach FL 33141. 305-866-5401.

Ampex MR-70 2 trk in gd, original cond. D deForrest, Insight Prod, 7441 Wayne Ave, Ste 10-D, Miami Bch FL 33141. 305-866-5401.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

MCI/Sony capstan & reel motors, any cond., recdg heads, most mfgs, machines, new, used. Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-826-0601, in FL 305-659-4805.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

MCI/Sony capstan & reel motors, any cond., recdg heads, most mfgs, machines, new, used. Relapped then sold. Amp Services, 224 Datura St No 614, W Palm Beach FL 33401. 800-826-0601, in FL 305-659-4805.

Channelmatic Spotmatic Jr (4) & net-share switcher 4 chnl, cable ad insertion equip, \$1300 ea; Tele-Engineering Ad Cue Jr, cable ad insertion controller, \$1200. R Stone, W-AIR, 322 Bay, Petoskey MI 49770. 616-348-2000.

Jerrold UM-2 & UM-4 TV modulators, BO. Pinetucket Recording, 747 Wire, Auburn AL 36830. 205-826-0390.

COMPUTERS

Want to Sell

TRS-80 mdl 4 microcomputer w/(4) 360K dbl sided drives, 3 internatl, 64K RAM, RS-232 port, software packages; Radio Shack DMP-1000 dot matrix printer; Radio Shack mdl 100 laptop computer with 36K RAM, internal 300 baud modem, RS-232 port, printer port, built-in software for text, telecom, Basic; Teletype w/keyboard, paper tape reader/punch, stand. K Hart, WIEZ, RD 3 Box 1414, Millintown PA 17059. 717-436-9089.

Macintosh SE 20 meg hard drive w/monitor, keyboard & \$5000 worth of software, 3 mos old. G Chapekis, Digital Prod, POB 22122, Denver CO 80222. 303-689-9114.

Blue Chip IBM XT compatible, 512K, 30 meg HD, CGA, color monitor, BO. C Larko Prod, 916 Fairfield Ave, Ft Wayne IN 46802. 219-424-2405.

Digital 350 prof, dual disc drive w/10 meg hard drive, PC complete (2), \$200 ea. P Russell, Bowdoin College, Sills Halls, Brunswick ME 04011.

SPOTCAST! A new spot analysis program. For PC or compatibles. In-depth. Find out if your station is a winner! Only \$49.95. Meyer Gottesman, 3377 Solano Avenue, #312, Napa CA 94558.

CONSOLES

Want to Sell

Collins 212T-1 audio control system, mint cond w/manual, \$595; Shure SR101 Series 2 portable audio mixer, rack mt in portable case, excel cond w/manual, \$395. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Ramsa WR-8816, 16x4x2x1 prod console w/EQ floor stand, outboard pwr supply, new; Harris stereo 5, Solid State 5 chnl; McMartin 500 Solid State 5 chnl stereo; UREI mod one 10 chnl Solid State stereo; RCA 100 Solid State 4 chnl stereo. R Lankton, WDUV/WBRD, 813-749-1420.

Gates Produce mono, modified w/switches & cue pots, manual & modifications, \$300. B Clark, Bullitt Bldg, Rt 1 Bardstown Rd, Mt Washington KY 40047. 502-538-4784.

McMartin B0592, 5 ch stereo, excel cond. Goodrich Ent, 11435 Manderson, Omaha NE 68164. 402-493-1886.

Yamaha PM-700 2x2x2 PA mixing board, \$400; Yamaha PM-400 8x2 PA mixing board, \$200; Shure 8x1 pro-rack mount mixer w/reverb, \$200. J Krepol, RNDL, 6147 Walker St, Philadelphia PA 19135. 215-624-1050.

Gates 10 chnl stereo Executive, gd cond, \$3000; Gates 10 chnl mono Diplomat, missing pwr transformer; Gates 8 chnl mono President, missing pwr transformer & most cards, gc for spare parts, \$500/both. B Mounjoy, W-DD, POB 1240, Elizabethton TN 37644. 615-543-5849.

Tapco C-12 12x2x2 board w/phantom pwr, \$700. Katherine, Linden Inc, 229 N Henry, Alexandria VA 22314. 703-549-4424.

Tascam 388 Studio 8, \$2300. P Wolf, WCRM, 241 NE 10th Ave, Cape Coral FL 33909. 813-574-5548.

NORTRONICS Replacement Tape Heads

Test Tapes, Degaussers, Gauges Cleaners, Swabs, Lapping Films Splice Bars/Tabs, Demagnetizers

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Campbell CA 95008
(408) 866-8434

Collins mono ten pot, \$300 plus shpg. C Larsen, KAMI, 815 Meridian, Cozad NE 64130. 308-784-1580.

Allen & Heath Modular Series 2000 8 chnl in/out mixing console w/equalization, pan pots, mixdown facility, patch bay, \$750. B Sitzman, Music For All, 110 County Rd 146, Trumansburg NY 14886. 607-273-2970.

BE 8M250A, 8 chnl monaural, 2 yrs old, excel cond, \$2000/BO, you ship or pick up. T Adams, New Wisconsin Radio Reading Service, POB 5541, Madison WI 53705.

Harris Medalist 12 chnl stereo, gd cond, avail in April, \$2000. G Faltus, WZMX, 905 Wethersfield, Hartford CT 06114. 203-296-1175.

Sonex, 1/2 rolls. Richard Lynn, 615-458-6616.

Wheatstone A-500, 6 chnl expandable on-air/prod console, brand new in crate, \$7000. P Wolf, WZCR, 2010 San Carlos Blvd, Ft Myers Bch FL 33931. 813-574-5548.

Wheatstone 8X, 18x8x2 production board w/internal patch bay, gd cond, \$2900. M Leach, Waves, 1956 N Cahuenga, Los Angeles CA 90068. 213-466-6141.

Gately EM 7, EQ 7 2 chnl stereo w/board EQ, echo, patch bay, monitor amp, CM Lab's & custom cabinet w/monitor system, \$795. T Shea, Shea Snd Stds, 973 McKinley, Baldwin NY 11510. 516-223-7291.

Gates Yard for parts. J Schloss, KICD, POB 7248, Spencer IA 31301. 712-262-1240.

Ramsa WR 8816 16x4x2 mixing console, like new, \$3800 FOB. G Jones, Southwest Mediacast, 110 Sierra, Kerrville TX 78028. 512-367-4587.

RCA BC 15/18 mono 8 chnl 32 inputs, gd cond, w/manual, \$500 plus shipping. R Kerbawny, WTNJ, Box 1127, Beckley WV 25802. 304-877-5592.

Ramko DC 8MS 8 chnl, stereo 18 inputs, excel cond, \$3800. R Trumbo, KNLF, POB 117, Quincy CA 95971. 916-283-4144.

Sparta 3410 8 chnl stereo prod or air board, gd cond w/docs, \$400. D Seavy, KROC, 122 SW 4th, Rochester MN 55902.

McCurdy SS 7500 custom 10-mixer audio console, \$1200. D Gunderson, KCCM, Box 72 Concordia College, Moorhead MN 56562. 218-299-3666.

Sony MX-6S 6 chnl mic & line mixer, like new cond, BO/trade. E O'Brien, Imperial Sound, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

Musimatic snd console, 10 input stereo mixing console, \$450; Peavey PA-1000S 10 input stereo mixing console w/built in EQ & 200 W amp, \$700. J McKinley, WJMR, 155 N Main, Fredericktown OH 43019. 614-694-1577.

Yamaha EM1600 6 chnl powered mixer, BO; Pyle MXK-73 hi freq crossovers, (2), BO. C Larko Prod, 916 Fairfield Ave, Ft Wayne IN 46802. 219-424-2405.

Want to Buy

Howe Audio 9000 parts needed desperately. H Gordon, WGY, 1430 Balltown Rd, Schenectady NY 12309. 518-381-4851.

DISCO & SOUND EQUIPMENT

Want to Sell

Roland DEP-5 digital multi-effects processor, excel cond, \$450. M Golladay, Circle Sound, Rt 2 Box 386, Newton Grove NC 28366. 919-594-1679.

dbx 500 sub harmonic synthesizer. R Lankton, WDUV/WBRD, 813-749-1420.

Orban 111b reverb unit, new, \$288; Mic Mix XL-210 reverb unit, new, \$288. G Chapekis, Digital Prod, POB 22122, Denver CO 80222. 303-689-9114.

JBL D16R2405, brand new replacement diaphragm for 2405 tweeter, 16 ohm, BO/trade; Switchcraft 645 stereo speaker selector box, selects up to 6 pairs of speaker systems, like new, BO/trade; JBL 51340 assorted x-over cards, (2) 500 Hz, (2) 800 Hz, (2) blank, 5 kHz, BO/trade; J Roper, Imperial Studios, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

Replace rotten speaker foams, any brand, \$34.90. Tri-State Speaker. 412-375-9203.

Disc recording equip incl Presto, Rek-O-Kut, Fairchild, Neumann, blanks, needles, manuals & advice on how to make blanks. K Gutzke, Custom Recording, 7134 15th Ave South, Minneapolis MN 55423. 612-866-6183.

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LIMITERS

Want to Sell

Harris MSP 90 (2), stereo AGC modules, stereo FM limiter modules, \$800 ea/BO. D Greer, WDZZ, Ste 1830 Genesee Twrs, Flint MI 48502. 313-767-0130.

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Dolby 334 FM processor; (2) RCA BA-45 AGC, (2) RCA BA-43 pgm amps in rack mount mainframe; Volumax 4000A. R Lankton, WDUV/WBRD, 813-749-1420.

Gates Solid Statesman AGC's (2), \$250/pr. H Widsten, KGNB, 1540 Loop 337 North, New Braunfels TX 78130. 512-625-7311.

RCA BA-6A in excel cond, w/rack mount shelf, face plate cover & connectors, \$250 plus shpg. B Leslie, Pro Recdg Svc, 13709 Maple Leaf, Cleveland OH 44125. 216-662-1435.

Shure M62V Level Loc, BO; Compiimiter 610, one good, one fair, BO. C Larko Prod, 916 Fairfield Ave, Ft Wayne IN 46802. 219-424-2405.

Harris ME-1 mod enhancer, \$150; Harris MSP 90 AM tri-band AGC, \$1000; Inovonics 230 AM multiband audio processor, \$900. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Motorola C-QUAM & CRL processing for AM. 314-576-0909.

Optimod 8000A, gd cond, \$1200. Mr. Ericson, 212-477-2489.

Optimod 8000A
\$1495 & UP
414-482-2638

CRL PMC-300A AM w/CRL SPF-300 NRSC adapter, excel cond, \$1000; CRL IPP-100 mic processor, \$1200. M Parsons, WJYJ, Box 706, Brainerd MN 56401. 218-829-1326.

CBS Volumax 400, clean, works, \$100; BE Spotmaster CLE 500, \$450. P Wolf, WCRM, 241 NE 10th Ave, Cape Coral FL 33909. 813-574-5548.

CRL SGC800, SEC800, SMP900A AM-4 stereo pkg, like new, w/manuals, instructions & parts for all modifications to date, BO. S Murdoch, WFNS, 7201 E Hillsborough, Tampa FL 33610. 813-620-9100.

Gates Solid Statesman, \$175. P Wells, KJOY, San Diego. 619-238-1037.

Aphex 250 type III exciter w/bass enhancement, like new, \$700. J McKinley, WJMR, 155 N Main, Fredericktown OH 43019. 614-694-1577.

CRL FACTORY SALE: Used & discontinued models, AGC's, limiters, etc. Call Walter Ellis or Bill Ammons, 1-800-535-7648.

ADR Express stereo (3), one modified for XLR connectors input & output, \$300 ea/BO. A Reis, 308 Eastgate Ct, New Lenox IL 60451. 815-485-7377.

Want to Buy

Automated Bdct Control Sta-Max. Pat Parks, KYKR, 27 Sawyer, Beaumont TX 77702. 409-838-3911.

Versa-Count or similar, used, cheap but repairable, programmable FM exciter. J Crawley, WLSK, Box 680, Lebanon KY 40033. 502-465-5762.

CBS Labs 4450 stereo Audimax AGC. J Pearce, KSSS, 2864 S Circle Dr, Ste 150, Colorado Springs CO 80906. 719-579-0880.

MICROPHONES

Want to Sell

Crown PCC-160 Cardioid condenser boundary mic in original box, used only few weeks, \$200. S Swanson, KBNL, Box 440029, Laredo TX 78044. 512-724-9211.

Sennheiser MD-421U w/case & clamp, vgc, \$200; EV RE-20 w/case & clamp, gd cond, \$200, plus shipping on both. J Emmel, WWAX, 509 Third St, Peckville PA 18452. 717-383-1118.

RCA Classic ribbon mics, send for list. B Davies, Virgo Prod, 5548 Elmer, N Hollywood CA 91601. 818-761-9831.

EV RE16, BO. C Larko Prod, 916 Fairfield Ave, Ft Wayne IN 46802. 219-424-2405.

Neumann U-87 new capsule, excel body, sound great, \$1350; Phase Linear 700, works, \$275; Phase Linear 400, loud & cheap, \$225. R McMillen, 3235 SE 39th Ave, Portland OR 97202. 503-239-6070.

B&K Type 2801 condenser mic, pwr supply, tube type, BO/trade. M O'Brien, Imperial Snd, 383 N Studio, Terre Haute IN 47803. 812-877-2663.

Shure 5M61-LC (8), omnidirectional dynamic, brand new w/factory warranty, excel for ENG applications, \$89. Jim, 1-800-366-5770 X1.

RCA ribbon mics including (1) 44-BX; (1) 77-D; KU3A10.0001; BK-11; BK-5; SK-46; WE639A, will trade for other high quality condenser, dynamic, ribbon mics & audio equip. Tracy Eaves, 615-821-6099 (evenings).

RCA ribbon mics including (1) 44-BX; (1) 77-D; KU3A10.0001; BK-11; BK-5; SK-46; WE639A, will trade for other high quality condenser, dynamic, ribbon mics & audio equip. Tracy Eaves, 615-821-6099 (evenings).

Want to Buy

RCA BK-5B w/windscreen, gd cond. R Laine, Box 10665, Golden CO 80401. 303-238-7830.

RCA BK-5A or B w/windscreen, gd cond. R Laine, POB 10665, Golden CO 80401. 303-238-7830.

RCA 44's, 77's, WE & other ribbon mics, working or not, also looking for dynamic & other types of mics. B Davies, Virgo Prod, 5548 Elmer, N Hollywood CA 91601. 818-761-9831.

MISCELLANEOUS

Want to Sell

Extel weather wire printer. R Lankton, WDUV/WBRD, 813-749-1420.

Gentner SPH4, Bantam patch panel, ITC eraser/splice finder ESL IV & other items, BO. D Doelitzsch, WDDD, Marion IL. 618-977-8123.

Cinema Engineering 9205-A bulk eraser. R Robinson, 203-269-4465.

Radio Shack 17-604 NiCad battery for 17-200/1050 CT-300, 301 cellular phones, new \$15. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Cushman Snowcat small two-man, for deep powder snow w/trailer, gd cond, BO. D Barton, KMTI, POB K, Mantit UT 84642. 801-835-7301.

Rack bays (2), 77" rack space, 82" overall, 17" deep, black wrinkle finish, one 61.5" rack space, 68" overall, 18" deep, gray finish w/yellow formica glued to sides. K Hart, WIEZ, RD 3 Box 1414, Millfintown PA 17059. 717-436-9089.

Anvil cases (10), 13 space, 22.75" x 24", EIA rackmount, 2" foam lines shock mounted, mech excel, cosmetic poor, \$300 ea. Tj Worrell, Multimedia, 7620 W 78th, Minneapolis MN 55439. 612-942-9681.

VHS video sales training tapes (16) 30 topics, \$1500. R Trumbo, KNLF, POB 117, Quincy CA 95971. 916-283-4144.

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WE patch panels (12), tip, ring, sleeve, 6 rows of 24 jacks, normalised wire wrap or solder, patch cords avail from ADC, \$35 ea plus shipping; Gates/Harris 994-4703-003 & 994-5066-001 motors w/limit switches, as is, \$50 ea plus shipping; Square D 200 amp 3-phase safety switch 3PDT center off, gd cond, \$100 plus shipping. R Karbawy, WTNJ, Box 1127, Beckley WV 25802. 304-877-5592.

Heathkit weather station, display only, \$25; Gentner Silence Sensor, \$95. P Wells, KJOY, San Diego. 619-238-1037.

Kohler 30 kW 3-phase gen, currently runs on propane, \$6000. G Faltus, WZMX, 905 Wethersfield, Hartford CT 06114. 203-296-1175.

Tellabs dual wideband repeat coil module 4425 in box; Gates 6" equip rack; 20" x 19" equip racks; dual row patch bay & cords, jacks & various parts; (15) ABC cue command decoders; (15) wall mount cart racks; (100) cart tapes; Comex Bleepmate 675 program delay; Teac audio amp w/VU meter, BO/all you ship. R Lynn, 615-458-6616.

Patch bay, \$65; antique tube tester in vgc, \$125; 52 album sized mangers, \$25/all. S Dynes, Dynes Comm, 307 S Penn, Wheeling WV 26003. 304-233-8856.

Tellabs dual wideband repeat coil module 4425, still in box; (2) dual row patch bay, Richard Lynn, 615-458-6616.

Gates 20" XX19" equip racks (2); (15) various sized metal cart racks; Gates 6" equip rack. Richard Lynn, 615-458-6616.

Harmon-Kardon mixers, new DPR7; Meissner mixer five inputs-battery; Cannon plugs, 3 prong, male & female; 40 new tubes & resistors cheap; Lafayette TE22 audio gen; Sen-core transistor & diode tester; manuals for Ampex, Pultec, Altec & others. Mr. Oliver 212-874-7660 in afternoons.

Grampian cutter heads, 1D feedback (tand-berg); patch bays (4) 24 inputs single, also patch cords; Daven 600 ohms attenuators (silent) (8) excel; Presto 6N cutter lead screws; Edital blocks for recorders 1/2"; EV 12TRX speakers (2) & cabinets. Mr. Oliver, 212-874-7660 in afternoons.

Grampian cutter heads, 1D feedback (tand-berg); patch bays (4) 24 inputs single, also patch cords; Daven 600 ohms attenuators (silent) (8) excel; Presto 6N cutter lead screws; Edital blocks for recorders 1/2"; EV 12TRX speakers (2) & cabinets. Mr. Oliver, 212-874-7660 in afternoons.

Elgar HIT-H7.5 120/240 V, 7.45 kW isolation transformer, excel cond, \$2600; Sonex brown flame retardant sound treatment, 400 sq ft, 3" thick, also 50 sq ft of virgin brown 3" Sonex, w/some access holes, gd cond; Penn-Fab grey 2" & 3" sound treatment, over 300 sq ft, few panels w/access holes; also limited amount of hard-to-get 2" blue PennFab avail, box of 50sq ft at \$85. A Reis, 308 Eastgate Ct, New Lenox IL 60451. 815-485-7377.

Conex AS-101 (2) audio switchers, excel cond, \$695; Conex AS-501 relay board, \$175; Conex RS-232 interface, \$99; Conex CS-25B-10 dual 25 Hz sensor, \$199. Jim, 1-800-366-5770 X1.

ESE 190 station master clock w/spare impulse driver, battery backup, WWV rcvr, ESE digital slave & impulse driver output, no slaves, \$700; Belden 8766 wiring, 15-pair cable for interstudio or patch bay wiring, lengths from 50 to 125', clean ends, like new, \$1.50/ft; Audionics Phase Audio console mount studio furniture, (3) wall mounted studio console tables, two never used, call for details, \$400 ea. A Reis, 308 Eastgate Ct, New Lenox IL 60451. 815-485-7377.

Rotron Blowers for Eloom, CCA, CSI, McMartin, Harris, rebuilt & new. Goodrich Enterprises Inc. 11435 Manderson St., Omaha, NE 68164 402 493 1886 FAX 402 331 0638

Harmon-Kardon mixers, new DPR7; Meissner mixer five inputs-battery; Cannon plugs, 3 prong, male & female; 40 new tubes & resistors cheap; Lafayette TE22 audio gen; Sen-core transistor & diode tester; manuals for Ampex, Pultec, Altec & others. Mr. Oliver 212-874-7660 in afternoons.

Want to Buy

Wire marking machine. M Starin, WJYJ, 457 Varney, Manchester NH 03102. 603-625-1165.

Digital VT Series video terminals & key-boards. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

RCA Broadcast News, especially 1955 and earlier. Russ Hamnett, KNAU, Flagstaff AZ 86011. 1-800-523-8870.

Jazz record collections, 10" LP/12" LP bebop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, NNYN 10003. 212-674-3060.

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Want to Sell

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General Radio 681-B AM freq deviation meter. K Hart, WIEZ, RD 3 Box 1414, Millfintown PA 17059. 717-436-9089.

Motorola 1310 AM stereo mod mon in excel cond. G Ciapper, KKGK, POB 9032, Gresham OR 97030. 503-667-1230.

McMartin FM mod monitors, TBM3500B main chnl, TBM2200A stereo, TBM2000B SCA, TBM4500A, all or part tuned & tested. Goodrich Ent, 11435 Manderson, Omaha NE 68164. 402-493-1886.

Bird 3128 wattcher alarm/RF power monitor, up to 10 kW, 450 kHz to 2300 MHz, mint cond w/manual, \$350. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Belar FM mod monitors, FMM-1, FMS-1, SCM-1, RFA-1 all clean & current calibration; McMartin TBM3700, TBM2200 FM mod monitors. R Lankton, WDUV/WBRD, 813-749-1420.

McMartin 5500 aural mod monitor, TV chnl 6, \$250 plus UPS. J Crawley, WLSK, Box 680, Lebanon KY 40033. 502-465-5762.

Belar AMM-1 AM mod monitor, clean & works fine, \$450. P Wolf, WZCR, 2010 San Carlos Blvd, Ft Myers Bch FL 33931. 813-574-5548.

TFT 760 EBS system w/AM rcvr, tone gen & decoder, gd cond; McMartin TBM 2200 stereo monitor & TBM 4000A FM/SCA monitor, American made, vintage, FCC type approved w/manuals, BO. B Webster, WLIT, 150 N Michigan, Chicago IL 60515. 312-329-9002.

Potomac AMO—19D 6-tower DA-2 digital antenna monitor, \$3800. Sony PVM-8200T professional color monitor, \$900. Sony BVE-800, \$400. Tektronix 1420 NTSC vectorscope w/case, \$2100. L Morton, 805-733-4275.

Want to Buy

Any older McMartin mod monitors. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

MOVIE PROD EQUIP

Want to Sell

Mitchell 16 standard w/acc, mags, lens, motors, cases, mat box, very clean, \$3500. G Sive, Your Video Conn, 31844 Rancho Amigos Rd, Bonsall CA 92003. 619-749-7662.

Bell & Howell Ringmaster 821A & 16mm projectors, 00 Series, \$300-\$400; also Neumann Super X 16mm power rewind, \$375. Katherine, Linden IN, 229 N Henry, Alexandria VA 22314. 703-524-4424.

RECEIVERS & TRANSCEIVERS

Want to Sell

Grundig Satellit 650, 1.6-30 MHz, 30 W audio, 60 memories, quartz clock, like new, original box, \$650. R Thomas, Rebel Recdg, 5555 Radio Ln, Jacksonville FL 32205. 904-388-7711.

High quality micro-miniature 67 kHz SCA decoder, about 1" square, protected & ready to install, \$15. D Jackway, 5742 Fair oak, Springfield MO 65810. 417-881-1846.

Heathkit FM-4 FM tuner in desktop metal cabinet; Fisher FM-90X FM tuner, signal strength meter, high impedance outputs. K Hart, WIEZ, RD 3 Box 1414, Millfintown PA 17059. 717-436-9089.

McMartin TRE6B (6) SCA rcvrs on 67 kHz, all solid-state, simple crystal change to your freq. P Lierman, KCSP, 601 W Collins Dr, Casper WY 82601. 307-265-5414.

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Johnson mobile/base/handheld two-way radios at discount prices, new. Mobiles, 15 W UHF, \$399, 35 W UHF, \$495, 25 W VHF, \$385. W Hohnstein, Deremer Radio, 33 Mai, Seward NE 68434. 402-643-3338.

REMOTE & MICROWAVE EQUIP

Want to Sell

Micro Controls PTS-10C composite STL, 9490 MHz, excel cond, \$2000; Micro Controls DRCR-9 remote control, \$1500; Micro Control 2001T/R 455.02 MHz STL, \$1000. M Persons, KKIN, POB 930, Aitkin MN 56431. 218-829-1326.

Pulse Dynamics remote bdct telephone w/(4) mics & one aux level input, \$100. M Persons, KKIN, POB 930, Aitkin MN 56431. 218-829-1326.

Moseley PCL606C composite rcvr only, excel cond. Goodrich Ent, 11435 Manderson, Omaha NE 68164. 402-493-1886.

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Scientific Atlanta 7325 digital processing unit w/150 digital audio decoder & voice cue decoder; 7300 wideband BPSK rcvr w/vari-ous crystals, \$5500. G Ayers, WWIT, POB 1369, Canton NC 28716. 704-648-3588.

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Gates Attache 70; custom made 5 chnl remote mixer. K Hart, WIEZ, RD 3 Box 1414, Mifflintown PA 17059. 717-436-9089.

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Marti RPT-2 dual freq, gd cond, \$800 plus shipping. R Kerbawy, WTNJ, Box 1127, Beckley WV 25802. 304-877-5592.

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Marti STL-8 (2) xmtrs & (2) rcvrs for stereo STL system, will reset to your freq, \$3500. J McKinley, WJMR, 155 N Main, Fredericktown OH 43019. 614-694-1577.

Marti M-30B xmtr & matching receiver on 170.15 MHz, works, \$500. G Smith, KORQ, 915-673-2545.

Marti RPT-25 & R-50450 xmtrs & rcvrs set up for stereo, 450.925 & 455.925, recently factory re-aligned, \$2400/all or BO. G Fullhart, WVKS, 4665 W Bancroft, Toledo OH 43615. 419-531-1681.

Andrew PL 619 C, 6' solid reflector dish w/feedhorn & mount, for TV use in 1.9-2.3 GHz band, \$1400. A Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

Fairchild Dart 384 w/1 audio card & 350 converter; McCurdy card & DIC 1, 1 year old, no manuals, \$3750/BO. Klay Anderson 1-801-580-5529

Microdyne 1100-PCDR (5) satellite demodulator/receiver, SCPC, freq agile, compandered, 70 MHz input, excel cond, only one rack unit high, \$1200/BO, you ship or pick up. T Adams, New Wisconsin Radio Reading Service, POB 5541, Madison WI 53705.

Scientific Atlanta DAT-32 w/75 & 1.5 stereo card, also cue. Dale, NW Talk Radio, POB 68088, Oak Grove OR 97268. 503-774-0459.

Moseley TRC-15 for 10 kHz subcarrier w/Hallikainen digital display & ITO-177 computer interface, fair cond, \$400. G Falutz, WZMX, 905 Wetherfield, Hartford CT 06114. 203-296-1175.

Symetrix T1-101 telephone hybrid, \$300. M Persons, WJY, Box 706, Brainerd MN 56401. 218-829-1329.

AVQ-10 Weather Radar. Complete systems, many operational, some for parts. Plus full set test equipment, manuals, etc. Priced extremely reasonably for immediate sale. KRES, 300 W. Reed, Moberly mo 65270. 816-263-1600.

Want to Buy

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TV satellite uplink, prefer Ku-band, exciter, HPA, etc, truck unimportant. Ugly George Satellite TV, 314 W 52 St, Nyny 10019. 212-677-2200.

Fairchild Dart-384 7.5 kHz dual audio module. J Cole, WBTM, 710 Grove, Danville VA 24541. 804-793-4411.

Any Ku-band TV satellite uplink, portable or not, prefer Ku-band. U George, Satellite TV, 314 West 52nd, NY NY 10019. 212-969-0240.

QEI 7775 FM ATS. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

STATIONS

Want to Sell

Partners/Investors wanted for new high-power FM in mountain states & for AM/FM combo in deep south, \$10K minimum, serious inquiries only. L Fuss, KOZZ, POB 159, Fayetteville GA 30214. 404-460-6159.

10 kW clear channel AM & Class A FM, can be upgraded to Class C-2.50 kW, either of both, owner financing possible to qualified buyers. 501-470-1525.

FM 67 kHz subcarrier avail, Class A FM station xmtr locate in Queens County, NY, greater Nassau, Queens, Westchester & Southern Connecticut coverage. J Caracciolo, WDRE, 1600 Stewart, Westbury NY 11590. 518-832-9400.

Midwest FM (2), upgrade avail to C-3, will finance w/down; also (1) AM FT, serious inquiries only. Radio, POB 459, St Charles MO 63302.

Class B FM in Northern California, 3 county coverage, BE automation system installed, AC format. R Trumbo, KNLF, POB 117, Quincy CA 95971. 916-283-4144.

CPs for AM/FM combo located in resort area between major Montana markets, 10 kW AM, 50 kW FM w/possible upgrade, some equip included in package, BO. H McDonald, Broadcast Associates, POB 607, Veradale WA 99037. 509-924-8298.

Olympic City/Atlanta Metro, AM station w/10 acres of land at tower/xmtr site & all station equip, \$350,000. PO Box 52682, Atlanta GA 30355.

AM & FM radio stations for sale in Central Arkansas, selling all or part, some financing. 501-376-0880 week days, 501-470-1525 nights/weekends.

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Financing wanted for stereo AM, CP obtained, will serve 3 major markets in SE Arizona. Rex, 1121 Plaza Azul, Sierra Vista AZ 85635. 602-458-5431.

LPTV CP in Ladysmith VA, hits Richmond, 800 W. chnl 40. 703-569-5308 leave message.

Want to Buy

Looking for AM, FM, or combos to take over with no down. J Ballard, ALL Prod, POB 1786, Apl Vly CA 92907. 619-2617787.

Seeking financing assistance for station start-up, willing to get started but no collateral or money. J Ballard, ALL Prod, POB 1786, Apl Vly CA 92907. 619-261-7787.

Small AM in California, troubled or oark OK, owner financing. Baoul Scavullo, +15-584-1027.

STEREO GENERATORS

Want to Sell

RCA BTS-101 (2); RCA BTX-101 SCA. R Lankton, WDUV/WBRD, 813-749-1420.

Moseley SCG4-T 67kHzSCA gen (2), \$250. P Wells, KJQY, San Diego. 619-231-1037.

BE AX10 & AS10 AM stereo gen & monitor w/manuals, BO. S Murdoch, WFNS, 7201 E Hillsborough, Tampa FL 33610. 813-620-9100.

AEL 2203 in gd cond, \$400; RCA BTS-1B in vgc, \$600; Wilkinson SG-1E in gd cond, \$450. J McKinley, WJMR, 155 N Main, Fredericktown OH 43019. 614-694-1577.

Want to Buy

Low pass filter 53 kHz low pass filter for Collins 310Z-2 exciter/stereo gen, urgently needed. J Pearce, KSSS, 2864 S Circle Ste 150, Colorado Springs CO 80906. 719-579-0680.

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Panasonic WJ 540P B&W, \$15C D Hurd, Harding Univ, Box 853 Station A, Searcy AR 72143. 501-279-4658.

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Fidelipac 300 gray carts (200), \$1 ea or all for \$150. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

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Bdct training school for underprivileged needs any AM bdct equip for training students unable to attend regular bdctg schools, able to pay shipping on small items. F Smith, The Bdct Training School For the Underprivileged, 2408 Chamberlain, Chattanooga TN 37404. 615-6247126.

Capital Children's Museum needs mics, headphones, CD players, Hi-8, VHS & 34" cameras, decks & access. C Grothe, Capital Children's Museum, 800 3rd St NE, Washington DC 20002. 202-675-6872.

Equip for non-profit educ FM in SD needed incl cart machines, bdct console, will also trade. C Hubbeling, KTEQ, 501 E St Joseph, Rapid City SD 57701. 605-394-2231.

Equip donations for non-profit organization, 10,000 W AM, new 50 kW FM, 88.5 MHz, including studio microwave & xmtr. W Goforth, WBHY, POB 1328, Mobile AL 36633. 205-432-8484.

5 kW FM xmtr, 2 element antenna, RF wattmeter, 200' coax, sat rcvr equip. T Hunt, KILA, 2201 S 6th, Las Vegas NV 89104. 702-731-5452.

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Monte Vista Christian School, would appreciate any donations of used TV broadcast equipment. T Quinn, 408-475-0423.

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Tek 1L20 spectrum analyzer plug in module in mdl 132 portable pwr supply unit; Singer MF 500/UR-3 spectrum analyzer; B & W 410 dist meter. R Lankton, WDUV/WBRD, 813-7491420.

RMT 506 mainframe, rack mount w/DM-502A freq counter, SG-505 audio signal gen, SC-502 oscil & AA-501 audio analyzer, avail late January, BO. J Bisset, Multiphase Consulting, 703-379-1665.

Sony-Tek 335 dual trace portable oscil, w/case, probes, manual, like new, \$750. B Dorsey, TVS, 195 Tenth Ave, Nyny 10011. 212-675-0437.

Eico 425 push pull oscil; Eico 1032 regulated pwr supply; 12 V pwr supplies, (2) separate units; Eico 1120 capacitor substitution box; Waveforms mdl 510-B oscil; RCA IF7084 small parts drawer cabinet; B&K DynaJet 607 tube tester in portable case; Precision 612 tube tester; B&K 907 transistor equip analyst; Precision E-200-C signal gen; US Army Signal Corps BC-221-N freq meter. K Hart, WIEZ, RD 3 Box 1414, Mifflintown PA 17059. 717-4369089.



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HP 5245L electronic counter & HP 5253B freq converter, \$275/both plus \$20 shipping. M Gollub, WMJS, Box 547, Prince Frederick MD 20678. 301-535-2201.

Tektronix 555 quad-trace oscilloscope w/pwr supply & roll around cart, \$600. J McKinley, WJMR, 155 N Main, Fredericktown OH 43019. 614-694-1577.

Radio Design Labs ACM-1, new, in factory box, for use in monitoring AM noise in FM xmtrs, \$1250 prepaid/insured UPS. D Peluso, KJUL, 2880 E Flamingo, Las Vegas NV 89121. 702-732-2200.

Tek 528 waveform monitor, strong tube, recent calibration, all paperwork, \$800. G Sive, Your Video Conn, 31844 Rancho Amigos Rd, Bonsall CA 92003. 619-749-7662.

Leader waveform monitor w/matching vector scope; field intensity meter mod BW-7A 50-270 Mz AM & FM. Dale, NW Talk Radio, POB 68088, Oak Grove OR 97268. 503-774-0459.

Technics SH-3433, 4-chnl audio scope, simple oscilloscope, FM multipath scope, \$300/BO. Alan, Calvery Baptist, 1380 Valley Forge Rd, Lansdale PA 19446. 215-368-4444.

Radio Design Labs ACM-1 AM noise monitor for FM, demo unit w/factory warranty, \$1095. Jim, 1-800-366-5770 X1.

Hewlett-Packard 8591A 9 kHz digital spectrum analyzer w/tracking generator, RS-232 interface, storage cards, AM/FM demodulator, \$18,500. Delta OIB-1 RF operating bridge w/18" leads, \$1900. Hewlett-Packard 7470A digital plotter, \$500. Holaday Industries HI-5000SX system including HI-3002 isotropic broadband field strength meter, E-field, H-field & low frequency H-field probes, HI-3320 datalogger, backpack, printer & case, \$5200. Portable LORAN-C locator, \$400. General Radio 1211-C 0.5-50 MHz unit oscillator, \$300. L Morton, 805-733-4275.

Want to Buy

Complete board A3, reciprocal amp for HP 8690B sweeper; also want 8699B & 8699B plug-ins. Herb, CFQC TV, 216 First Ave N, Saskatoon, Sask S7K 3W3, Canada. 306-249-1656.

Book for Radio Specialties 1163-50-5 FM deviation meter, M Persons, KKIN, POB 930, Aitkin MN 56431. 218-829-1326.

Potomac Instruments FIM-41 field intensity meter. F Spaulding, 883 San Simeon Dr, Mtn View CA 94043. 415-961-5018 voice/fax.

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Harris 5 kW FM w/MX-15, gd cond, \$14,500. P Wolf, WZCR, 2010 San Carlos Blvd, Ft Myers Bch FL 33931. 813-574-5548.

Continental 816R-2B 10 kW FM, less exciter, never turned on, avail immed. B Dean, KXKT, 1108 Douglas, Omaha NE 68002. 800-736-3835.

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CCA FM10DS FM exciter needs crystal, BO; CCA SG-1D stereo gen, BO; Moseley SCG-9 stereo gen, BO. C Larko Prod, 916 Fairfield Ave, Ft Wayne IN 46802. 219-424-2405.

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Harris MS15 FM exciter or equiv, 91.1 wbmopposite input, with or w/o stereo or SCA cards, to \$1000. A Hagler, KMUD, POB 135, Redway CA 95560, fax: 707-923-2655.

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