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Radio World®

Vol 15, No 17

Radio's Best Read Newspaper

September 11, 1991

NAB Shift May Help In-Band

by Judith Gross

WASHINGTON Now that the NAB has had a change of heart about in-band DAB systems, it seems likely that support and investment as well as new sys-

tems proponents will surface.

At the end of July, six months after the NAB's Radio Board unanimously endorsed Eureka 147 DAB and approved efforts toward a joint NAB-Eureka licensing agreement, the association's DAB

Task Force announced that the position would be "modified."

The change reflected growing conflict from radio group owners, many of whom opposed the NAB's DAB policies openly in letters to the FCC.

Just before the DAB Task Force was to sit down for two days of presentations from four additional DAB proponents, a Radio Operators' Caucus meeting in Washington brought the controversy to a climax.

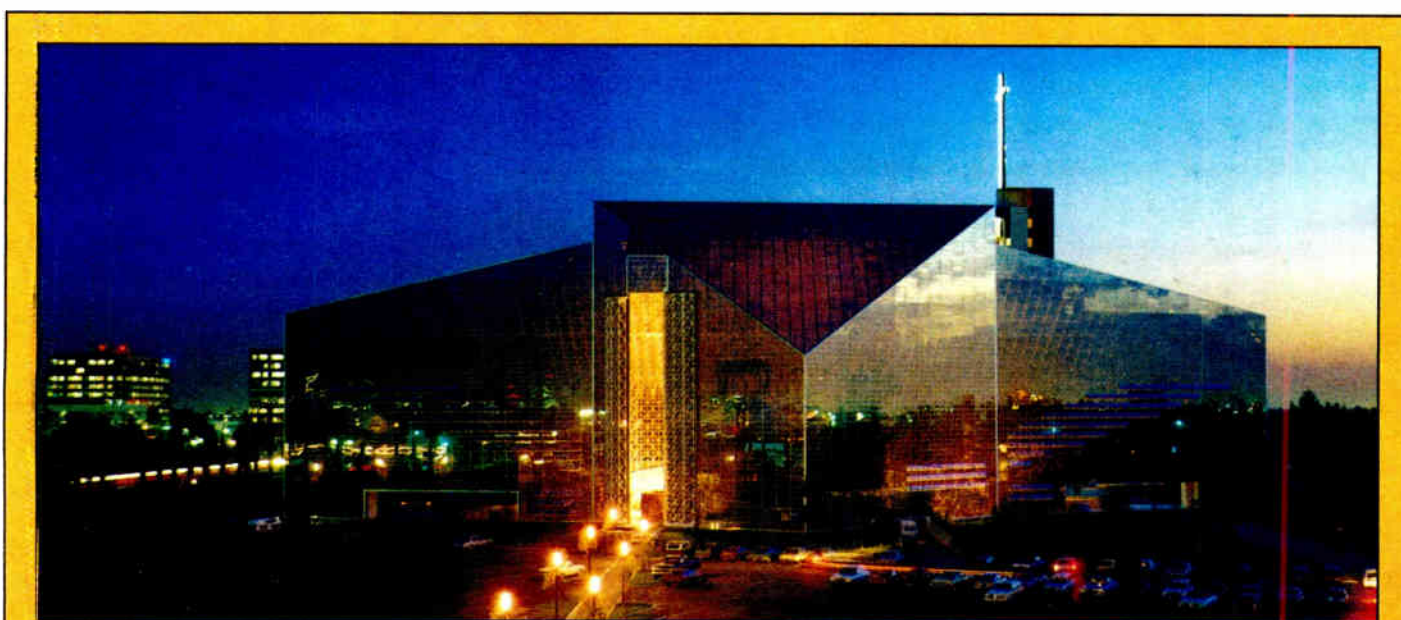
"Parity is the real burning issue with most owners," Radio Ventures' Jerry Lyman noted. "Elevating inferior facilities to the level of big stations is very troublesome for those who want to protect their investments," he said.

Shamrock's Bill Clark, noted that his station in Phoenix, KMLE, had informally surveyed listeners about the signal quality of FM. "The perception among 47 percent of those listeners was that the FM is already as good as CD-quality," Clark said.

Other ROC members voiced concerns about the number of stations per market increasing if Eureka is adopted. Jacor's Randy Michaels asked if the NAB had considered the enormous impact of such a result.

"The threshold question is the economic dislocation issue. In Atlanta, the 14 signals that are there now could become five times that," Michaels said. He echoed the sentiments of others when he asked, "Why can't the NAB run a

(continued on page 8)



Spreading the Word:
LPB helps reach listeners outside the Crystal Cathedral, p. 13.

No Mobile In-Band Demo at Radio '91

Systems Are Not Yet Ready to Be Shown

SAN FRANCISCO There will be no mobile demonstration of in-band DAB technology at this year's Radio 1991 show, slated for Sept. 11-15, here.

Even though the radio industry—and even the NAB—has warmed to the prospect of in-band digital for both AM and FM, the only in-band system to be demonstrated so far is not far enough along for a mobile demo, according to in-band system developers.

"It would have cost \$800,000 to do a mobile demo of the Acorn (USA Digital) system," said Tony Masiello, director of technical operations for CBS Radio. CBS and Westinghouse are working on the system developed by Gannett and Stanford Research Institute, although there is no formal contract between the three groups.

"We'd rather spend that money to de-

velop the technology further, then set up a mobile demonstration once it's in a form that can be most useful to broadcasters," Masiello said.

He noted that the technology for Gannett's Project Acorn AM and FM DAB systems has been in use in military applications for several years, but at a cost different than for broadcast use.

"If we rushed a mobile demo at the radio show, we wouldn't have been able to bring the technology down to that cost efficient level yet, so it would only have been for show," Masiello added.

He said Acorn's researchers are currently working out the signal extraction portion of the system and getting it ready for mobile testing. Masiello said that the most likely Acorn demo for the Radio 1991 show will be similar to the one at the spring NAB show in Las Vegas, "with perhaps a little more work on the multipath reduction."

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NEWS BRIEFS

DAB Demo Is On

SAN FRANCISCO Radio 1991 convention attendees will likely get a chance to hear a mobile Eureka 147 DAB demonstration similar to the one at the NAB's spring show, according to the NAB.

Although FCC approval for the experimental broadcasts is

pending, NAB Staff Engineer Kelly Williams said DAB equipment has been found for the show. The NAB previously was not sure if it could have Eureka equipment on hand because of a scheduling conflict with a European consumer show.

The San Francisco demo will consist of A/B comparisons between the FM and DAB signals

during coach bus rides through various parts of the city, using a stereo feed from KOIT and a demo tape. The DAB booth at the convention center will also receive five different formats of DAB material.

The signal will be broadcast on UHF channel 52, 3.5 MHz wide with up to 500 watts maximum power. The antenna will be located on Mount Suttro with an actual height of 1,400 feet above sea level.

Williams noted that the DAB will get a more rigorous multipath test during the radio show

than it had in Las Vegas because of the numerous hills and tall buildings in San Francisco.

NAB to Kick Off AMAX

WASHINGTON The NAB will kick off its improved AM receiver campaign at Radio 1991 in San Francisco launching a promotional program for the new "AMAX" certification.

The EIA and NAB agreed to promote improved AM radios earlier this year through the voluntary AMAX certification

mark. AMAX radios will have such features as 7.5 kHz frequency response, external antenna connection, noise blanking, expanded band and bandwidth control. A separation designation will be affixed to AM stereo radios (AMAX Stereo).

The campaign will officially kick off Oct. 1. NAB officials said more than 1,100 stations will participate in the promotion through solo promotional spots and joint spots with electronics retailers in their markets.

FCC Says No to Drugs

KINGSTREE, S.C. The FCC has upheld its revocation of WCBC's license, finding that Williams County Broadcasting Corp. is "unqualified" to remain as the station's licensee because of the drug conviction of one of its chief stockholders.

The initial decision to revoke WCBC's license was based on a cocaine possession/intent to distribute conviction of controlling stockholder Gregory Knop. Knop also admitted to bribing law enforcement officers and lying to a sentencing judge, the FCC said.

"Illegal" Rock On International Band

ERIE, Pa. The FCC recently took action against an illegal station broadcasting rock music on 7415 kHz, a frequency reserved for International Fixed Public Radio broadcasts.

Erie resident Mark Radecki was fined \$1,000 after the FCC pinpointed the location of the station through the efforts of the Buffalo, N.Y., field office and the agency's nationwide monitoring network.

Mid-Year Station Totals

WASHINGTON As of July 31, 1991, there were 10,943 commercially licensed radio stations in the U.S.

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Circle 60 On Reader Service Card

Cheney Opposes L-Band Use

by Arthur Cole

WASHINGTON Fearful of relinquishing spectrum valuable to the military, Secretary of Defense Dick Cheney has spoken out against releasing L-band for DAB.

Cheney recently fired off a brief letter to Commerce Secretary Robert Mosbacher saying he was opposed to turning over the L-band spectrum to commercial radio.

The FCC currently is attempting to have the U.S. support some L-band and some S-band spectrum for DAB broadcasting at the upcoming World Administrative Radio Conference (WARC) next year. The Commerce Department, through its National Telecommunications and Information Administration (NTIA), which oversees the Voice of America broadcasts, is also expected to make an L-band recommendation.

The State Department is expected to rule on the U.S. position this fall.

Critical spectrum

In the letter, Cheney called the L-band a "critical portion of the radio frequency spectrum" that is "heavily utilized" by the defense department for telemetry purposes.

"The reallocation of the telemetry frequency spectrum will have a severe impact on weapon systems development,

testing and the integration of new technologies used in Department of Defense airborne weapons platforms," the letter said.

According to one congressional source,

... he was opposed to turning over the L-band spectrum to commercial radio.

the Cheney letter was prompted by concerns over pending legislation that would turn over 200 MHz of government-held spectrum to commercial use.

"Defense is basically saying, 'We will not give up any more of our spectrum. This is where we draw the line,'" the official said.

A spokesman at the NTIA said Mosbacher replied to Cheney's letter by stating that the Commerce Department will continue to work with the FCC to try to find another spectrum for DAB.

"We are not supporting a reallocation of L-band frequencies," said Richard Parlow, associate administrator of spectrum management at NTIA. "There are other DAB proposals that we feel are more reasonable.

"We are going back and forth with the Commission," he said. "We've made

proposals to locate DAB, at least the satellite portions, in the S-band (2310 MHz). And there are a number of promising in-band solutions for the terrestrial portion."

Touchy issue

On Capitol Hill, staffers said legislators are still wrestling with the DAB question. Rep. John Dingell (D-Mich.), chairman of the House Energy and Commerce Committee, is said to be undecided on the L-band issue.

"He hasn't taken a public position yet," said Dingell spokesman David Leach.

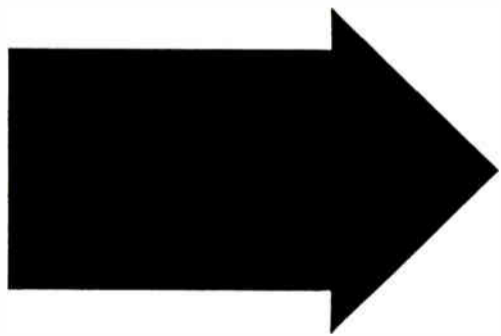
"But he is concerned about the commercial implications of withholding L-band."

Because of the government resistance to giving up L-band, groups who had thrown their support behind L-band have softened their position.

The NAB has opened the door to a compromise between the pro- and anti-L-band camps within its ranks by allowing in-band supporters to make a pitch to the DAB Task Force.

The NAB board had previously unanimously endorsed the European Eureka 147 DAB system, which would utilize the L-band.

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Circle 128 On Reader Service Card

DAB and HLT Are H-O-T in S.F.

by Judith Gross

FALLS CHURCH, Va. "We should have begun every session title with either DAB, HLT or time brokerage," said NAB executive director of operations John Abel.



He was talking about the radio show and those are the hot topics, all right. We'll be hearing the buzz just about now in the City by the Bay, where I hope there ain't a whole lot of shaking (or quaking) going on while we're there for Radio 1991.

After much criticism of the spring NAB Eureka DAB bus demo, "some improvements have been made," NAB says. But frequencies are so scarce that there won't be an experimental FM available to compare taped formats between Eureka and FM.

Instead the demo will compare live programming from KOIT-FM with Eureka DAB. Should be enough multipath in Frisco, but there'll be a gap filler on hand just the same. The Eureka folks had to rush the gear from Berlin where it was appearing at a large consumer electronics show.

The NAB folks say this demo will be better than Vegas, so let's hope there are no rap lyrics to embarrass the more delicate among us.

And let's hope there's nothing else to whine about after we take a few rides. Although I'm sure we can always find something if we try real hard.

The Eureka demo will be done at 751 MHz—no L-band until this October in Washington, D.C. There, I told you we could find something to criticize if we thought about it for say, half a

second or so.

Two in-band systems will have booths, although Acorn will probably more or less duplicate its Vegas showing, since work on the mobile part of the system continues.

But we'll get at least a preliminary run-down of the American Digital Radio system. Radiotechniques' Ted Schober is going to let broadcasters envision a DAB station of their very own and see how it plots on an allocations map. No hardware yet, though.

And oh, yes, they wanted to devote a session at the convention to the shock jocks. No kidding. They were going to call it *Controversy Versus Good Taste*. But son of a you-know-what, none of the controversial types wanted to get on stage and debate the issue.

Or maybe, nobody wanted to get up there and be ripped into dirty little pieces by them. Anyway, there won't be any debate on the issue of taste, after all, and the session has been renamed *What Management Needs To Know About High Profile Talent*.

I'd just as soon call it "Keep the moneybags and mouth soap handy," but those folks who name the session have no sense of the absurd.

Good taste on the airwaves brings to mind my old pal Cousin Brucie, who, it seems, will gain immortality in, of all places, *Archie Comic Books*.

The CBS Radio folks, who bring the Cuz's radio program to a still-adoring public, wanted to let me know that Brucie was heading to Riverdale High for a special October issue of the comic book series.

Yeah, it's a sock hop full of suspense, featuring (who else?) The Archies. You remember, "Sugar, Ah Honey Honey . . ." All right, so I was once a teeny-bopper. So sue me.

Anyway, it's nice to see that radio still has the hearts of the country's teens, at least in Riverdale. Now, what I want to know is, how come Archie and Reggie and Jughead (not to mention Betty and Veronica) never get old enough to gradu-

ate and go to college? Is it anything like Zeno's paradox?

Another interesting campaign kicking off in San Francisco at the Radio Show, by the way, is the AMAX promotion. NAB says stations have pledged some \$20 million in ads for the new, improved receivers, designed to show folks that AM doesn't hafta sound bad.

In order to get the AMAX mark, an AM receiver has to comply with the NRSC standard and distortion receiver standard



WCBS's Cousin Brucie hosts a Riverdale High sock hop. . .

IS-80. It should have a frequency response of at least 7.5 kHz for stationary and 6.5 kHz for mobile listening.

It also needs tuning for narrowbanding under noisy conditions (manual or automatic), must have AM noise-blanking, external antenna and expanded AM band capability (to 1705 kHz).

Stereo is not, unfortunately, part of the service mark description. But if the manufacturer puts it in, it will be called (surprise): AMAX Stereo.

Now this is not just more whistling in the dark about AM. Some auto receivers already have them (without the logo, yet) and we'll find out which ones as the campaign gets underway.

In a way, you might say it's a bit historic. Stations and receiver manufacturers getting together and agreeing on a joint effort. Sets a good precedent for the tech-

nologies of the future, don't you think?

OK, now I've heard everything. We've had all-Elvis, all-news, all-comedy. How 'bout: all-commercials? That's right, all spots, all the time.

Well, it's being done down in Adel, Georgia, where new owner John Williams took the WDDQ-FM from country to all-commercial. No music, just ads. It seems he owns the real estate around the Adel exit off I-95.

No, not just the real estate, but the HoJo's, Truck Stop, Econo-Lodge, Days Inn, gas station and clothing store surrounding the exit. And what a nifty way to get tired, hungry, threadbare, shop-happy motorists running on empty to part with their hard-earned bucks!

The spots are run through the PC-based Smartcaster supplied by Broadcasters General Store. Williams is about to undergo a Class A upgrade to 6

kW, and yeah, he wants to sell national spots, too.

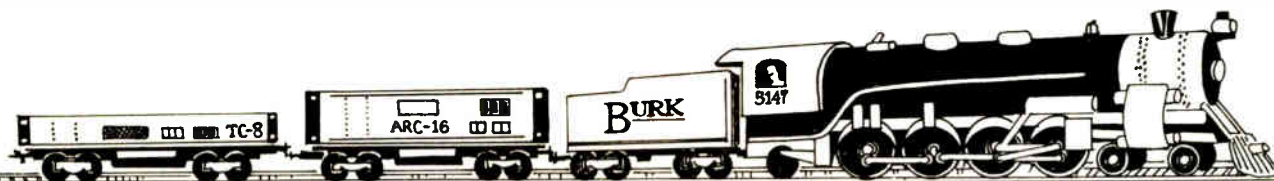
And I guess he is providing some sort of public service for the weary traveler. So who's complaining? Maybe this format will catch on. Then again, maybe they should call it the "all-annoyance" format.

Oh yeah, and I was glad to see that the cause of democracy and positive change prevailed in the Soviet Union. Felt especially good after meeting that nice crew from Gostel Radio at last year's Radio Show.

Of course, I was getting all ready to commandeer a pirate ship and set sail to go blast them full of hard-hitting, good ole American rock 'n' roll. But I guess that won't be needed, now.

Any metal-heads out there want to buy a skull and crossbones banner, cheap?

Heard a juicy tidbit? Spill your guts to Earwaves by faxing JG at 703-998-2966 or writing to P.O. Box 1214, Falls Church VA 22041.

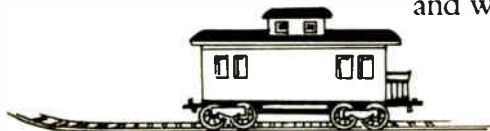


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Wideband processing? No thanks

Dear RW,

With all respect to Randy Johnston (RW, July 24, 1991), multiband audio processing is here to stay.

Back in the early to mid 1960s, most AM and FM stations used wideband processors (generally an Audimax followed by a Volumax) and were able to achieve loud, highly compressed sound.

Multiband processing was devised as a method of eliminating some of the undesirable artifacts of the wideband processors while still permitting very high levels of average modulation (and the resulting increase in loudness).

It's true that multiband processing can change the spectral balance of some source material. It will, however, preserve the dynamic resolution.

A wideband processing system maintains spectral balance at the expense of dynamic resolution. As an example, imagine feeding the 1812 Overture, from CD, into a wideband processor. The canon "hits" will totally obscure anything else on the recording until the processing system recovers.

With a multiband processor, only the low frequency bands will be driven into heavy

compression. The other audio bands will continue to process normally while the low frequency amplifiers recover.

As an option, a wideband system can be adjusted to "gently" process the incoming audio. This method will preserve the dynamics at the expense of loudness. I don't know about you, but I don't want my stations to be "Black Holes" in the middle of the dial.

Back to wideband audio processing? Thank you, no.

Frank Berry
Director, Tech. Operations
WQYK AM/FM
Tampa/St. Petersburg, Fla.

Seeking contacts with Armstrong

Dear RW,

I am currently researching a 40-minute feature to be broadcast on BBC Radio 4 which would examine the events surrounding the death of Edwin Howard Armstrong, inventor of the FM transmission system. The program will be a tribute to a man who was owner of patents earning millions of dollars in royalties, who died believing he was a failure. It was 13 years after his death in 1967, and some 17 years after the last of his patents expired, that Armstrong's legal claims were finally and fully vindicated.

I am presently trying to contact anyone who might have known Armstrong, worked with him or who might have some family connection. Whilst we have access to tape recordings of early sound tests in order to make the program a viable proposition, it is essential that we talk to someone who will be able to help us tell Armstrong's story.

If any RW readers have had any connection with Armstrong, they may write me at British Broadcasting Corporation, Broadcasting House, Whiteladies Road, Bristol BS8 2LR, England. They can telephone me at 011-44-272-742160 or alternatively by fax on 011-44-272-730793.

Jaclyn Parry, Researcher
BBC Radio 4
Bristol, England

Respond to the EBS NOI

Dear RW,

John Gatski's article (RW Aug. 7, 1991) on the FCC deadline for EBS comments (Dec. 31, 1991) is an excellent review of the 12 page Notice of Inquiry. Emergency communications are an indispensable part of the broadcast engineer's art, and one practical expression of the compassionate side of our profession's nature.

The NOI selected four systems as having promise as a replacement for the EBS; however, the door is open to any other contestants. One of the entries—which the FCC calls the ICEBS (Improved Colorado EBS)—is in fact the EAS (Emergency Announcement System) first covered in the Aug. 22 and Sept. 12, 1990 issues of RW. RW was kind enough to facilitate making this specific technology public domain.

Many of us gripe legitimately about the faults of the EBS. We engineers do

If you grab a tiger by the tail, you have to keep moving or risk getting mauled. With DAB, only some quick backpedaling has kept the NAB from being overpowered by the technology it sought to control.

The NAB's early embracing of the Eureka system at L-band elicited a groundswell of vocal opposition so widespread that the association was prompted to bow to the will of the majority and look into in-band alternatives.

At a minimum, the NAB suffered some loss of face among broadcasters for trying to steamroll Eureka past an industry unwilling to accept it as the only choice for DAB. A letter-writing campaign spearheaded by Sconnix's Randy Odeneal—perhaps the most outspoken of Eureka's detractors—led the NAB to concede that in-band DAB should be considered on a parallel track to the L-band system.

A Tiger By The Tail

In what must be seen as a victory for the in-band contingent, the NAB's DAB Task Force has reviewed presentations from in-band proponents, and Project Acorn and American Digital Radio have been invited to provide information on their systems at the Radio 1991 convention, which starts today.

The backlash from broadcasters has had one positive effect for the NAB: It has positioned the association once again as a forum for emerging technology, rather than exclusively as a system proponent. By its recent actions, the NAB has been able to deflect some of the criticism it has taken for its role in Eureka's development.

The value of regaining the status of a (somewhat) open forum cannot be underestimated for an association that purports to represent the interests of the broadcast industry.

It is important, however, to acknowledge the point made by DAB Task Force Chairman Alan Box: The L-band issue is not going to go away. Because it is supported by Canadian broadcasters and satellite system proponents, the NAB still will have to observe developments in L-band DAB. This includes monitoring Canadian L-band tests as well as conducting its own research, which is expected to begin following Radio 1991.

Clearly, the NAB should have some input into the development of broadcast technology in the U.S. But in the future, the association should take a lesson from its recent experiences with DAB and refrain from trying to tame a tiger all by itself.

—RW

have an opportunity to make it better. In the case of the EAS, it is a project undertaken by a single SBE chapter (24 in Denver) which enlisted the help of the state authorities, broadcast association, and received aid and input from such unlikely sources as cable companies, two-way radio concerns, and the amateur radio community.

While the EAS was born at the grass roots of broadcast engineering, it may not be the best system. Consider the other contenders:

The National Weather Service's WRSAME is very similar to the EAS. So close that adapting EAS's scanning and redundancy features, cost reducing hardware, and expanding the scope of WRSAME to include CATV and other electronic media could well preserve the benefits of the EAS and capitalize on the momentum of the WRSAME system, already in partial implementation.

On the other side of the coin, the EAS might use unassigned data space, or lengthen its message to accommodate "type of emergency" information (this point is potentially confusing; both the EAS and WRSAME prioritize emergencies from "test" to "all-out warning," but the WRSAME is also capable of indicating type: "wind storm" to "tornado," for example).

Sage Alerting System offers the Radio Data System (RDS) as a contender for an EBS. The EBS would become data sent via FM, AM(?) or TV subcarrier. To the broadcaster, it represents a means to get into the RDS world, which can be used for non-EBS information. The EBS information would appear on a printer or other data monitor, even listeners' radio displays.

The California EDIS system is a packet data system that appears to the broadcaster as data (like the RDS) but is carried on non-broadcast channels.

This NOI is our opportunity to tell the FCC what is important:

Should the EBS be upgraded? At what cost?

How important is speed? Are broadcasters willing to turn over their on-air signal to an automated system in the case of tornados or chemical spills, or should an employee be required to review, edit, and determine whether and how to broadcast the information?

How important is redundancy? Should every message go through a single point, or should the system be able to restructure itself and allow even non-traditional (i.e., police and amateur repeaters) to be used by the system?

Should EBS activation rest in the hands of the broadcaster (CPCS-1 mostly), following requests from federal or state authorities, or should activation by city, county, state, national, and weather services be permitted?

Must a system be a national standard? Should national and regional activation be possible? Is a separate system and standard for each locality an option?

Should a newer, more reliable, less operator-based system result in reduced testing, logging and other FCC requirements?

In any case, for all the letters to the editor in RW, it is rather important to respond to the NOI, even in general and brief terms. A simple "keep the EBS," or "we need a faster, inexpensive, or whatever system," is in order.

Save a life, please write! Send an original and five copies to: Office of the Secretary RE: Docket 91-171; EBS improvement Federal Communications Commission Washington, DC 20554

Each of the proposed systems (and maybe a new, yet-unheard-of system) can likely be modified or combined to meet our needs and wants if we tell them.

Frederick M. Baumgartner
Engineering Manager,
WTTK & WTTV-TV
Indianapolis, Ind.

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Radio World
September 25, 1991

UNCOMPROMISING QUALITY SUPERIOR PERFORMANCE



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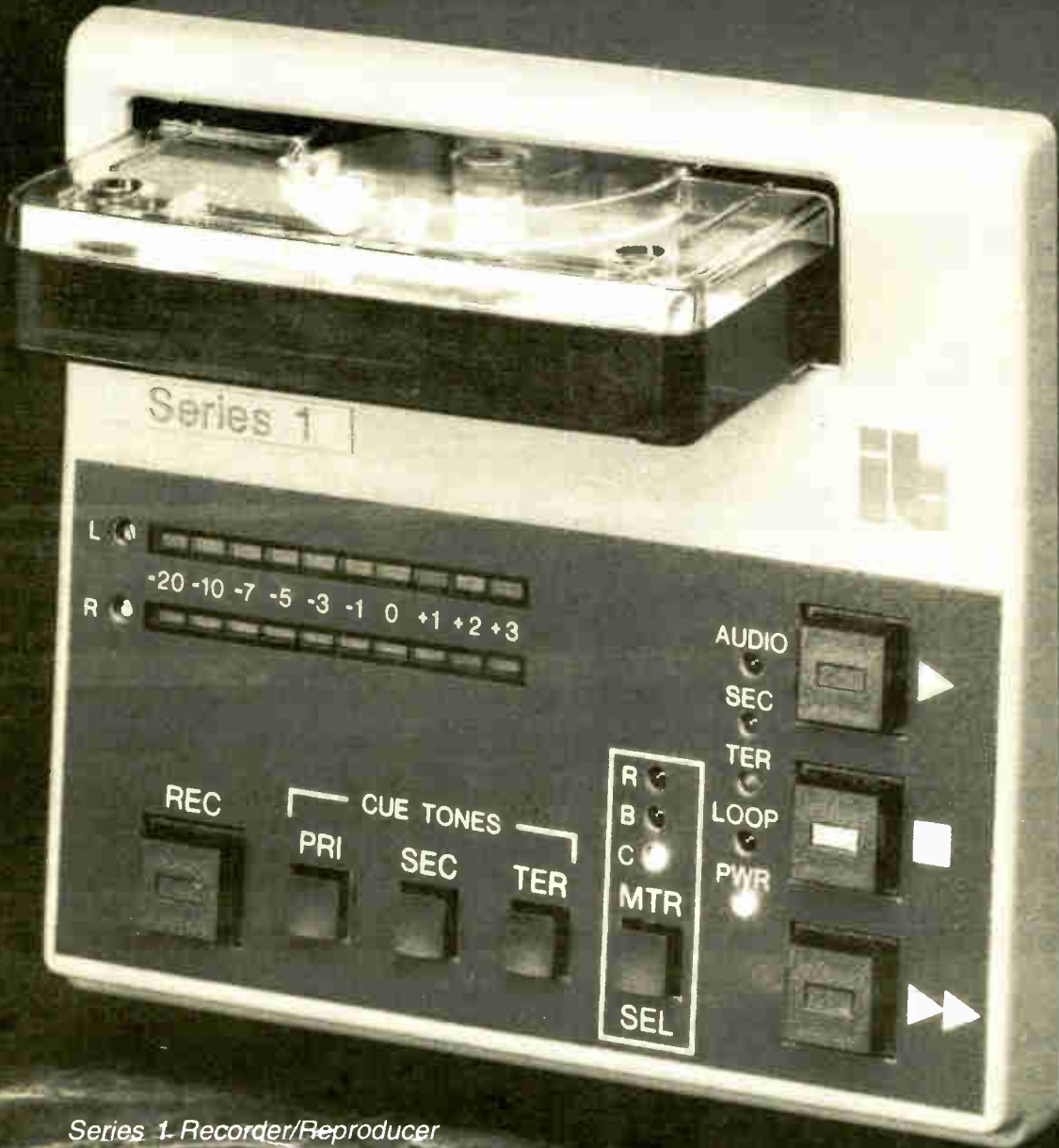
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Circle 151 On Reader Service Card

WorldRadioHistory

Annual FCC Fees Considered

by Arthur Cole

WASHINGTON A U.S. congressional committee approved an annual fee schedule for broadcasters last month, slightly reducing some fees from earlier versions of the bill.

The measure was approved by the

House Commerce Committee and is expected to be voted on by the full house in early September.

The fees, heavily opposed by the NAB, would be imposed annually on all radio, television and cable providers as well as an array of telecommunications services.

The NAB believes the fees are nothing

more than a spectrum tax.

Even though the bill represents lower fees than originally proposed, a statement by the NAB said the organization will continue to fight the measure.

NAB opposition

NAB Executive VP of Government Relations called the fees a "double whammy" on broadcasters because they would come in addition to "cost-of-regulation fees" the FCC already charges for services.

Earlier versions of the bill were even worse, May noted. He credited Rep. Matthew Rinaldo (R-N.J.), the ranking Republican on the House Telecommunications Subcommittee, with putting pressure on the subcommittee leadership to lower some of the fees before sending the measure to the full committee.

"We want to express thanks to Rep. Rinaldo and others who expressed concern about the spectrum tax proposal," he said. "We hope to have an opportunity to discuss the issue again during the full committee markup."

"We think the committee is finally beginning to recognize that this is a spectrum tax disguised as a fee schedule," May added. "There is no connection between service provided by the FCC and this fee, it is clearly based on a perceived ability to pay."

As it stands now

As marked up by the committee, the bill would impose some of the following fees:

- \$100 for Class II and Class III part-time AM stations. An earlier version of the bill put the Class II fee at \$150.
 - \$500 for Class I full-time AMs.
 - \$100 for Class II, Class III and Class IV AMs. Classes II and III were previously \$300 and \$200, respectively.
 - \$500 for Classes C, C1, C2 and B FMs.
 - \$100 for Classes A, B1, C3 and D FMs.
- The earlier version put these classes at \$300.

- \$2,000 for VHF and UHF TV stations.
- \$100 for low power, translator and booster TVs, broadcast auxiliaries and international broadcast stations.
- \$150 for cable antenna relay service.
- \$175 per 1,000 subscribers for cable systems. The earlier version had a cable fee of \$300 per community unit.

Telephone-related fees remained the same through the markup while the fees for an operational satellite dropped from \$50,000 to \$30,000. The fee for an operational antenna dropped from \$105,000 to \$85,000.

The fees are expected to generate \$65 million in revenues for the FCC.

ADR In-Band to Show

by Judith Gross

SAN FRANCISCO A second in-band DAB system proponent will exhibit at the Radio 1991 convention, to be held here September 11-15. The NAB has offered free exhibit space to DAB systems proponents, especially in-band, now that the association has softened its policy on in-band systems.

In addition to the Acorn system, American Digital Radio, developed by New Jersey-based Radiotechniques, will have a booth at the convention with information on its FM in-band system.

"We are expecting to have DAB allocations software which can help determine where DAB signals can be located so they don't interfere with other DAB signals or existing stations," system developer Ted Schober said.

Schober said one of his partners in ADR, Peter Moncure of RadioSoft, will be able to provide protection ratios based on FM allocations that will compare potential DAB stations to FM and to other DAB stations within an area.

The ADR DAB system, which Schober said has been modified and is now called ADR-2000, is a timed spectrum sharing in-band system where chunks of spectrum are "specially related" to each other in a proprietary way, according to Schober.

Each channel occupies about 200 kHz and the relationship between spectrum slices allows for multipath elimination. Schober added that he is still looking at the ASPEC compression algorithm as a candidate for the source coding part of the system.

Schober said his booth at the show will have the allocations software but that the hardware has yet to be developed. He said he has computer-modeled his system and hopes to have a hardware demo at the spring NAB show.

He said one purpose of exhibiting this early in the system's development is to persuade radio group owners to lend their support—possibly as investors.

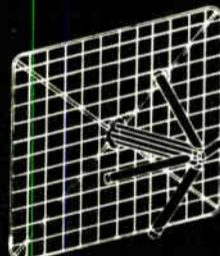
"We've worked out an investment plan that would allow a station group owner to invest a modest amount and not risk losing a large investment. The group owner could then have a hand in managing the technology's implementation," Schober explained.

He acknowledged the competition he faces from the other in-band DAB systems, particularly the Acorn system, which is farther along in development.

"But we feel we're the only system that can guarantee 100 percent multipath immunity at all times within a defined coverage area," Schober said.

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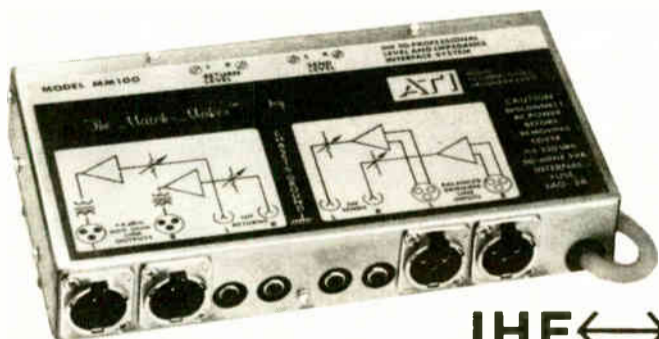
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Circle 19 On Reader Service Card

Encryption Approved To Foil Eavesdropping

by Frank Beacham

WASHINGTON The FCC has amended its rules to allow broadcasters to use digital encryption technology with remote pickup broadcast stations to prevent unauthorized interception of intra-station communications.

The rule change was enacted to enable station licensees to prevent eavesdropping by competitors and others of sensitive communications relating to news gathering or program production.

"This change was prompted by the Commission's receipt of several applications for authorization to use F3Y emission (digital scrambling) in the Remote Pickup Broadcast Service," an FCC announcement said. "The applicants wanted to keep communications relating to news reporting confidential until the stories could be aired."

According to the FCC, broadcasters told the Commission that although

"third party reception" and use of such radio signals was prohibited, the competitive nature of news crews to be first with an exclusive news story made necessary the "extra level afforded by digital encryption technology."

A 15-year old concept

The digital scrambling of voice communications on two-way radios came into widespread use about 15 years ago when it was adopted by police departments, FCC engineer Joe Johnson said.

Johnson helped write the original police rules and also wrote the new proposal for broadcasters. "The original F3Y designation came about in private land mobile when police departments got tired of being overheard by criminals," Johnson said.

Johnson explained that encryption requires a special digital transmitter that creates a precise scrambling sequence

(continued on page 10)

NAB Softens on In-Band

(continued from page 1)

parallel track between in-band and Eureka?"

NAB DAB Task Force Chairman Alan Box defended both the NAB's endorsement of Eureka and its quest for new spectrum in the L-band. Box noted that at the time of the Radio Board's endorsement, very few facts about in-band systems were known. He also said the L-band question won't go away.

"If the NAB stops its quest for L-band, the satellite proponents will still push for it and likely get it," Box said.

As the ROC meeting ended, members stopped just short of backing a resolution to support in-band DAB development. Instead they deferred to the DAB

Task Force in the hope that the next two days of DAB presentations would resolve the conflicts.

Two days later, after the task force had heard from USA Digital (Gannett-CBS-Westinghouse), American Digital Radio (RadioTechniques), Mercury Digital, and one non-in-band proponent, Stanford Telecom, Box announced that the task force would recommend a "modification" of the NAB's DAB goals.

"We want to encourage the investment in and development of in-band DAB systems," Box said.

He noted that the task force would meet again at the Radio 1991 show and hear from the remaining DAB in-band proponents: Kintel, Synetcom, and LinCom, as well as a company that has experimented with DAB via wireless cable, EmCee. At that time, the task force will rewrite NAB's DAB policy, he added.

The final modifications, which will include in-band, would be subject to full Radio Board approval, Box said.

But he also maintained that the NAB would continue to push for L-band spectrum "to keep its options open" at the upcoming World Administrative Radio Conference (WARC). Box said that negotiations with Eureka partners on a licensing agreement will continue.

Tony Masiello, director of technical operations for CBS Radio, a supporter of USA Digital (otherwise known as Project Acorn in-band DAB), said that he could see more dollars and support being given to in-band because of the NAB's change of heart.

"If you know the industry and your trade association is behind you, it's easier to give it your support," Masiello said.

During the ROC meeting, CBS Radio VP Nancy Widman pointed out the tremendous cost of developing an in-band system.

"What Nancy was saying was, if the industry isn't behind us, why are we spending the money?" Masiello explained. "Now it's worthwhile for new and existing in-band proponents. We can feel safe."

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FM's Well-Kept Secret Exposed

by John Gatski

WASHINGTON *Psst.* Want to know a secret?

The secret is that FM could have the same frequency response as DAB. That's right, old faithful FM can deliver the 20 kHz audio of a CD.

Or, should I say, FM is theoretically capable of such a frequency response. I qualify this statement because there are several obstacles to such fidelity—including the 30-year old FM stereo standard.

The FM band's 15 kHz limit, now universally accepted, was the result of the stereo standard that was developed in the late 1950s and early 1960s and adopted by the FCC in 1961.

In creating the standard, the old NSRC (National Stereophonic Radio Committee) set the stereo pilot signal at 19 kHz. To avoid audible conflicts with the pilot, most tuner section's frequency responses were rolled off steeply from 15 kHz to allow use of wide-band, pilot-canceling filters.

Engineers were not overly concerned in 1961 about the 15 kHz limit because it was considered the hi-fi standard of the time. Most of the early hi-fi records of the time peaked out at 12-13 kHz.

But as hi-fi technology got better from the early 1960s, 20 kHz became the accepted high frequency limit of human

hearing. Since the technology has changed to allow wider frequency response in audio gear, some audiophiles have pointed out, why shouldn't FM keep pace?

Supposedly, some FM mono radios made prior to stereo were capable of delivering close to 20 kHz, but there never were any stations that broadcast such an open signal. That situation still

CUE and REVIEW



exists today.

According to receiver manufacturer consultant Almon Clegg, AM stations could broadcast 20 kHz audio many years ago. These were stations broadcasting in the 1930s, he said, that had no neighbors, high power and could "open it up."

I doubt, however, that these stations had much hi-fi material to showcase unless they did live broadcasts.

From a practical audio standpoint for FM, there really is no use to up the frequency response to 20 kHz. The magical 20 kHz is a number that is really not that far away from 15 kHz anyway. Most adults can't hear much

above 15 kHz (except for Superman), and very little musical information exists in that range—especially in pop music.

And listeners are not likely to throw away current FM receivers for a new version that will not offer audible improvement in most cases.

Some high-end tuners on the market already squeeze a few more kilohertz of frequency response with narrower-band, pilot-canceling filters, allowing somewhere close to 18 kHz. If you can get 18 kHz out of an FM tuner section, providing a station is broadcasting such material, you're doing pretty well in my book.

Besides, if FM was improved to 20 kHz it does not mean the signal-to-noise ratio would improve to DAB levels. Best case FM tops out at around 80 dB for a high-buck tuner. Typical numbers for good receivers average in the 60-65 dB range. DAB systems, however, have been boasting a 90 dB or greater signal-to-noise ratio.

Clegg, who has done consulting work for such companies as Panasonic and Denon, said there has been informal talk over the years about bringing FM up to current hi-fi standards. That, of course, would mean moving the pilot beyond 20 kHz.

The discussion, however, was never

that serious, according to Clegg. One major reason is the inherent band constraints of moving the pilot to perhaps 23 or 25 kHz to free up the additional 5 kHz in frequency response. It would require changes in the FCC's mandated FM mask.

Clegg doubts that stations could transmit 20 kHz audio at 100 percent modulation (or more, with subcarriers) within the current 200 kHz bandwidth. At current modulation levels, somebody's neighbor would no doubt complain. Of course, if modulation levels were reduced it might work, but then stations have to worry about lower signal-to-noise ratios.

In other words, a lot of complicated changes in the rules would have to be made in order to eke out less than an octave of frequency response, Clegg noted. Another receiver engineer put it more simply: "You're kind of stuck."

While talking to engineers about FM's fidelity limits, one of them reminded me of the NAB's recent DAB/FM comparison that actually produced, perhaps, an unintended conclusion.

Although much of the test's intent was to showcase DAB's multipath resistance, another point also came through. At the time, I remember noting that the FM signal sounded very good when we were not in a multipath area—even when compared to the latest DAB technology.

Judging by the industry reaction to 20 kHz FM, the band appears to be about as hi-fi sounding as it will get under the present broadcasting system. But that's not necessarily a bad thing.

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AM Docket Nearing Completion

by John Gatski

WASHINGTON The FCC staff continues to fine tune the monumental AM improvements package that it has worked on for nearly a year, according to the Mass Media Bureau.

Docket 87-267 is comprehensive rulemaking that touches many technical areas surrounding AM and has garnered a flood of comments on how to best make changes to improve the band.

FCC Assistant Mass Media Bureau Chief William Hassinger said the staff is still working on it, but hopes to complete the rulemaking and forward it to the full Commission within the next month or two.

The FCC is considering several

proposals within 87-267, including the so-called "ratchet" clause, which would mandate a 10 percent interference reduction when making any major station changes; increasing the first adjacent channel protection ratio from 0 dB to 16 dB; filling the expanded band (1605-1705 kHz); AM stereo and increasing the Class III power ceiling to 50 kW.

Several parties that filed comments on the docket last fall believed that the "ratchet" clause could be damaging to many AM stations.

Hassinger said the comments on the docket were "all over the place" but some elements did not receive much comment, such as whether the expanded band slots should be filled by allotment

or assignment.

Of those that filed comments last fall, opinions were varied on how best to fill the expanded band. Some said that the worst case interfering stations (including clear channels) should be put in the new slots. Others commented that daytime-only stations could benefit the most from the move to the less-crowded portion of the band.

The FCC originally planned to open the expanded band in 1990, but decided to wait and include the new band's implementation in the AM package. Receiver companies have been adding expanded band tuners into their radios for over a year.

Numerous comments centered around

how to best reduce interference. Several noted that adjacent channel interference is not as big a problem as man-made interference.

The Commission has less incentive to require AM stereo or adopt mandatory receiver standards in the rulemaking because of the recent NAB/Electronic Industries Association (EIA) agreement to promote improved AM radios under the AMAX logo.

Although AMAX radios would not be required to transmit in stereo, the standard does require improved frequency response (7.5 kHz), noise blanking to reduce electrical interference and wide/narrow bandwidth circuitry, and external antenna connection. Stereo radios with such improvements would carry the AMAX certification mark.

FCC OKs Encryption

(continued from page 8)

and a receiver set to receive that sequence.

"It's like the movie, 'Dr. Strangelove,' where they take this little box and the guy turns the numbers on the box to read 1, 2, 3, 4, 5, 6 . . . that's the scrambling code," Johnson said. "If the receiver is turned to 1, 2, 3, 4, 5, 7, even though you have the right receiver and are on the right frequency, it will not pick up the transmission. The sequences must be exactly the same."

To those monitoring an encrypted signal without the code to unscramble, the transmission sounds like white noise, Johnson added.

In the summer of 1990, the FCC staff granted waivers to permit the use of digital encryption technology to WBTV-TV and WSOC-TV, both of Charlotte, N.C.

"After the request for the special licenses, someone here (at the FCC) asked why not permit it (for everybody)," Johnson said. "We asked what's the down side. So we put out a proposal and nobody objected."

ID required

In a response filed with the FCC, ABC requested that stations using digital encryption be required to give non-encrypted identification at 15 minute intervals in order that any party receiving interference from the transmission can easily identify the source. The FCC adopted that request, requiring stations using F3Y emission to transmit unscrambled analog or international Morse Code station IDs at intervals not exceeding 15 minutes.

But, according to Bill Napier, assistant VP of operations at Charlotte's WBTV, the station ID matter is not much of a factor at his station due to the short duration and infrequent use of encryption.

"Our typical transmissions only last about 90 seconds and we identify the station at the beginning and end of each transmission," Napier said. "We mainly use this for sensitive news situations."

WBTV's competitor, WSOC-TV, also uses encryption for news-related communications. "We use both the non-encrypted and encrypted modes," CE Merle Thomas said. "We use the technology because of news competition and just to keep our communications private."



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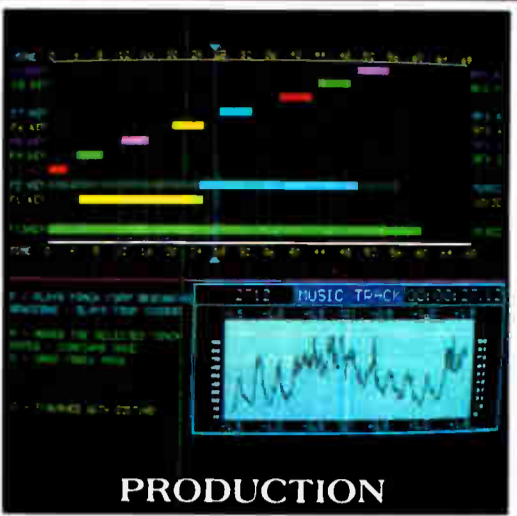
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DAB Firms File for Preference

Satellite CD Radio, Strother Communications Request "Pioneer" Consideration from FCC

by Judith Gross

WASHINGTON Two of the original FCC petitioners on DAB have jumped in early with requests for licenses under the new "Pioneer Preference" ruling.

Satellite CD Radio, whose petition last May began the debate over DAB, and Strother Communications, which has filed for numerous experimental frequencies, both asked for a preference, each with a somewhat different "twist."

While Satellite CD's request is for a nationwide hybrid satellite/terrestrial DAB service, Strother has asked for separate DAB licenses in three major markets.

Satellite CD Radio originally proposed 34 local and 66 national satellite digital channels on L-band, but later modified its proposal to include operations in the

Mobile Satellite Service (MSS) band. attention to award a single license to a pioneer. The company has asked the Commission to revisit the issue and remain open about the quantity of licenses based on the service being proposed.

SCI cited its previous petitions to the FCC for experimental authority to test DAB services. The company has received the go-ahead to test DAB on UHF-TV frequencies in Boston and Washington and is anticipating L-band test approval by mid-August. The com-

pany also has filed for in-band and satellite test authority.

SCI also pointed to its own spectrum study on DAB, only one of two completed so far (the other was the NAB's spectrum study) and its plans to set up a DAB test center in Washington as proof of meeting the Pioneer Preference technical criteria.

"This experimental facility will provide transmitters, test equipment, antennas, STLs and other related digital audio equipment to test DAB," SCI wrote. The company also said it would operate two test buses and was forming a technical advisory group to draft independent

DAB test outlines.

SCI maintained that "one license is an insufficient reward when the pioneer proposes a service in which there could be thousands of licensees." In the case of terrestrial DAB service, the company said, "three licenses would represent an appropriate reward for SCI's pioneering efforts."

SCI asked specifically for licenses in Washington, Boston and Los Angeles, and noted that it too had invested "hundreds of thousands of dollars and countless man-hours in the study and evaluation of DAB technology."

Both SCI's and Satellite CD Radio's petitions requesting preferences were filed in time for the end of July filing deadline the Commission had set for would-be pioneers who had previously filed new service DAB petitions.

The Pioneer Preference requires that a petitioner ask for a specific service using a new technology or upgrade of existing technology. . .

Mobile Satellite Service (MSS) band.

The Pioneer Preference requires that a petitioner ask for a specific service using a new technology or upgrade of existing technology, and that the petitioner prove technical feasibility of the plan.

Satellite CD Radio, which intends to use a DAB technology developed by Stanford Telecom, maintains that its previous description of the exact DAB (or DAR—Digital Audio Radio, as Satellite CD calls it) satellite/terrestrial service meets that qualification.

In a separate petition, the company also proposed some service in the S-band (2300 MHz). The FCC has recommended that the U.S. WARC position include some L-band and some S-band for DAB.

As to its proposal for MSS service, Satellite CD Radio also asked the Commission to adopt a "duopoly licensing scheme." That specific request addresses the FCC's original intention to award MSS to the American Mobile Satellite Service Consortium.

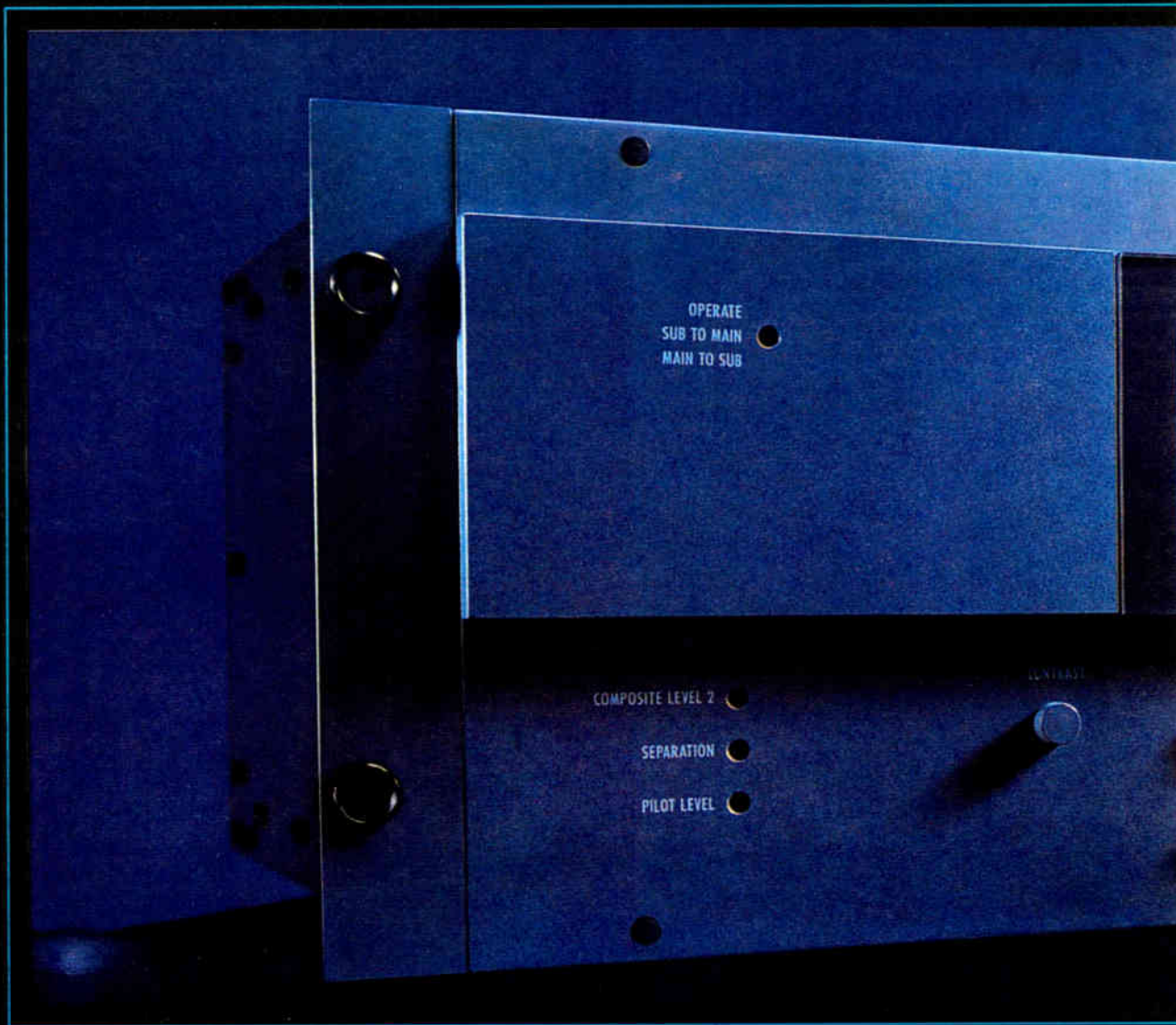
"In light of the recent U.S. Court of Appeals decision reversing the Commission's 1986 decision to establish a consortium for the provision of MSS in the upper L-band, the consortium approach proposed in the petition would appear to be no longer legally viable," Satellite CD wrote.

The company said there appears to be enough spectrum for two MSS licensees and requested that Satellite CD Radio be awarded one of them.

Concluding its request, Satellite CD Radio said it has spent "considerable resources developing its proposal and the technology needed to bring it to fruition." The reward for this, the petition stated, should be a Pioneer Preference.

SCI's main objection to the wording of the Pioneer Preference has been its in-

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LPB Helps Spread the Word

by Dee McVicker

FRAZER, Pa. Drive-in church services? They do indeed exist, thanks to LPB of Frazer, Pa., and Part 15 of the FCC Rules.

According to LPB President Edward Devecka, one of the first churches to offer a drive-in service was the Garden Grove Community Church near Anaheim, Calif. At the insistence of the congregation's renowned pastor, Dr. Robert H. Schuller, the system was built in 1955 so churchgoers could drive through the church's parking lot and listen to the week's sermon on their AM receivers without leav-

ing their automobiles.

So popular was the concept that Schuller later put in a similar system at the famous Crystal Cathedral. The drive-in system, installed by LPB, is one of the more distinguished in the country.

Open wall policy

"Evidently, there's a whole wall that opens up so you can see (the congregation) from the parking lot," said Devecka of the cathedral drive-in.

LPB, best known in broadcasting circles for its consoles and low-powered AM transmitters, has installed drive-in sys-

tems for Oreland Presbyterian Church in Oreland, Pa.; Reverend Bill Midema's El Dorado Park Church in Long Beach, Calif.; and countless others.

OFFBEAT RADIO

"We did an awful lot of drive-in theaters when they were popular," Devecka commented.

Church drive-ins, like drive-in theaters, are protected under the Commission's Part

15 regulations and are unlicensed services broadcasting on the AM band, typically on 530 kHz. Subject to restrictions that prohibit them from interfering with licensed AM stations, church drive-in services typically broadcast within a confined area at very low powers.

Typically, a low-powered 5 W to 30 W transmitter is used for the service. To radiate the signal, a cable usually is buried beneath the drive-through surface to act as the antenna. Unlike carrier current systems, which LPB also has been involved with, drive-in church services do not require a coupling unit.

"The RF output of the transmitter is connected directly to cable," said Devecka, whose company offers proprietary leaky cable for this purpose. Placement of the LPB cable, which is similar to standard coaxial only with an outer braid to leak RF, depends on the area of coverage, he added.

Hard of hearing parishioners

Inside the church, LPB and the Commission's Part 15 also have benefited hard-of-hearing parishioners.

Again using leaky cable and a low-powered AM transmitter, typically less than 5 W, this service offers parishioners the ability to hear sermons more easily on their AM receivers. To radiate the signal, LPB's exclusive RADIO-AIDE leaky cable, which runs approximately 300 feet, is looped overhead—or underfoot, in the facility's basement.

Audio source for the inside AM service, as with drive-in services, originates from the congregation's public address system to bring the sermon, choir or organ music to the church's airwaves.

Distributed cable AM transmission also is being used in churches for a myriad of other purposes, including language translation. In 1985, for example, a Billy Graham Crusade held at Anaheim Stadium in Anaheim, Calif., was host to more than 500,000 people—many of whom did not speak English.

Needing a system to relay language translations, the Graham organization decided to invest in low-powered AM transmission. The result—an expansive setup, with low-powered LPB AM transmitters operating on several unused AM frequencies based on LPB proprietary leaky cable.

During the crusade, volunteer translators, set up in the upper deck section of the stadium in announcement booths overlooking the stadium, translated Billy Graham's sermon into seven languages every night of the event.

The translators were supplied with headset mics, enabling them to translate the sermon over the AM band. These headsets provided the volunteers with an audio feed direct from the stadium sound reinforcement system and enabled them to translate the sermon into the headphone mic for broadcast to participants through the radio system.

Those wanting to hear the service on AM were free to bring their own battery-operated AM receiver or to purchase radios offered by the Graham organization at cost. More than 13,000 radios were sold by the organization for this crusade alone.

Today, this setup travels around the world with Billy Graham's crusades. Said

(continued on page 31)

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Shedding Light on Tower Rules

by Harold Hallikainen

SAN LUIS OBISPO, Calif. Last month, I pointed out several methods of meeting the FCC's required daily inspection of tower lights.

I mentioned that most stations do a local or remote inspection of the tower lights or the current drawn by the lights. Tower light alarms were rare. Since then, I've received information on a tower light alarm system available from Flying Fur Industries. You can call them at 303-484-2704.

INSIGHT ON RULES

In addition, I received a letter suggesting that Part 17.54 of the FCC Rules requires correct tower light lamp voltages only on steady burning "obstruction lights." Most tower lighting rules use the word "obstruction" only in reference to the steady burning lamps.

Obstruction lamps

However, I believe the "obstruction" is the tower itself, so all lamps are obstruction lamps and subject to the voltage requirement of 17.54. This is supported by the section on reporting tower light failures (17.48(a)), which refers to "any flashing obstruction light."

A reason for running lamps at lower voltage is, of course, to extend their life. Lamps normally die due to the extremely high inrush current. I just measured the cold resistance of a 620 W 120 V lamp at 1.7 ohms, giving an inrush current of 71 amps, compared with a steady state current of 5.2 amps.

This 71-amp inrush causes severe magnetic forces on the filament and blows any "weak spot" in the filament that would otherwise be able to take the 5.2 amp steady current. The inrush current is only 70 amps during the initial flash of the lamp.

Successive flashes draw less current, since the filament does not cool off to the ambient temperature quickly. Still, this initial current probably causes a lot of lamps to fail. The inrush current is limited somewhat by wiring resistance. It seems possible to choose a wire size to wire the tower lights so the lamps still get the right voltage, but the inrush current is substantially reduced due to the wire resistance.

Another approach might be for the tower light flasher manufacturers to use phase control to "soft start" the lamps. The FCC rules do not specify the optical rise and fall times of the flashing beacon, so some research may be required here.

New schedule of fines

In the past, the FCC has typically fined stations \$1,000 for tower light problems, with an extreme case drawing a fine of \$8,000. The FCC has released a new schedule of fines. Inadequate tower lighting and marking will now draw a fine of \$20,000.

A station can get a \$20,000 fine for misrepresentation to the FCC, tower lighting and marking problems, unauthorized construction or operation, unauthorized transfer of control, false distress broadcasts or misuse of distress and safety frequencies.

Refusing to permit inspection of the station can result in an \$18,750 fine. Many

people think a station must be available for inspection only "during normal business hours." Part 73.1225 authorizes the FCC to make an inspection during the station's normal business hours—or any time the station is operating.

Part 73.2526(d) requires the public inspection file to be available "during regular business hours," and 73.1225 lists the records that must be available during an FCC inspection. Part 73.1225 does not list the public inspection file, yet at least one station was cited for not having it available in the middle of the night.

A \$17,500 fine may result from failure to respond to FCC communications or malicious interference. I saw records of one station owner who refused to sign for certified mail. The FCC ended up sending the mail without certification.

Show EBS test

In the past, a station would typically get a \$1,000 fine if the EBS equipment was not operating properly. That has been increased to \$12,500. If your station log does not show transmission and reception of the required weekly EBS test, it is likely the station will be cited for this violation.

It is *very* important that the weekly log review by the chief operator is checked for these log entries. Any missing EBS log entry should be noted in the log review, along with what action is being taken.

A \$12,500 fine also may result from running excessive power, unauthorized emissions, unauthorized frequency, indecent programming (though this is an active area in the courts), equal employment opportunity (EEO) violations or political broadcast violations.

A \$10,000 fine may result from unauthorized discontinuance of service. Part 73.1750 requires the FCC to be notified at least two days in advance, then requires the station authorizations to be immediately sent in for cancellation.

A \$10,000 fine also may result from use of unauthorized equipment (type approved, etc., as required), violation of the main studio rule, unauthorized location (probably transmitter location), or inadequate frequency coordination. Part 73.1125 generally allows an AM station's main studio to be located anywhere within the 5 mV/m daytime contour, and an FM station's main studio to be located anywhere within the 3.16 mV/m contour.

Immediately notified

The FCC must be immediately notified of any change in the main studio location. I've recently read that the FCC expects the "main studio" to have the capability of putting programming on the air. A management and staff presence also is expected at the main studio, possibly requiring a minimum of two people (one management, one staff).

Some stations have maintained a minimal main studio within the specified contour while having a major studio in a larger nearby community. Other stations broadcast network programming almost exclusively, or have entered time brokerage agreements, reducing the required staff level and program origination requirements. These stations especially should ensure they are complying with the main studio expectations of the FCC.

A \$7,500 fine may result from failure to make required FCC filings or maintain the public inspection files.

A \$5,000 fine may be levied if a station does not maintain technical logs (yes, the station log is still required), for broadcast of telephone calls without permission or failure to maintain time-brokerage files. A \$2,500 fine may result from a failure to make required measurements.

Intentional violation

The actual amount of a fine may vary plus or minus 90 percent, based on amount of harm, intentional violation, prior violation of same rule, economic gain by the rule violation and ability to pay.

Bill Sepmeier of National Supervisory Network tipped me to the new FCC Broad-

cast Station Self-Inspection Report (see separate news story in this issue).

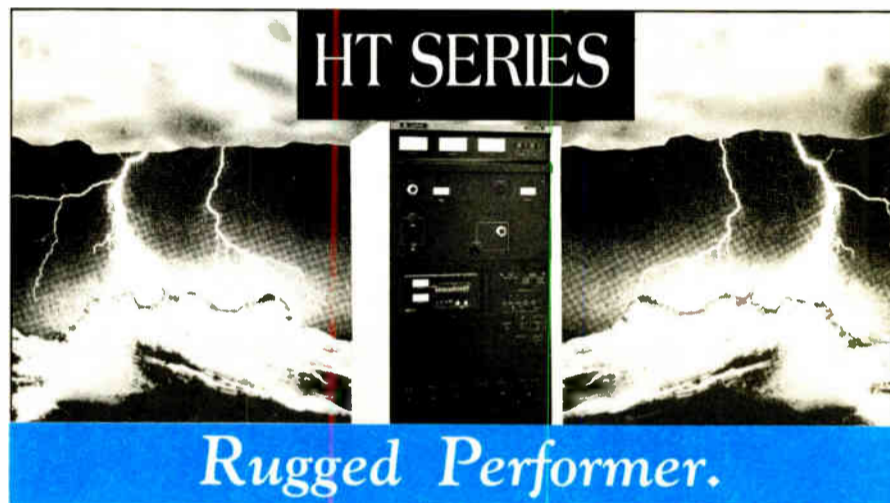
The 20-page form looks like an excellent idea. Next month, we'll review the Self-Inspection Report in detail. If you'd like a copy, send \$2 for copying to H&F, 141 Suburban Road, Building E4, San Luis Obispo, Calif. 93401-7590 and an SASE envelope (52¢ postage).

Finally, I'll look forward to seeing you at the NAB Radio 1991 convention in San Francisco. NAB has asked me to be on the "New FCC Technical Regulations and Your Responsibilities" panel on Friday, Sept. 13.

■ ■ ■

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.

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A Road Tour of Radio From the Heartland

by George Riggins

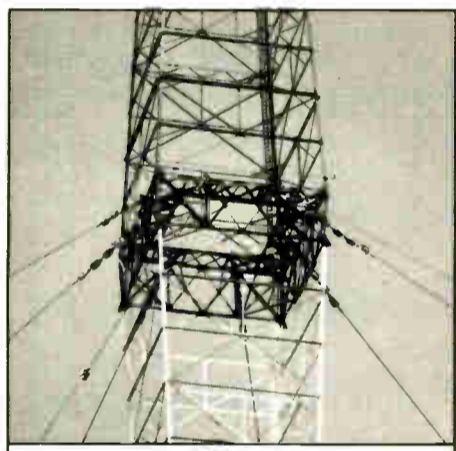
EVONA, Ky. No, you will not find the location on a modern map of Kentucky.

Evona was a small back-in-a-hollow post office that was closed about 30 years ago when the last postmistress retired.

Helen and I are staying on property that has been in the family since about 1825. It is two or three hollows over and up a creek from the nearest radio tower. There is no line of sight to any transmitting location. The closest FM transmitter is about 16 or 18 miles away. The next nearest FM transmitters are about equidistant ESE or WSW.

Yes, it's the time of year when we travel around and attempt to report what we do and do not hear. Here in Evona, nothing but white noise was discernable using the "Tin Ear" on the AM band during the day. I heard Radio Havana and KRLD Dallas/Fort Worth in the middle of the night.

The FM band was another story. There were about 10 or 12 good signals, including at least two of the Kentucky State Net-



WSM's guy lines revisited.

work stations. A look at the topography indicates that no FM signal *should* have penetrated into the area where Helen and I were staying.

Next stop.

MONTROSE, Miss. Way out in the Piney Woods. The Tin Ear did not do any better out in the woods of Mississippi than it did in the narrow hollows of Kentucky. The nighttime AM fare included one or two stations from Mexico and WBAT with the Texas Rangers baseball game. FM reception was good, although there were not as many stations to be heard in comparison to the Kentucky location.

One note: All but one or two of the FM signals lit the stereo indicator and were strong signals. None of the AM signals was strong enough to have any effect on the tuning indicator.

Next.

NASHVILLE, Tenn. We revisited the WSM transmitter location for additional pictures of the guy points on the tower and the open wire antenna feed. In fact, both the main antenna and the short auxiliary antenna use an identical open wire feeder rather than coax line.

Another interesting item in the history of WSM is the fact that an early owner liked symphonic music and rebroadcast symphony orchestras live from Europe long before there were trans-Atlantic broadcast program lines. To accomplish the task of obtaining good quality music

live, a triple diversity receiving system was designed and installed.

One antenna was located at the WSM transmitter location and the other two receiving antennas—all Rhombics—were offset by about a mile on either side of the transmitter location. One or two of the



poles for the Rhombic located at the transmitter site still are standing near one edge of the property.

WSM still has a complete machine shop at the transmitter location. Fabrication of items not readily available on the open market is done on the premises. One project in progress was a new diesel fuel filtering and recirculating system for the emergency generator.

The picture showing the guy lines at the mid-point of the WSM tower was taken from the transmitter building. One must remember that the face of the tower at the mid-point measures 38 feet across and is about 385 feet above the ground.

DUNCAN, Ill. Yes, Duncan is still on the map. There are about seven families still living in this former farming community. They do not have too much of a menu to choose from when it comes to entertainment on the radio bands.

The powerhouse Chicago AM stations were good listening at night. All four of the 50 kW stations had signals that would activate the tuning indicator and light the stereo light. I was even able to get the score of a Los Angeles Dodgers baseball game by listening to Harry Caray on the Cubs broadcast.

Some of the Peoria stations, both AM and FM, could be heard in the middle of the night. I am surprised that there is not a station licensed to Princeville, Ill. It appears that almost every other little dot on the map qualifies for a local station.

Quad Cities was another location that presented signals at night for the lonely seeking noise or company. Nothing from St Louis or Springfield, though.

A quick update regarding WBT-AM Charlotte, N.C. Dave Herick, GM of WCEH Hawkinsville, Ga., recently called to report that Hurricane Hugo had done in the two outer towers at WBT. Dave stated that he grew up in the shadows of the towers and feels that he has lost two long remembered and familiar landmarks.

John Stalder of Springfield, Ohio, called to report another "Franklin" tower. John reports that WBNS-AM Columbus, is using a shorter version of the Blaw Knox antenna used at WSM, WLW and WBT. At 1460 kHz, a 5/8-wave antenna should be about 420 feet high. This figure ignores all variables and is based on free space factors. Please don't prove me too far off the actual measurements.

■ ■ ■

George Riggins has experience in radio and electronics dating back to the 1930s.

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Safety (First) Can Save Lives

by Barry Mishkind

TUCSON, Ariz. On the surface, radio seems to be a safe occupation. After all, except for the sales staff, everyone sits around inside all day. The most strenuous effort might be when the DJ tries to reach for the next cart while talking into the microphone.

But as we discussed last month, stations that care about the work environment really try to eliminate hazards of all sorts. By avoiding broken furniture, torn carpets and wires strung around, about the worst you might expect is a hangnail.

Even on a remote, there's probably more

danger from the DJs eating too much chicken or pizza than from an upset listener. Most larger market stations now routinely send multiple staffers or interns out to remotes.

Yet the one place where safety really counts often is the most neglected: the transmitter site.

Dangerous safari

Usually the least visited part of a station's facilities (many managers have never even been there), the transmitter site can harbor many dangers. Some are easily handled with minimal exposure. Others require real effort on the part of management.

Since there is little traffic, some stations use the transmitter building as a sort of storage shed.

Another little annoyance comes from the animals attracted by the clutter or lack of activity. Rodents, spiders, wasps, etc., can often be found living among the transmission gear and other items.

These problems are relatively easily cured. Some effort at keeping the site clean and orderly will result in less clutter and falling boxes. That and regular visits by an exterminator will prevent spiders and rats from taking over.

Somewhat more dangerous are technical problems that exist and have been ignored or forgotten over a period of time. Some of these can kill.

A prime example is the exposed transmission line or matching network that was put in quickly to fix a problem. The CE might know the danger and be careful. But visitors may not, and the engineer himself may even forget which conductor is hot with RF at which time.

Good Engineering Practice

GEP (Good Engineering Practice) and the FCC Rules require that things like this are covered, preventing contact with persons in the building. Even if the CE is the only one with a key to the door lock and the building is surrounded by a locked fence, the inside of the building must be safe.

One engineer was written up by an inspector for having the back of the transmitter open and the interlock defeated. The reason given—that the fan had failed and the back was open for ventilation—was not accepted.

For most engineers, the number of fried snakes and mice (and their smell) is enough of an inconvenience. There's no need to endanger pets or human visitors—not even that pesky program director.

True, some tests require opening the protective covers or bypassing the interlocks in high voltage or high current areas. This can present real danger to technical personnel. One solution presented, in a discussion in the SBE echo on FidoNet by moderator Ray Vaughan, suggested transmitters have more built-in test meters, with clip-on test leads that could be placed on components.

Buddying up

Nevertheless, under pressure from the PD or GM to get back on the air more quickly, the engineer all too often finds himself taking shortcuts. If such repairs are attempted while tired, the engineer is truly putting his life in his hands.

Reports that come in such as the one

from WZAL-AM in McDonough, Ga., where a man was electrocuted while working on a transmitter, are truly sad to hear. Worse yet, the initial reports seem to indicate he might have lived if someone had been on site with him.

An engineer I spoke with recently nearly had his lights put permanently out by a transmitter that supposedly had only low voltage on. Shocked across the chest, he likely owes his life to having another person on site—he wasn't able to dial the phone for help.

Perhaps this is an area in which the SBE could really make a difference for the average engineer. By not only regularly educating members to the dangers, but helping ownership to see the need to have two

ECLECTIC ENGINEER

persons on site whenever dangerous voltages are present, would be a real service to the industry.

Should there be an FCC rule or law mandating a second person? Or are the OSHA rules already enough? While considering this, remember federal and state OSHA inspectors check precious few transmitter sites, and too many owners know that.

Sentiments of several engineers polled seem to indicate that some organized effort in this area would be good. Individually, they don't have much clout against management that resists spending cash on a second person "just in case." Positive attitudes toward safety don't just happen without effort.

Other hazards

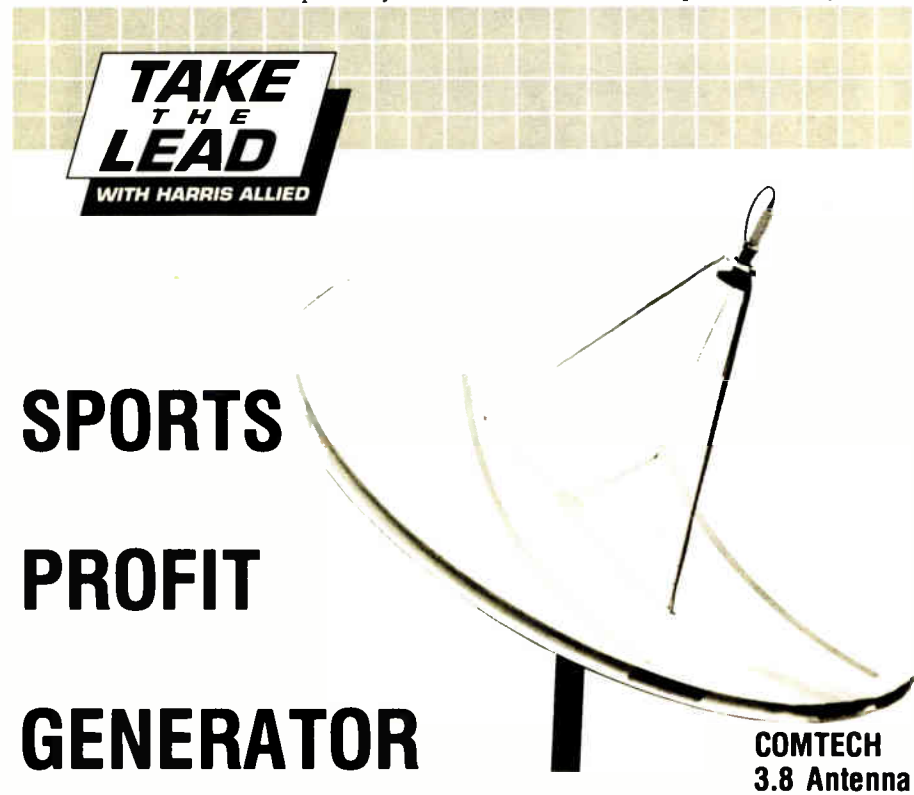
Actually, this positive attitude toward safety really applies to a lot of activities that occur at the transmitter site. For example, unless the foliage is kept cut back, it's possible for an engineer walking out to the tower to trip and fall in a hole dug by an animal or to be bitten by snakes. While not instantaneously fatal, it's no joke to be hurt out where you are often alone.

Sometimes a station will ask the engineer to mount or repair an antenna or even a tower light. While this can save lots of money compared to the fees of a tower crew, one minor miscalculation can put someone in danger.

EPA and local laws relating to RF levels have received a great deal of press over the past few years. While it's true that many engineers have sat under 50 kW transmitters for years without apparent harmful effect, it wouldn't hurt for a station to spend a little money to investigate whether there are any RF "hot spots" that ought to be avoided where possible.

So, does the management of your station

(continued on page 30)



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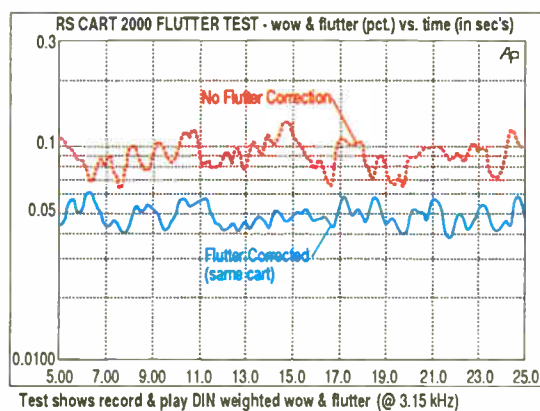
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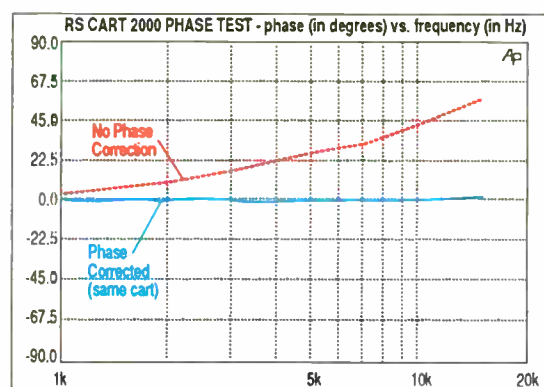
The RS-CART 2000 is the only cart machine to incorporate active flutter correction. This encode-decode system records a pilot tone on the cue track. On playback, the pilot is FM demodulated to drive two dedicated all-pass filter time delay networks to achieve up to a 50% wow and flutter reduction.

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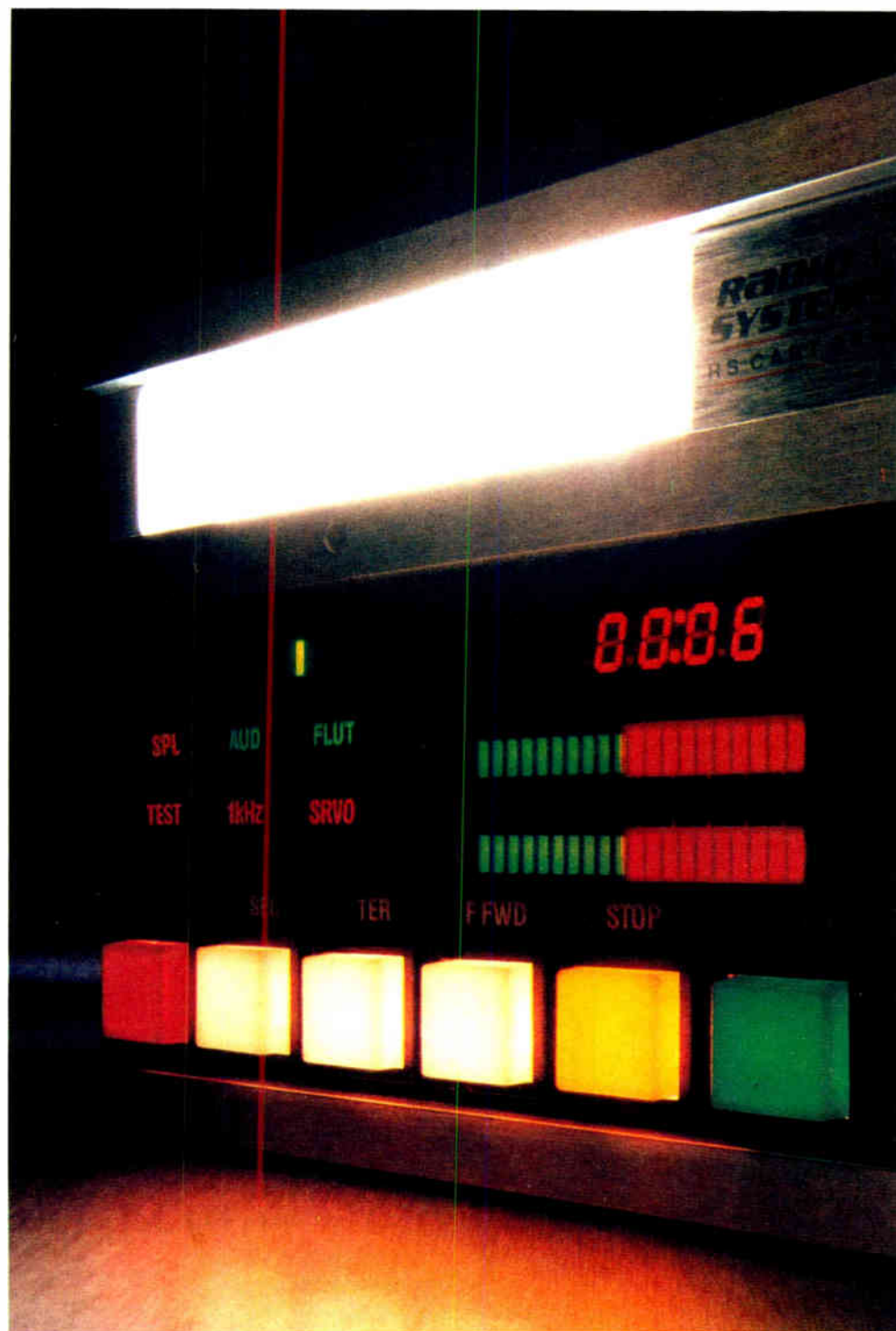
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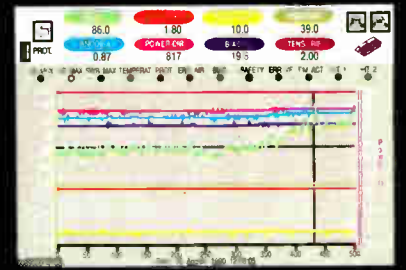
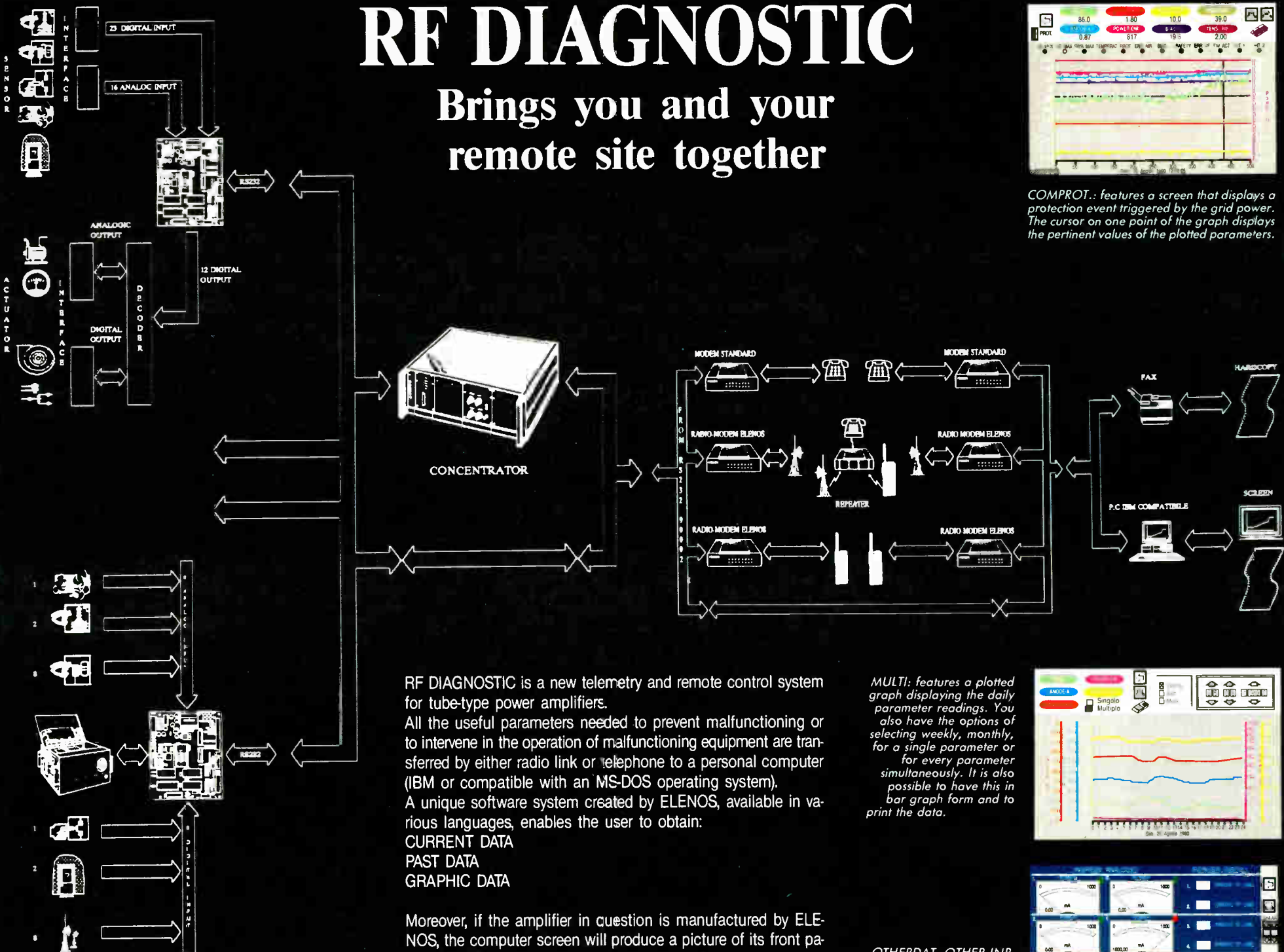
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COMPROT.: features a screen that displays a protection event triggered by the grid power. The cursor on one point of the graph displays the pertinent values of the plotted parameters.

RF DIAGNOSTIC is a new telemetry and remote control system for tube-type power amplifiers. All the useful parameters needed to prevent malfunctioning or to intervene in the operation of malfunctioning equipment are transferred by either radio link or telephone to a personal computer (IBM or compatible with an MS-DOS operating system). A unique software system created by ELENOS, available in various languages, enables the user to obtain:

- CURRENT DATA
- PAST DATA
- GRAPHIC DATA

Moreover, if the amplifier in question is manufactured by ELENOS, the computer screen will produce a picture of its front panel (with high graphic resolution) including all current meter readings. Of particular interest to the engineer are:

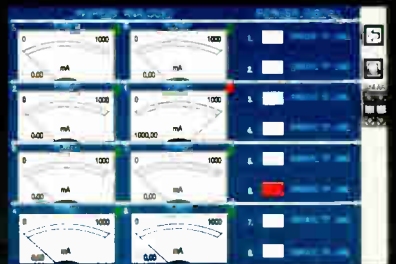
- ◆ a ZOOM function which allows enlargement of any detail for easier reading.
- ◆ the HELP function: an online troubleshooting manual that guides the user to assess the causes of malfunctions, and in some cases comes up with solutions.
- ◆ the use of a MOUSE and icon representation which allows even inexperienced computer users to be able to work with the PC.

Direct access and automatic saving of data means that the readings of all functional parameters prior to an event are stored and therefore even occasional anomalies can be isolated and treated. It is also possible to send all data of such parameters directly to ELENOS, or to your service center to receive analysis, advice and diagnosis. Please call or write for more information on the ELENOS RF DIAGNOSTIC system today.

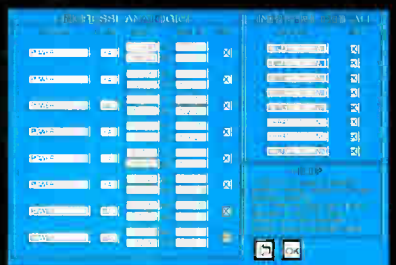
MULTI: features a plotted graph displaying the daily parameter readings. You also have the options of selecting weekly, monthly, for a single parameter or for every parameter simultaneously. It is also possible to have this in bar graph form and to print the data.



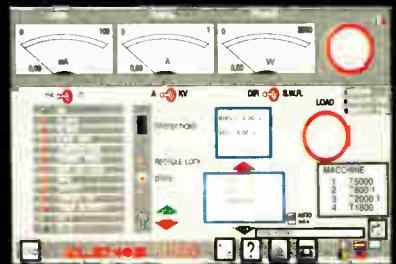
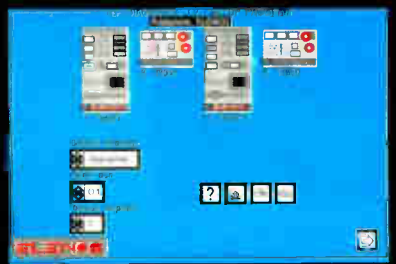
OTHERDAT, OTHER INP: with this feature you can display preset values. The green led shows that the values are within the set threshold limits. It is possible to redefine the scale and the alarm thresholds for maximum and minimum presettings on every analog instrument. It is also possible to define the description and the enabling and to disable the measurements.



RFSETUP: this feature allows a transmitting site with more than one transmitter to work on the same communication line.



T1800: if the transmitter controlled is made by Elenos, the monitor displays the front panel with the meters exactly as they are. In addition to the information displayed on the front panel, it is possible to have other functions displayed at the test points inside the transmitter. Some functions are remote controllable.



ALL THE LOGOS: this feature provides the possibility of adding your station's logo on installation of the software.



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Circle 53 On Reader Service Card

DEALER INQUIRIES INVITED

Static Protection for Towers

by John "Q" Shepler

Part III

ROCKFORD, Ill. You've installed power line surge protectors to clamp those high voltage spikes right at the service entrance. This blocks one major path that lightning takes into your equipment. The next most frequent entrance is via the antenna system.

Lightning strikes to the tower follow a direct path back to the transmitter, possibly destroying everything in the way. The tower itself, FM antenna, tuning units,

ment a stage at a time.

The most likely candidate for a lightning hit is the tower. Protecting the tower also is one of the best ways to protect all of the other RF equipment.

Think of the tower as a great big lightning rod. It's the highest structure in the area, by design. This makes it the most likely candidate to take a strike when thunderstorms come over.

Lightning, like all other electricity, likes to take the shortest path to ground. Shortest means lowest impedance. The shortest physical distance is not always the lowest impedance. However, when air is the only thing between highly charged clouds and ground, the tallest conductor in the area is most likely the lowest impedance path.

Here's something that might surprise you. A lightning rod works best by *not* getting hit by lightning. The whole purpose of those pointy rods is to drain off charge before it can build up high enough to cause an actual lightning strike.

The idea is that sharply pointed objects discharge static much better than rounded objects. Rounded objects tend to build up a charge. Pointed objects drain a charge. Prior to a strike, lightning is nothing more than a big static charge. The clouds are building up one polarity and the ground is building up another. Anything connected to the ground has the same charge as the ground itself.

Now, if your tower has the smallest gap to the clouds and the same charge as everything else, it's going to get hit for sure. Better to reduce the potential between the clouds overhead and the tower and let some other charged object take the hit. You can do this by having one or more sharp points on the tower and having the tower grounded for DC.

Most towers have a pointed metal "lightning" rod attached to the top of the tower and sticking up above the beacon. This rod needs to have a low resistance DC connection to ground through the tower

members. It is best if the rod is welded to the top section and the sections are welded together. If the connections are

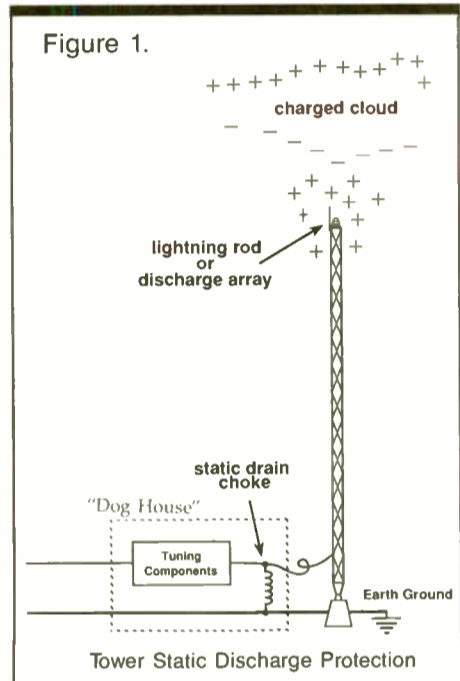
Q-TIPS

corroded, the DC resistance is higher. A corroded tower is also a poor radiator if it is being used as an AM antenna.

The bottom of the antenna needs a good earth ground. For FM and communication towers, this involves simply connecting the tower frame itself to a solid earth ground. AM antennas are trickier, because connecting the tower to ground generally shorts out the signal. What is needed is a DC path to ground that also looks like an open circuit to RF. Such a device is called a "static drain choke."

The static drain choke is a coil of wire mounted on an insulating form. It connects from the AM feedline to antenna ground. The wire doesn't have to be a large diameter because the static discharge currents will be less than an amp.

(continued on page 31)



coupling transformer, feedline, connectors, phasor and transmitter RF sections are all vulnerable.

Do you have any extra antennas hanging on the tower? RPU or two-way antennas and their transceivers are just as likely to be damaged in a strike as your main transmitters.

Let's look at how to protect this equip-

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Circle 144 On Reader Service Card

A Course in Couplers

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. To do a remote broadcast via telephone lines or to put on a telephone talk show, you need a telephone coupler. This device interfaces your audio mixer with the telephone network.

Most couplers have a modular phone jack for the telephone line, another modular jack for a telephone set and audio send/receive jacks that connect to your mixer (Figure 1).

Before we look at specific models, let's define some terms associated with audio couplers.

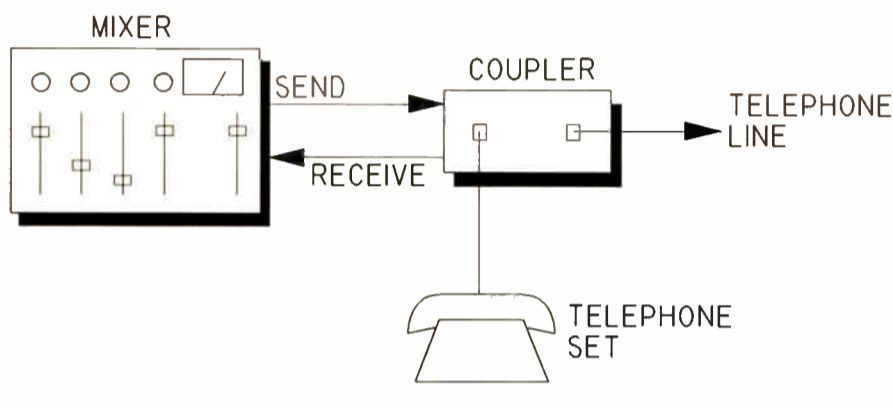
• *Telco*: The telephone company.

Typically, this transformer has a single primary winding for the telephone line, two secondary windings for mixer-audio send and receive, and a third secondary winding for an RC equalizer circuit.

LINE OUT

• *Null*: The separation in dB between the send and receive audio signals, approximately 15 dB. Some couplers come with a null control. Advanced couplers add digital signal processing circuitry to achieve more than 45 dB of separation.

Figure 1.



- *Line*: The telephone cable that connects the coupler to the telephone network (usually via a wall jack).
- *Set*: The telephone handset you use with the coupler.
- *Modular telephone jack*: The standard RJ11C jack used to connect a set or a line to the coupler.
- *Hybrid or hybrid coil*: A transformer in the coupler that transfers telephone audio to your mixer and transfers mixer audio back to the phone line. The hybrid coil is a multi-winding transformer that permits simultaneous two-way communications.

- *Seize or hold*: To load or terminate a phone line. The phone company wants you to put a load on the line. This load tells them to feed a phone signal to you, to establish communication with a dialed-up telephone line.
- *Tap*: A high-impedance or bridging connection to a phone line. A coupler with this feature lets you send and receive audio while using the telephone at the same time. The telephone holds or terminates the line.
- *Loop*: A complete telephone circuit; a connection to a dialed-up party.
- *Loop drop*: Provided by most telephone companies, loop drop is a disconnect signal from the phone company.

With these definitions in hand, we can understand the features of commercially available couplers. Let's look at some made by Gentner Electronics Corp.

First, Gentner's Hybrid Coupler provides an easy, inexpensive way to couple your audio to the phone line. This passive device lets you send and receive audio simultaneously.

To use the coupler, simply plug in a telephone and a telephone line. Also connect audio cables to and from your mixer. A switch on the front of the coupler lets you seize the line, tap the line or disconnect. A null trimmer permits adjustment of the audio separation between send and

(continued on page 30)

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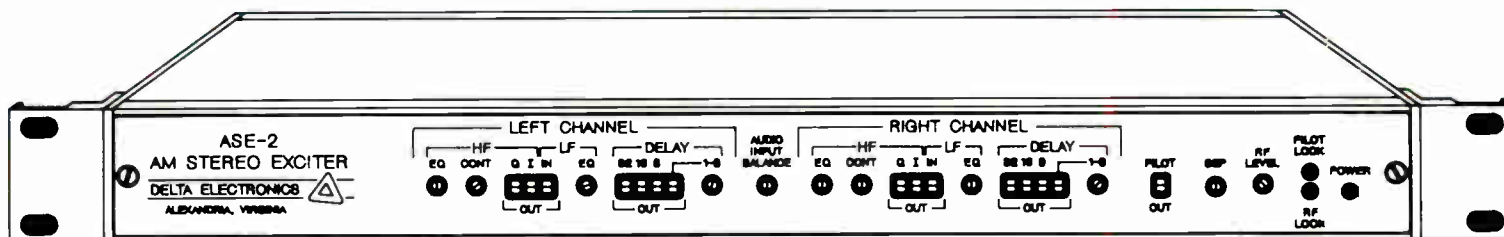
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WORKBENCH

Planning for Winter

by John Bisset

FALLS CHURCH, Va. It's hard to think of the serenity of fall without also conjuring up the season to follow. Now is the time to plan your attack against Old Man Winter.

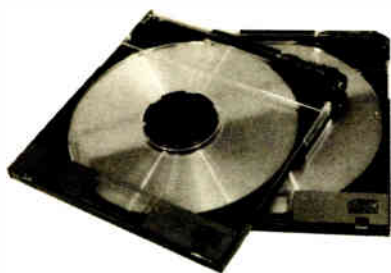
We begin with a tip from KICD CE Joe Schloss. Spencer, Iowa isn't

known for its mild winters and Joe has racked in plenty of time sweeping snow out of satellite dishes. So much so that he found that applying a car paste wax to the dish in the fall made cleaning the snow out of it a much simpler task.

The job is easier on larger dishes by using an extended sponge mop

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Tools can be safely stashed in a tackle box mounted to the side of an equipment rack in shared transmitter locations.

to both apply and buff the paste. Wrapping an old T-shirt around the mop will make buffing easier. The hardest part of this tip is trying to get the GM to reimburse you for car wax.

★★★

If your station has a traffic plane or RPU with multiple antenna receive sites, you'll want to look into the 4RV-Voter package from Doug Hall Electronics of Columbus, Ohio. Jon Banks, CE at WLTT-FM here in Washington, D.C., installed one recently and I'm as impressed as he is with how it works.

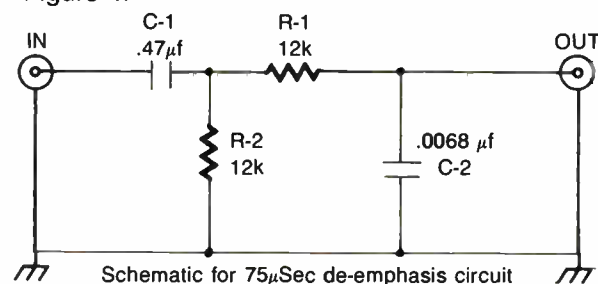
Doug Hall Electronics builds a lot of amateur and two-way gear. The frequency response on this device is reasonable, and if you have a PL system and can ID your transmissions

if no one else is on that frequency, you can set the system up to vote on noise.

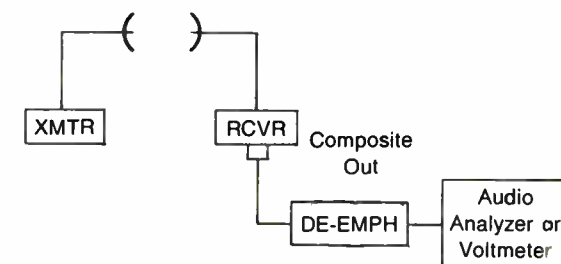
The system votes on how clean the signal is, and then switches to that best receiver. When the sites are

WJLA-TV Maintenance Engineer Anthony Ferrigno came up with the solution to this problem, pictured in Figure 1. In addition to holding some basic tools, the metal tackle

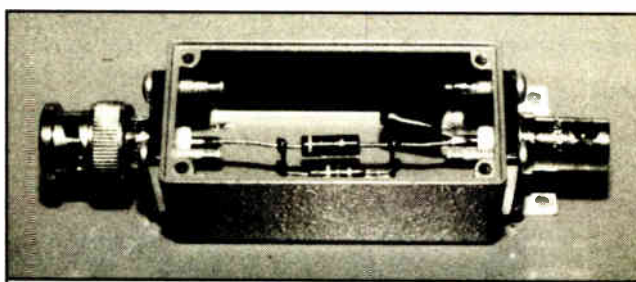
Figure 1.



Schematic for 75µSec de-emphasis circuit



Typical use of de-emphasis circuit to verify SNR in an STL system



The STL de-emphasis circuit can be conveniently mounted in a bnc-equipped Pomona™ box.

matched up well for level, the switching is inaudible. If you'd like more information, circle Reader Service 16.

★★★

Another concern as one prepares for winter is the adequate supply of tools at each site. For a typical transmitter site, this is not a problem. After all, it's either you or your assistant who has keys, so no tools should be walking off. At shared sites, tool security can be another matter altogether.

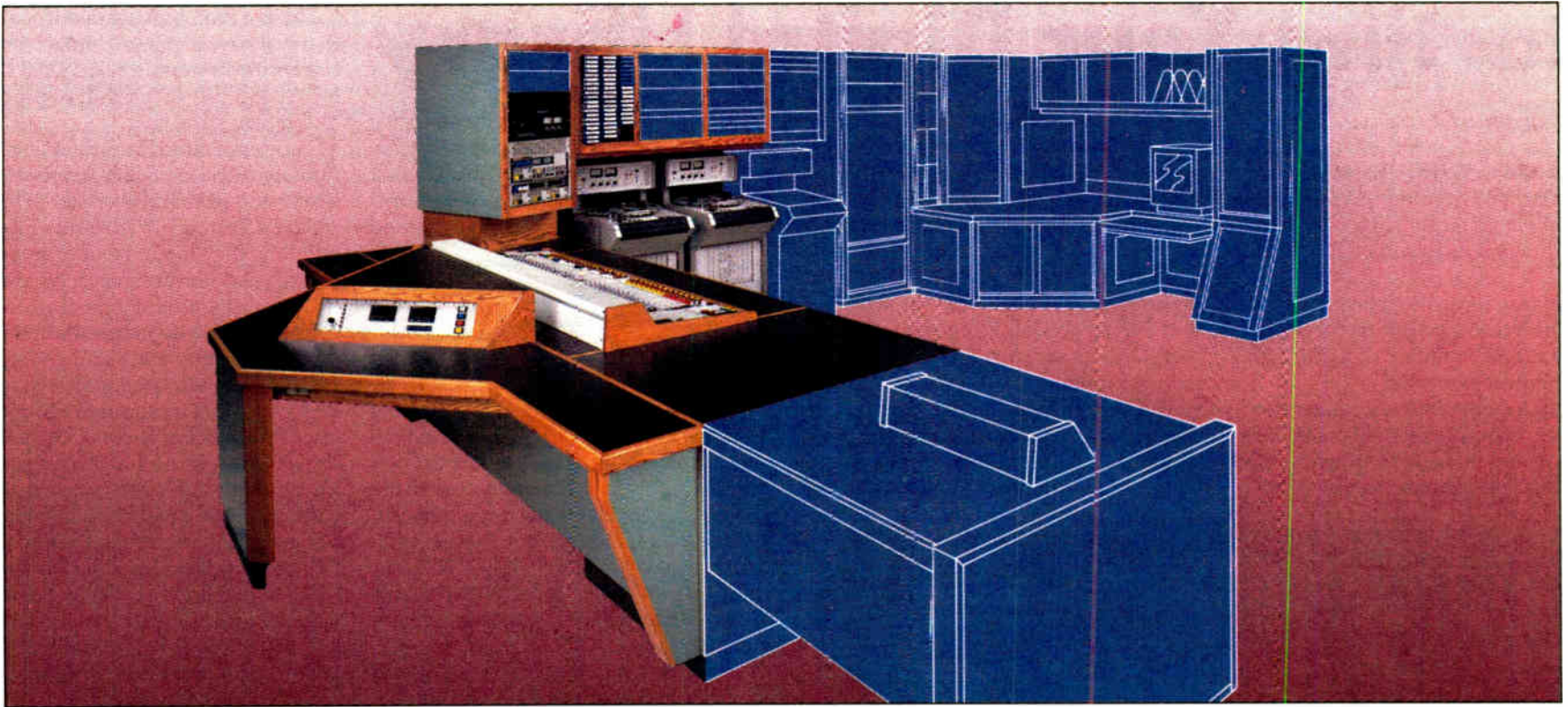
box also holds a slim-line telephone. The combination lock eliminates forgotten keys—in fact, a key to the rack door can be kept inside (one less key for your key ring). For a rooftop STL or RPU site in which your rack is just one of a number of tenants, a locked tool-box makes sense.

While you're at that STL site, you'll find measuring the composite output of the STL receiver easier by using the de-emphasis circuit shown in Figure 2. When built into the

Pomona box as shown, with built-in bnc jacks, the construction is a breeze. TFT supplied the schematic for this particular test fixture. The concept can be used with any STL that uses 75 µsec pre-emphasis and de-emphasis to enhance signal-to-noise figures.

■■■

John Bisset, a principal with Multi-phase Consulting, a contract engineering company, can be reached at 703-379-1665.



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Starting Your Digital Library

by Mel Lambert

STUDIO CITY, Calif. Rapid developments in digital recording and production techniques often mean that keeping up to date with technology can be a daunting task.

Several new recording/playback media have been introduced during the past decade, including compact disc, DAT and magneto-optical systems.

Without a comprehensive understanding of their many operational parameters, it is all too easy to become overwhelmed by the available options.

So just how can we expect to keep up with the rapid advances in digital technology? Hopefully, columns such as this can help define the latest developments and news from our industry, but there also exists a fine collection of textbooks that can rapidly bring you up to speed.

This month, I would like to provide a brief survey of what I consider to be very useful additions to any chief engineer's technical library.

• "The Art of Digital Audio," second edition, by John Watkinson (Focal Press, 1990), is quite possibly *the* best source of information on a broad range of digital subjects.

Various chapters cover analog-to-digital conversion and DACs; data coding techniques; DSP functions; digital interconnect and I/O formats; channel coding; error-correction schemes; video-based

DIGITAL DOMAIN

and stationary-head recorders; disk-based recorders including WORM and magneto-optical; and compact disc. Watkinson's style is highly readable and covers the ground thoroughly. Highly recommended.

• "Principles of Digital Audio," second edition, by Ken Pohlmann (Howard W. Sams, 1989), also is an eminently respectable source of information, written in an easy-to-follow style.

Chapters cover audio basics (room acoustics and hearing); basic digital theory; basic recording and playback techniques; coding/interfaces and transmission; error correction; hard-disk and optical storage techniques; CD basics; DSP functions and digital audio workstations. Thoroughly recommended.

• "Digital Audio Operations," by Francis Rumsey (Focal Press, 1991), takes a detailed look at the techniques for setting up and operating an all-digital facility, including serial and parallel digital I/Os; as well as synchronization of multiple digital sources, including processors, editors,

recorders and workstations.

This is a thorough treatment of a subject that will have increased impact on broadcasters as we move toward DAB and the increasing use of hard-disk production and replay systems.

• "Tapeless Sound Recording," by Francis Rumsey (Focal Press, 1990), provides a basically non-technical overview of the principles and practice of hard-disk recording, and how they might be used in a variety of production environments. An ideal book for the uninitiated user that needs to be quickly brought up to speed with random-access recording and editing systems.

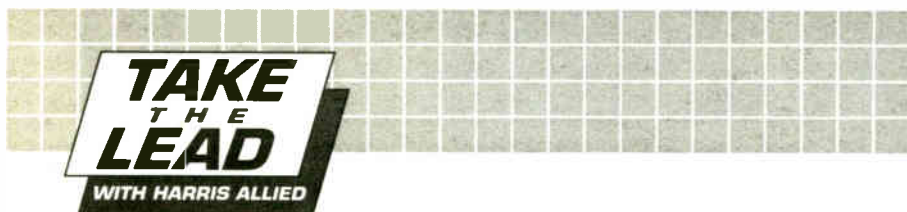
• "RDAT," by John Watkinson (Focal Press, 1991), provides a thorough technical and operational description of Digital Audio Tape, including mechanical transport designs; recorded signal formats; error-correction schemes; and just about anything else you might need to know about this professional recording format.

A comprehensive treatment of a potentially complex subject.

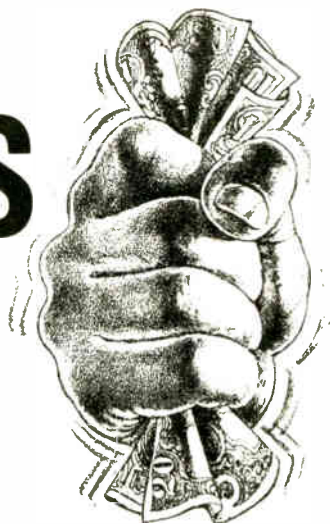
• "Coding for Digital Recording," by John Watkinson (Focal Press, 1990), provides a comprehensive overview of the various principles of magnetic and optical recording; characteristics of stationary- and rotary-head transports; concepts of channel coding; error-correction techniques; plus detailed analysis of several recording formats, including compact disc, DAT and CD-ROM.

• "Digital Audio Broadcasting: A Status Report and Outlook," by Marcia L. De Sonne (National Association of Broadcasters, Washington, 1990), represents an essential introduction and overview to the

(continued on page 30)



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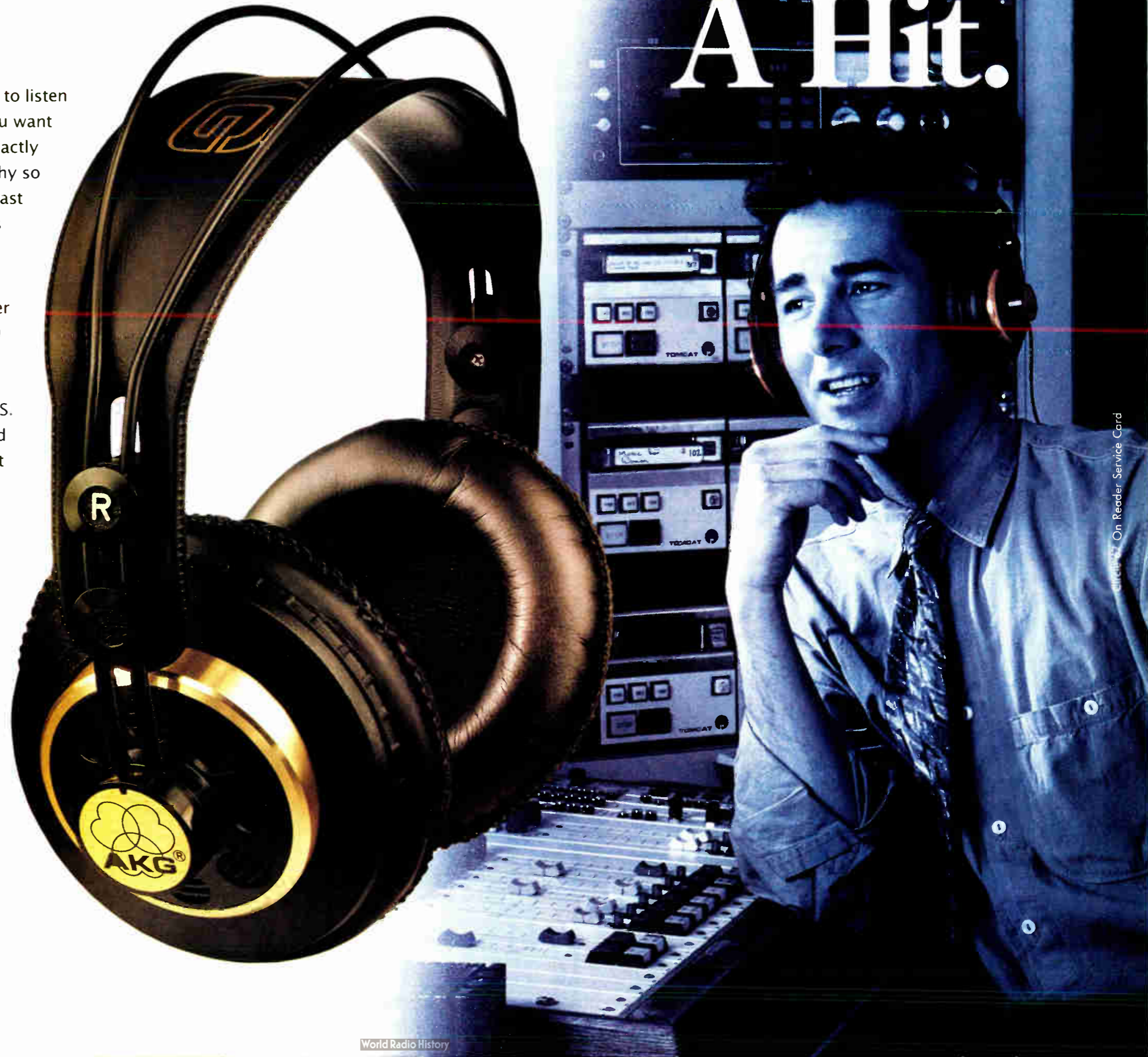
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A Hit.



Circle 15 on Reader Service Card

Your Digital Library

(continued from page 28)

various technical and operational parameters of DAB formats and transmission systems, as well as insight into the eventual adoption of a broadcasting standard.

- "Audio in Digital Times: Proceedings of the AES 7th International Conference," (Audio Engineering Society, New York, 1990), contains a wide cross section of technical papers describing both consumer and professional systems, including several that describe new generations of hard-disk and magneto-optical recorders, workstation designs and setting up an all-digital broadcast facility. A virtual treasure

trove of fascinating and highly relevant information.

- "The AES/EBU Interface Conference," (Audio Engineering Society, New York, 1990), which was devoted to topics such as "Standards and Circuit Design," plus "Using the Interface and Future Developments," and covers just about all that broadcasters would ever want to know about implementation and operation of this widely-used digital I/O.

Various articles describe the differences between the professional AES/EBU interface and its consumer version; importance of ensuring stable clock and synchroniza-

tion sources; addition of program labels to a digital bitstream; and practical experience with carrying AES/EBU-format signals around a large broadcast facility.

- "Proceedings of the Third Annual Digital Radio Station Seminars—NAB Radio 1990, Boston," (National Association of Broadcasters, Washington, 1990), includes several papers that cover digital interface standards; a new digital audio "cart recorder" and a hard-disk system for sequencing and replaying commercials.
- "The Tapeless Directory," by Yasmin Hasmi and Stella Plumbridge (Sypha, London, 1990), comprises an annotated listing of some 50+ digital audio workstations, with brief technical and operational descriptions, compiled by two independent consultants based in London, England.

Although now slightly out of date, this directory provides a useful starting point.

Also worth having on hand are copies of the following AES Standards, which also provide a great deal of operational data about implementing reliable digital interconnections within the all-digital broadcast facility of just 10 minutes into the future:

- "AES3-199X: Recommended Practice

for Digital Audio Engineering Q Serial Transmission Format for Linearly Represented Digital Audio Data," is the main source of information about this industry-wide digital I/O format.

- "AES11-1991: Recommended Practice for Digital Audio Engineering Q Synchronization of Digital Audio Equipment in Studio Operations" provides a comprehensive set of guidelines for ensuring that components in a digital studio lock together successfully, and provide reliable, trouble-free transfer of digital data.

- "AES17-1991: Standard Method for Digital Audio Engineering Q Measurement of Digital Audio Equipment," provides a number of techniques for specifying and verifying the performance of a number of characteristics of digital hardware, including analog input/output amplitude and overload, linear response, signal-to-noise, crosstalk and separation.

■ ■ ■

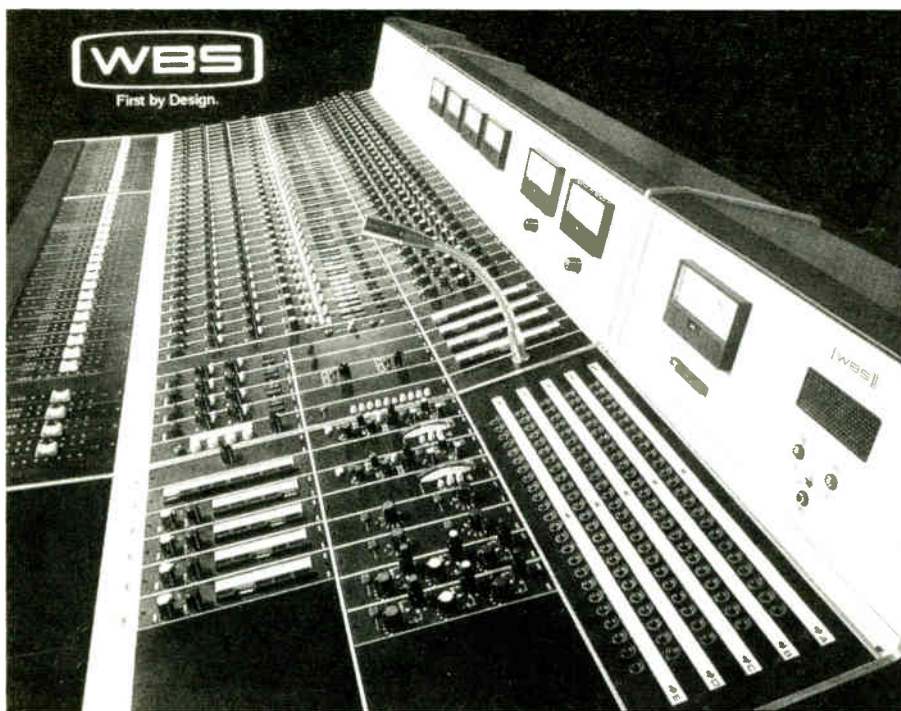
Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for more than a dozen years. Now principal of Media&Marketing, a consulting service for the professional audio industry, he can be reached at 818-753-9510.



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A Course in Couplers

(continued from page 24)

receive audio.

Send audio is via a quarter-inch phone jack, -10 dB nominal level, 600 ohms unbalanced. Receive audio is the same but with -20 dB nominal level. You can select an internal limiter for both send and receive audio.

Claimed frequency response is 250 Hz to 3.2 kHz ± 0.1 dB; signal-to-noise ratio is greater than 60 dB, and THD is less than 0.1 percent.

The Gentner Auto Coupler is like the Hybrid Coupler, but with extra features including line-level balanced audio in and out, auto-answer and auto-disconnect.

A three-way switch selects On (connect audio to and from the phone line); Off (disconnect); or Auto (auto-answer and auto-disconnect).

If your telephone company does not provide the normal loop drop hang-up signal, you would use the Auto Coupler CP, which has a Call Progress Decoder that works with most telephone equipment.

The Auto Coupler requires an included external power supply. Specs are the same as for the Hybrid Coupler, except that the send and receive audio are balanced and the send-audio input impedance is 20 kilohms.

Gentner also makes the PeopleLink teleconference interface, which couples a conference audio mixer to the phone line. The PeopleLink includes several features for convenient, high-quality teleconferencing.

Thanks to Dave Pedersen, Sales Engineer at Gentner, for the information. You can reach Gentner in Salt Lake City, Utah, at 801-975-7200.

■ ■ ■

Bruce Bartlett is a microphone engineer and technical writer for Crown International and the author of "Stereo Microphone Techniques," published by Focal Press. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

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Safety First

(continued from page 18)

really *know* the conditions at your transmitter site? Why not invite your owner and/or GM to visit the site with you? If he does, he'll understand your concerns much more easily.

No discussion of safety can be complete these days without considering the potential danger of the two-legged predator. With many transmitter sites out in isolated areas, or even areas of town that have become dangerous in recent years, personal security has become an important consideration for many.

We'll look more into this problem next time.

■ ■ ■

Barry Mishkind, RW's "Eclectic Engineer," is a consultant in Tucson. He can be reached at 602-296-3797, or 1:300/11 on FidoNet, or "barry@coyote.datalog.com" on Internet.

Protect Your Tower

(continued from page 23)

The coil will have many turns so that it has a large inductive reactance at AM frequencies, which looks like a high impedance to the signal. The DC path for static discharge will look like a low impedance path to ground.

The static drain choke is installed in the doghouse or antenna tuning unit along with RF tuning and matching components for the tower. You buy these chokes from the same companies that provide the other antenna tuning components.

It might be worthwhile to make sure yours is still working by shutting down power, opening the feedline and measuring the DC resistance from tower feed to ground. It should be on the order of a few ohms or less. Otherwise, you have an open choke or a bad connection.

Figure 1 shows the completed static electricity discharge path for an AM tower.

Sometimes that one pointed rod cannot get rid of the charge fast enough. If you have this problem either because of location or a tall tower, you can still do something to prevent strikes. What you need to

do is install an array of discharge points.

A dissipation or discharge array consists of something that looks like long, very sharp, barbed wire or a spiked stick. This material is formed into a dome over the tower, a ring around the tower or an arm that sticks above the tower. The principle is that many points will drain the static faster than one point. This is similar to the idea that many parallel wires will offer a lower DC resistance than a single strand.

You might be interested in knowing that ships and aircraft use multiple discharge points to safely drain static charges. Under certain conditions, you can see this action at work as a faint blue glow called "Saint Elmo's Fire."

Check the ads in **RW** for suppliers of dissipation or discharge arrays. User reports indicate that these can be very effective.

Next month we'll look at the other key components of tower protection: the grounding system and lightning strike protection.

John Shepler is an engineering manager, writer and longtime RW columnist.

LPB Spreads the Word

(continued from page 13)

Devecka, "They use at least five translators at each crusade and sometimes more than that. They reel out the cable and anyone with a pocket radio can listen in, so people who speak a foreign language can tune to the proper frequency and listen to the services in that language."

A brief hiatus

After six or so years of traveling with the Graham organization, the low-powered transmitters returned to the LPB factory recently for a brief hiatus and service check.

Despite having been bounced around the world and having translated hundreds of Billy Graham sermons, the transmitters were given a clean bill of health by LPB

technicians, who found only one small part that needed to be changed in one of seven transmitters, according to Devecka.

Proud of LPB's product track record, Devecka pointed out that thousands of low-powered LPB transmitters are being used by a variety of companies and for a variety of reasons.

"We have a lot of different applications close to every major city," he said, listing sound systems for race tracks and baseball stadiums as just two of the low-powered applications for which LPB and the Commission's Part 15 have been responsible.

Dee McVicker is a free-lance writer and regular contributor to RW. She can be reached at 602-899-8916.



Bring your station into the 90's with CAT-LINK—the digital STL/TSL.

"It's a dream system—we get specs like the microwave wasn't even there. CAT-LINK has completely eliminated the STL delay."

Jeff Andrew, WGCI-FM, Chicago

"CAT-LINK solved all our problems in 4 minutes—2 minutes to install each end. Performance has been impeccable."

Paul Christensen, WIVY-FM, Jacksonville, FL

"CAT-LINK makes money for us, and it improves the sound of the station."

Mike Callaghan, KIIS-FM, Los Angeles CA

"CAT-LINK has held up through extreme heat, a hostile RF environment and nasty summer lightning storms."

Dick Byrd, WZGC-FM, Atlanta GA

Two-way multi-channel communications

CAT-LINK digitizes the entire composite signal with no data compression, so you can run the stereo generator and processing at the studio, where they really belong. At the same time, CAT-LINK sends and receives up to four customized auxiliary channels with no crosstalk—SCAs, control channels, voice communications, RS232 data, AM audio, transmitter readings and satellite or remote program feeds. What's more, CAT-LINK gives you extra capabilities like transmitter building surveillance via closed circuit TV and an analog telemetry channel.

Transparent digital transmission

CAT-LINK encodes the fully processed composite signal, then decodes it at the transmitter. You always get full stereo separation, without the phase or amplitude variations that plague two-channel STLs. Dynamic range is up to 84 dB, and your processed composite signal can use virtually all of it. You hear clear, clean, undistorted audio—all the time.

No audible delays

CAT-LINK's real-time digital encode/decode process doesn't introduce audible delays as data compression can. Jocks can monitor on-air without problems.

Flexible signal path options

• 23 GHz

Stations across the country are avoiding 950 MHz problems by using 23 GHz with CAT-LINK. They've stopped worrying about frequency congestion and interference, repeater-induced signal degradation, and fresnel zone clearance fading. 23 GHz dish sizes also reduce wind loading and tower space requirements.

• DS1 (T1) Data Line

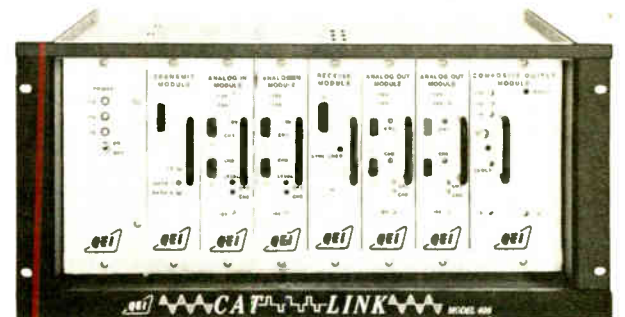
CAT-LINK is cutting phone bills for stations that don't have a clear microwave path. With CAT-LINK, a single bidirectional DS1 line replaces multiple Class A telco lines, providing multi-channel STL and TSL over the same link. Already available virtually anywhere, DS1 service is getting cheaper every day.

• Fiber Optic

CAT-LINK and its optional fiber optic modem provide direct connection to discrete fiber.

• Twisted Pair

CAT-LINK will drive up to 5000 feet of twisted pair wire without repeaters. Four wires provide full two-way multi-channel capabilities.



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AMPLIFIERS

Want to Sell

Crown MT1200 pwr amp, 1200 W, bridge mono, excel cond, \$750 ea+shipping. Philip, Big Red Sound, 172-28 Henley Rd, Jamaica NY 11432. 718-523-2815.

CBS Labs 1602 stereo DA, 8 outputs/chnl, \$150. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

Dyna ST-70, pair, w/tube preamp PAT-2, \$400; all mint NAD 2140, as new, \$225. R Nelson, Tropical Brcdcsing, 14093 SW 142 St, Miami, FL 33186.

Bogen Challenger 6-chnl amp, gd cond, \$75; Gates M6108 mon amp, gd cond, \$50; Henry Eng Match Box, excel cond, \$100; Lauderdale DA-8 4x2x2 dist amp, vgc, \$175. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Auditronics 1100DAGLC dist amp (20), in (2) Auditronics 1100MF 10-input mainframes, w/Auditronics PS60 RM external pwr supply, used 6 mnths, \$1500/all. B Lord, Lord Brcdcsing, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

CBS Labs 1602 dist amp, dual 1x8, \$150. P Cibley, Cibley Music, 138 E 38 St, NY NY 10016. 212-986-2219.

Halco PB-2T R/PB amp, BO; Altec 1569-A 75 W amp tube, like new, BO. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Marti PGM-20 line amp, \$40. P Wells, KJQY San Diego, 619-238-1037. FAX: 619-238-6157.

Bogen AP35 stereo tube amp, \$50. M Saady, First City Rec, 141-60 84 Rd #3E, Briarwood NY 11435. 718-846-2062.

Tascam 1 headphone amp, 200 hrs; (2) Tascam LA-8 line amp, like new; call for prices. D Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

Dynakit PASII pre-amp, new & used cable w/Canons 3 prong; manuals for Ampex 351/350/601 & mixer MX-35; Pultec EQP1A; Univox headsets, new, stereo or mono guitar; monitor panel for 8 trk recorder through speakers to stepdown to 2 trk, or whatever. Mr. Oliver, 212-874-7660.

Want to Buy

Tube amps & remote mixers, incl RCA OP-6, OP-7, WE 22-D, RCA T3A Series. B Davies, Virgo Prod, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

Altec 287-F/287-W, any cond; also, WE amps, Marantz & Ampro vacuum tube audio amps, Westrex cutter amps. D deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

Altec 287-F/287-W, any cond; also, WE amps, Marantz & Ampro vacuum tube audio amps, Westrex cutter amps. D deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

ANTENNAS & TOWERS

Want to Sell

Jampro JHCP 6-bay FM brdcs antenna, tuned to 100.3, 20 yrs old, gd cond, recently removed, BO; ERI G5 4-bay FM antenna, on 100.3, used less than 6 mnths, excel cond, BO. B Harris, KXLT, 5350 S Roslyn St #210, Englewood CO 80111. 303-741-5654.

Used 3-1/8" xmission line components: dielectric thurline section; to N adapters; bullets & 48" line section; various solder flanges; female Helix flange. J Bisset, Multiphase, 703-379-1665.

RCA MI-19089 3-1/8" 90° swivel mitre elbows, (1) unused w/double flanges & hardware, (1) used but excel cond, \$250/both. R Lambert, 520 Sharpe Rd, Columbia SC 29203. 803-754-2932.

Set of (8) guy wires, can be used for AM/FM 300' tower, approx 1/4" diameter, w/insulators, like new, \$650. R Chambers, KSUE, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

ERI CP-3 bay, suitable for Class A, tuned to 103.1, retunable, \$250; Gates ATU boxes (2), 3'x3'x3' aluminum w/inner & outer door for pole/fence mounting, w/feedline clamp & ammeter switch assembly, \$200 ea. F McCoy, 2118 W Warner, Chicago IL 60618. 312-712-3529.

Belden cable: 8449, 8790, 8422, 9750, 8448, 8663, 8627, various lengths, new, \$100/all or will sell separately, you ship; (4) Andrew 78ARF, 3" helix connectors, never used, \$300 ea/\$1100 all. R Kerbaw, WTNJ FM, Box 1127, Beckley WV 25802. 304-877-5592.

Celwave CP-1000 2-bay, 2 kW antenna, missing harness, tuned to 107.1, can sell sep as (2) 1 kW single bays, BO. J Galanses, WAVI, POB 25016, St Croix VI 00824. 809-773-3693.

Celwave CFM-LP-3 FM antenna, 3 bay wideicers, tuned to 104.5, excel cond, \$2000. J Jetzer, WXER, 414-893-1045.

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ERI 4-bay circ polarized high pwr antenna, tuned to 105.3, gd cond, bullets should be replaced, please call. C Loughry, WFRB, RD2 Box 373, Frostburg MD 21532. 301-689-8871.

Stainless Tower GST-500, 500', 6' face, tradeout for dismantling. W Baxter, WRVM FM, POB 212, Suring WI 54174. 414-842-2839.

Cablewave splice for 1-5/8" coax, \$195; Cablewave gas blocking end connector for 1-5/8" line, w/EIA flange, \$145; Phelps-Dodge CFM-LP-4 4-bay FM antenna, 94.3 MHz w/randoms, circ, excel cond, ready to ship, \$1500. B Brewer, KOKL, 410 W 6th, Okinulgee OK 74447. 918-756-3646.

FM - ANTENNAS

Designed and built for your frequency. Choose from 1 to 12 bays and five power levels. Financing available. Call Jimmie Joynt at S.W.R. 800/279-3326

ERI FML 3-bay tuned to 92.5 FM, used 2 yrs, packed in orig boxes w/all parts, like new, changed freq, \$2900. H Thompson, WLYU FM, POB 111, Lyons GA 30436. 912-526-8122.

Cablewave HF 4-1/8", 250'; CU2Y Flexwell cable; 6-1/8" gas pass; 6-1/8" gas barrier connector; \$3000/all. B Weiss, KLSI, 3101 Broadway #460, Kansas City MO 64111. 816-753-0933.

Bendix Radio, 24" x6" diameter, loading coil w/5" diameter variometer inside, unused, made for US govt. \$70. J Cunningham, YS-DA, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Andrew 1-5/8" splice kit, new; used 1-5/8" splice kit; 3-1/8" to 1-5/8" reducer; BO. D Tabor, WLCK-WVLE, Box 158, Scottsville KY 42124. 502-237-3148.

Angular guyed tower, 120', on the ground, \$500. J Stromquist, WNCB, 2828 Piedmont Ave, Duluth MN 55811. 218-722-3017.

Rohn 170' self support tower, 5 yrs old, on ground, \$5000 & you ship. Also, 300' tower, 48" face, 20 yrs old, galvanized, very good shape, \$1300/BO & you take down. J Lackness, 409-838-2938.

Want to Buy

ERI rototiller antenna, 6 or more bay, on or near 93.3 & 95.5; tower, 500' taller, standing on ground; feedline also needed. R Wachter, KNSX, FAX: 314-921-2122.

Cablewave/Celwave 150-160' 1-5/8" air dielectric xmission line in gd used cond. K Diebel, KTJC-FM, 1207 Louisa St, Rayville LA 71269. 318-728-5852.

Cablewave HFM LP-4 antenna, 4-bay horiz only, tuned on or near 95.9 MHz; Also, any Class A antenna, horiz only, 4-8 bays, tuned to 95.9 or 96.7 MHz, incl Phelps Dodge, RCA, Collins, etc. T English, 70 Middle St, Bridgeport CT 06604. 203-366-9321.

Tall towers & antennas, 1 10-bay 107.1, 1 10-bay 98.3 or tunable; also, xmission line. B Zellmer, Colorado Farm Net, Box 2475, Greeley CO 80632. 303-330-1342.

AUDIO PRODUCTION

Want to Sell

Tone processor (2), 25 Hz, \$375. R Chambers, KSUE, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

Eventide BD980 stereo delay, 15 kHz, excel cond, \$3500; Orban 222A stereo enhancer, excel cond, \$500; Tascam RS20 spring reverb, excel cond, \$100. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

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Dolby 361 SR & A type NR stereo pair w/cards for SR & A, work fine, \$2200/pair; BSR/dbx stereo tape hiss reducer, RCA inputs, variable low pass filter dynamically dependent on program content, \$49. R McMillen, 503-239-6070.

dbx 128 Type II NR w/comp & expander, \$150+shipping. Philip, Big Red Sound, 172-28 Henley Rd, Jamaica NY 11432. 718-523-2815.

Lexicon 224, 404 reverb, excel cond, BO; UREI 529 EQ, excel cond, BO. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

dbx 140X NR in orig box, not used, \$100. S Cassidy, Radio Prog Services, Box 472, Manitou CO 80829. 719-661-1744.

Want to Buy

Burwen TNE7000A or comparable. T Young, Bible Brcdcsing Network, 1300 N Battlefield Blvd, Chesapeake VA 23320. 804-547-9421.

dbx Type 1 audio processing equip incl CD players & EQs. S Wood, Modern Syst Res, 12648 La Costa Ct, Los Altos CA 94022. 415-941-8000.

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Ham radio operators looking for surplus audio processors, mixers & mics, as well as other inexpensive gear that could help bcdt engr play radio at home among enthusiasts for vintage AM. Please write w/offerings. WAA3VJB, Box 73, West Friendship MD 21794-0073.

AUTOMATION EQUIP

Want to Sell

Complete Automation System for satellite network, (2) 48-tray Instacarts, format Sentry with software. G. Katz, KCEZ, POB 7568, Chico, CA 95927. 916-342-2200.

SMC 450 Carousel (3), gd cond; triple deck cart player; MSP-1 programmer & control head; 350 Carousel for parts; SMC tone gen. J Galanses, WAVI, POB 25016, St Croix VI 00824. 809-773-3693.

Conex CG25 tone encoder, excel cond, \$200; Conex CG25-R tone encoder, excel cond, \$225; Gates time pulse module, gd cond, \$100; Gates ATC logging encoder, gd cond, \$125; Schaler 903 automaton system incl (4) R-R, (3) Carousels, used, \$4000; (3) Sonomag 250 cart Carousels, gd cond, \$200 ea; (2) Sonomag TS-25 tone decoder, vgc, \$200 ea. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Sonomag 350RS Carousel (2), used but operate, \$1000 ea/BO; (3) standard equip racks, used, \$300 ea/BO; BE automation rack, used, \$400/BO; Gates 5-chnl stereo Statesman board, needs work, BO. S Willett, WAYI/WBZA, Glen Falls NY, 518-792-2151.

Shafer/Cetec 7000 brain; also, (1) Audiofile & (2) SMC 248 Carousels, pick-up only, BO. D Doughty, H&D Brcdcs Group, POB 781, Utica NY 13503. 315-797-1330.

IGM Go-Cart 24, used 1 yr, w/manual, gd cond, \$3000/BO; Systemation Superswitch, 6 closures, w/manuals, like J Pescatello, WWWV-AM, 900 E Main St, Meriden CT 06450. 203-634-1470.

IGM Go-Cart 24 (2), 2.5 yrs old, on air, mint cond, must sell quickly, BO. J Amburn, KTUE/KJMX, POB 1260, Tula TX 79088. 806-995-3531.

BUSINESS OPPORTUNITIES

Want to Sell

Prior owner/operator w/22 yrs exper will build your AM/FM station, facility construct to hiring/training staff, upgrades, turnarounds, will consider equity. R Ritchey, 512-828-9252.

CAMERAS (VIDEO)

Want to Sell

Panasonic AK-30 (2), w/brdcs grade Plumbicons, gd cond, BO. D Brennan, Brennan Entrprs, 3596 Lorna Ridge Dr, Birmingham AL 35216. 205-823-0088.

Panasonic AG-450 S-VHS camcorder (2), new cond, all access, \$1200 ea firm+UPS. R Larson, Larson Prod, 3 Braden St, PI ME 04769. 207-764-3770.

Ikegami 730A w/Canon J1299 BIE lens, plate, case, excel cond, \$4200. M Veselich, Walden Group, POB 10451, Marina Del Rey CA 90295. 213-671-0392.

CART MACHINES

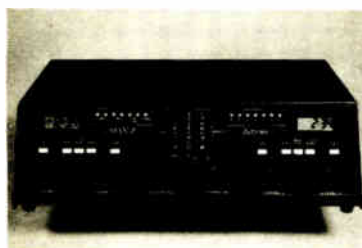
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Spotmaster 500C PB cart machine, works, as-is, no manual, \$300 incl UPS ground. L Spivey, WLLS AM/FM, Hwy 231 S, Narford KY 42347. 502-298-3268.

Cartridge tape winder, works, as-is, no manual, timer broken, \$60 incl UPS ground. L Spivey, WLLS AM/FM, Hwy 231 S, Narford KY 42347. 502-298-3268.

Misc cart players incl: ATC, BE, Collins, Gates, Harris, Spotmaster, Tapeaster, some for parts, call for details. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Keycart mono cart R/P w/extra belts, 3 yrs old, \$300. R Ness, WGEN, 1003 S Oakwood Box 67, Geneseo IL 61254. 309-944-4633.

UMC 11-113 mono repro, 3 tones, \$325; set LEL alignment gauges for Ampro cart decks, \$15. P Wells, KJOY San Diego, 619-238-1037. FAX: 619-238-6157.

Nortronics cart machine R/P heads, single/dual trk, \$10 ea. M Jones, WIVK, 6711 Kingston Pk, Knoxville TN 37939. 615-588-6511.

Spotmaster 505, (2) R/P, (1) P only, gd cond, \$200 ea; Sparta cart delay, like new, \$500. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-262-5963.

BE Cartwinder w/over 200 Fidelipac carts for parts, gd cond, BO. M Ring, WTNV AM/FM, 134 Mallin St, Watertown NY 13601. 315-288-0790.

BE eraser/splice finder, Audicord DL stereo recorder, Otari CTM10 stereo R/P, never used, BO, like new equip, used only in limited lab testing. S Martin, 609-235-3900.

Spotmaster 500, plays but needs work, you pay shipping, \$150. B Davis, BDMZ Prod, 408 N 11 St, St Joe MO 64501. 816-279-6851.

IT PDII (2), w/remote start, fair cond, \$100 ea. J Pescatello, WMMW-AM, 900 E Main St, Meriden CT 06450. 203-634-1470.

BE 3203 stereo R/P w/3 tones, mint cond, used very little, \$1495; BE 3102 stereo P w/3 tones, mint, \$995; BE 3300 mono R/P w/3 tones, \$795. B Moutjoo, WITM-AM, POB 1240, Elizabeth TN 37644. 615-543-5849.

CASSETTE & REEL-TO-REEL RECORDERS

Want to Sell

Ampex AG-440B 1" 8-trk console, gd cond, BO. R Kaufman, Pams Prod, POB 462247, Garland TX 75046. After 3PM: 214-271-7625.

Tascam #38 Studio 8 track recorder, 10" reel with RC71 control unit, 12" hook up cables. In use now, excellent condition, and 12 channel # 1282 Biamp board, in use, lows, highs and outs, with speakers. Complete package \$2100. Would consider trade-in. Indiana 317-357-7766.

Broadcast Supply Fax 100 cradle mounts (3) for MK 5050II, used 8 months, \$40. B Lord, Lord Bldg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Otari 5050B 1/2-trk, new, \$2500/BO. P Accardi, Evangelistic Ministries, 1521 Upper Fords Pond Rd, Clarks Summit PA 18411. 717-587-2382.

Revox A-77 stereo R-R, \$250; **Revox A-700** stereo R-R in cabinet, \$300. R Chambers, KSUE, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

Misc R-Rs incl: Ampex, B&H, Omnilib, Revco, Scully, Teac, call for models & prices; Goldstar port cassette recorders, vgc, \$15. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Denon DRM2 (4), (3) w/new motor & idler arm, mic inputs, gd cond, all working, \$75 ea/BO or \$250/all+shipping; Uher R-R, DKN I/Os, cables, \$100/BO. B Strapko, 708-830-0701.

Audiotronics AV123-4TS 1/4-trk; **Infonics RR-1**, 73M, FT; **Infonics RR-2**, 74M, 2-trk; all gd cond, all/part, \$200 ea. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-262-5963.

Tascam Mini Studio Porta II, like new, wall papers & instruct, \$399. Dan, 206-546-1498.

Ampex 440-C 4-trk w/servo capstan, heads marginal, \$500. C Benner, WUSL-FM, 440 Domino Ln, Philadelphia PA. 215-483-8900.

Ampex AG440 1/2" 4-trk w/console & dbx type II NR, \$650. R Cornens, Madison Park Prod, 700 W Pete Rose Way, Cincinnati OH 45203. 513-651-5375.

Tascam 22-2, 1/4", 1/2-trk, 75/15 ips, clean, just tweaked, \$400. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

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Otari MX-5050B 2-trk stereo, gd cond, \$995; **Otari MX-5050** 2-trk stereo, gd cond, \$795; **Otari MX-5050 FT** record/play, \$595. B Moutjoo, WITM-AM, POB 1240, Elizabeth TN 37644. 615-543-5849.

Otari 8-chnl rcrdr w/remote, less than 200 hrs; **Otari 2-chnl rcrdr**, like new cond; **Master Cassette Deck MCS-3590** w/NR & dbx; (12) **Cassette Deck MCS-3556** for dupl cassettes; port case for Ampex AG-440B & case for electronics; call for prices. D Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

Scully 280 4-trk, in console cab, gd cond, BO; **Scully 280** 2-trk, w/portable cases, gd cond, BO. F Virtue, Virtue Studios, 8809-11 Rising Sun Ave, Philadelphia PA 19115. 215-763-2825.

Dictaphone 20 chnl logger, 1" tape, dual transport, fail-safe, time code gen/reader, metal cabinet, \$1500. Mel Crosby, Sequoia Electronics, 408-866-8434.

Ampex torque motors, new, AG440, \$50; AG440 w/brakes, \$80; 350/351 Series w/brakes, \$80. Mel Crosby, Sequoia Electronics, 408-866-8434.

Otari ARS1000-DC R-R PB tape deck (2), w/tone sensors, excel cond, \$600 ea. B Brewer, KOKL, 410 W 6th, Okinulgee OK 74447. 918-756-3646.

MCI JH-110B FT stereo for 14" reels, in metal roll-around cabinet, \$1875/trade for computer, etc. P Wells, KJOY San Diego, 619-238-1037. FAX: 619-238-6157.

Otari MX5050 1/4" 4-trk; **Teac 32-2B 1/4"** 2-trk. J Edman, Results Brdctng, 7732 Tampa Way, Shreveport LA 71105. 318-797-3211.

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Circle 77 On Reader Service Card

Ampex 602 FT mon, portable case, ave cond, \$60 UPS paid; **Ampex AG500 FT** mono, portable case, gd cond, \$150 UPS paid. W Arnett, WBAT, Box 839, Marion IN 46952. 317-664-6239.

Scully torque motors, new, Elenco brand, all speeds, \$200/each. Mel Crosby, Sequoia Electronics, 408-866-8434.

Sony TC105-A (3), (2) wrkg, (1) for parts, \$50/all+shipping; **Marantz PMD 200**, for parts, \$10+shipping. P Mueller, KUTA-AM, N Hwy 191 G-1, Blanding UT 84511. 801-678-2261.

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Teac/Tascam 35-2 & 35-2B R-R 2-trk rcrdrs, (1) w/dbx, recently refurb, w/attractive, custom, side-by-side console, excel cond, \$1700/BO+shipping. W Ahlberg, Davis Glick Prod, 11846 Ventura Blvd #306, Studio City CA 91604. 818-509-9100.

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North Hollywood, CA 91607 fax: 818-784-3763

Otari 5050B, new capstan motor w/PC board, \$100; **Panasonic SV3500 DAT** demo, checked by mfr, \$850/BO. R Rhodes, Rhodess Music, POB 1550, NY NY 10101. 212-245-5045.

Magnecord PF-6, (2) stereo, (3) FT mono, amps, cases, parts, manuals, all/part, fair-gd cond, BO; **RCA 2"** tape transport components, (1) capstan motor, (2) reel motor w/platforms, brakes, guides, pinch rollers, gd cond, BO; **Shafter** logging recorder, 10-1/2 reels, 3/6 ips, 1/4-trk, 2-chnl, gd cond, \$200. R Meyer, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-262-5963.

Ampex 300 (53) w/tube elec, w/new spare pinch roller & manual, drive motor may not operate, \$75+shipping. J Morinelli, Morinelli Entertainment, 901 Fairfax Rd, Drexel Hill PA 19026. 800-666-2641.

Vertigo Recording Services
12115 Magnolia Blvd. #116 818-907-5161
North Hollywood, CA 91607 fax: 818-784-3763

ITC 750 reel deck (2), (1) w/record amp & extra parts box, \$700/all; (2) **Magnecord mono R/P**, (1) rebuilt, (1) unknown cond, BO; **Rollaround** adj tape deck rack, gd cond, \$50+you pick up. R Ness, WGEN, 1003 S Oakwood Box 67, Geneseo IL 61254. 309-944-4633.

Electrosound 200 Series cassette splicer head, very low mileage, \$50. Mel Crosby, Sequoia Electronics, 408-866-8434.

Studer 820 2-trk master rcrdr, latest mods & software, mint cond, \$900+shipping. R Canata, Cantrax Recorders, 2119 Fidler Ave, Long Beach CA 90815. 213-498-6492.

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Circle 131 On Reader Service Card

Dictaphone 10 chnl logger, 1/2" tape, dual transport, fail-safe, time code gen/reader, metal cabinet, \$1000. Mel Crosby, Sequoia Electronics, 408-866-8434.

Two Scully 280 R-R's & one ITC Premium stereo cart R/P. Trade for small stereo console. Steve, 214-349-7070.

Want to Buy

Ampex MR-70, gd cond. D deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

Otari 4-trk in gd cond. J Laprad, Sunspots Prod, Box 403 W Side Station, Worcester MA 01602. 508-755-0732.

Ampex 351 stereo headstack, fair-excel cond. D MacKenzie, WJBR AM-FM, 2617 Ebright Rd, Wilmington DE 19810. 302-475-4000.

Uher recorders, all conds; also, access, manuals, new parts stock, promo items & ads; mini R-R recorders, esp 2" reel capacity; also, empty 2" & colored reels up to 5"; plus, vintage open reel access from '60s. J Morinelli, Morinelli Entertainment, 901 Fairfax Rd, Drexel Hill PA 19026. 800-666-2641.

Ampex MR-70, gd cond. D deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

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

Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 1131 Virginia Ave, Campbell CA 95008. 408-866-8434.

MCI/Sony capstan & reel motors, any cond., recd heads, most mtgs, 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.

CD's

Want to Sell

Adult contemporary library w/2200 songs on CD & cart, incl 93 Goldiscs & 230 misc CDs, add'l 170 songs dubbed on Scotchcart IIs, \$7500; **country** library w/1500 songs on 66 CD Goldiscs & 500 add'l Scotchcart IIs, \$6000; both used 6 months. B Lord, Lord Bldg, 13313 SE 208th St, Kent WA 98402. 206-631-2374.

COMPUTERS

Want to Sell

Tallgrass TG3135 external 35 meg hard drive & 45 meg tape back-up, software, interface card, manuals, \$500. S Kozak, 351 Pinewood, Bay Village OH 44140. 216-871-5897.

Okidata Laserline 6 laser printer, emulates HP Laserjet, utility software, manuals, \$300+shipping. V Gray, 6840 Sterling, Raytown MO 64133. 816-358-8929.

Wang 2200 PC Business System for use w/Computer Concepts Broadcast System, BO. M Ring, WTNV AM/FM, 134 Mallin St, Watertown NY 13601. 315-288-0790.

Want to Buy

CONSOLES

Want to Sell

JBL 7510 automated mic mixers, rack mount, (1) w/8 inputs, (1) w/12 inputs. S Kozak, 351 Pinewood, Bay Village OH 44140. 216-871-5897.

Autogram AC-6 stereo console, never used, mint cond, \$3500. Wayne, Broadcasters Unlimited, 903-581-0606.

Radio Systems ESA-10 w/manuals & copy stand, \$4500; BE 5S150 w/manual, \$1500. T Pless, WHVY, 112 Main, Annapolis MD 21401. 301-626-0103.

RCA 6B6 tube-type 2-chnl, functions wrkg, grt old board, \$600+shipping/BO. T Heathwood, Heritage Radio Classics, POB 16, Boston MA 02167. 617-969-9966.

Gates Ambassador 5-chnl w/(4) xtra chnls, used, \$300; **Gates Yard II** mono 8-chnl, vgc, \$500; **Prokit** audio mixer, 6-chl, used, \$75; **Shure**, M68 mixer, vgc, \$100; **Sony MX14** 6-chl mixer, gd cond, \$30; **Sony MX650** 6-chnl mixer, gd cond, \$50; **Sparta S-15** mixer, used, \$25. B Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Pyramid PR8900 mixers (2), grt cond, \$300/BO. J Galanses, WAVI, POB 25016, St Croix VI 00824. 809-773-3693.

Russco 505S stereo 5-chnl board w/10 inputs, cue & mon systems, \$600. J Laprad, Sunspots Prod, Box 403 W Side Station, Worcester MA 01602. 508-755-0732.

Collins 8081-1 portable console w/TT, all transistor, never used, like new, BO. J Anderson, WKCW/XRZ, 2192 Hwy 72 E, Corinth MS 38834.

Roland CompuEditor automated fader system (2), locks to SMPTE, \$700 ea; **Trident Series 80**, spare chnl & misc parts, \$200. B Seifried, Eclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

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

25+ exper in all phases of radio, sm & med markets, seeking station mngt pos in FL or S GA. B Sutton, POB 1065, Hobe Sound FL 33475.

Attention getting talk radio, full spectrum personality. H Friedman, 512-445-5453.

New DJ wants to break into TX market, any format, strong in commercial & news prod, any shift, tape & resume avail. S Bradshaw, 7727 Nimrod, San Antonio TX 78240. 512-523-2035.

15 yr vet, On Air & PD, top 40, oldies, rock, hot AC, please no dance station, SE only. 803-457-4556.

IDs, sweepers, sports, billboards, etc, for sm market budget minded station. 803-457-4556.

Recent grad, announcing since '87, wants to begin career, work anywhere, pay not important. T Morrow, 2353 Nebraska, Blair NE 68008. 402-533-2821.

Broadcaster w/2 yrs non-commercial exper seeks PT/FT commercial pos in SE PA, NJ or N DE. Milt, 215-533-3773.

Station manager w/news & prog exper, also, computer billing, collections, automation & strong sales background, very willing to relocate, young & highly motivated. Stan, 404-884-8531.

Aggressive, tireless, company-minded 31 yr old PD/OM seeks turnaround situation w/limitless opportunity, 11 yrs exper, AC/AOR/urban, SE location. James, 601-841-6815 nights.

11 yrs radio exper, PD, prod, DJ, traffic & news, seeking PD & On Air pos in Albuquerque/Farmington, NM. John, 503-267-2249.

Jazz host/producer, 12 yrs exper, seeks On-Air slot in Orlando/Tampa area, FT pref. P Lamattina, 6 Pineybranch Rd, Cranbury NJ 08512.

Exper eng accepting temp/FT assignments, anywhere, projects, construction, restoration, gen mgt. T Low, 2946 Amanecer Pl, Escondido CA 92027. 619-741-1054.

Engineer w/5 yrs exper, studio construct, TX site construct, all levels maint & planning, anywhere in Mid-Atlantic. Engineer, Rt 1 Box 179, Callaway VA 24067.

Chief eng, former tech dir of 26 stations, seeking eng mngr pos, SBE certified, FCC license, 13 yrs exper w/FM & AM directional. D Nelson, 206-387-3558.

Announcer w/5 yrs exper, esp in major market Baltimore, seeks FT shift in S-central PA, W MD or MD Eastern Shore, prod skills are excel, write for T/R: 8432 Pleasant Plains Rd, Baltimore MD 21204.

HELP WANTED

AM/FM or Combo wanted. No money down or equity position desired. Turnarounds or distressed OK. Anywhere in US. Will make it worth your time! B Simonson, 208 Blake, Galesburg MI 49053. 616-665-7140.

Pennsylvania based group owner seeking engineers with minimum 4 years experience. Hands on position dealing with AM and FM facilities. Travel involved. Send resume and salary requirements to: Radio World, POB 1214, Falls Church, VA 22041. Attn: Box #91-09-02FRW.

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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 \$10 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**
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CONSOLES . . . WTS

McMartin 1082V 8-chnl stereo console w/slido faders, 20 inputs, gd cond w/pwr supply, spare parts & manual, \$1000; Harris Medalist-10 10-chnl stereo console w/rotary faders, excel cond w/spare parts & manual, \$2000; Harris Medalist-8 8-chnl stereo console w/slido faders, excel cond w/spare parts & manual, \$1800. B. Mountjoy, WITM-AM, POB 1240, Elizabeth TN 37644. 615-543-5849.

ADM S/TV-24, 24-input w/4 subs, subs have EQ, 4 yrs old, excel cond w/doc & records, \$2000. B. Covey, WATL-TV, 1 Monroe Pl, Atlanta GA 30324. 404-881-3600.

Henry Fast Trac dubbing system, \$400. B. Lord, Lord Brdcstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Audio Arts Engineering 8X recording console, factory patch bay, 24x8x24 tri mon, brand new cond, \$7800. D. Kocher, Digital Sound Makers, 1901 Hanover Ave, Allentown PA 18103.

Tascam 5-A mixing boards (2), 200 hrs, call for price. D. Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

Ward-Beck custom 32x8x2 TV audio console w/external 24 row patchbay in excellent condition, on air until 6/91, \$42,500/BO, buyers ships. Call Audio Consulting & Engineering, 415-512-7391.

Want to Buy

API or Neve consoles; esp API 550A & 550B; also API & Neve EQ & other modules; anything considered. J. Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Langevin AM4A w/documents. J. Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

DISCO & SOUND EQUIPMENT

Want to Sell

Dukane 3A235 1/3 octave sound reinforcement syst EQ (2), \$250 ea; UREI 530 stereo octave EQ, \$250. S. Kozak, 351 Pinewood, Bay Village OH 44140. 216-871-5897.

Roland SRV-2000 midi digital reverb, mint, \$475; pair UREI 809A studio time align mon, \$1250; Valley People Dynamite compressor, 2 chnls, \$395. P. Accardi, Evangelistic Ministries, 1521 Upper Fords Pond Rd, Clarks Summit PA 18411. 717-587-2382.

Klipsch horns in road cases, pair of spkrs, 4 pieces, will handle 300 W/chnl, excel cond, BO. R. Kaufman, Pams Prod, POB 462247, Garland TX 75046. After 3PM: 214-271-7625.

Furman RV-1, 1-space rack mount spring-type reverb w/limiter, tone controls, unbal 14" I/O, excel cond w/manual, \$110. S. Hofmann, Cameron Univ Theatre, 2800 W Gore Blvd, Lawton OK 73505. 405-581-2428.

RCA/Altec 3-way PA system, all horn loaded, 18" bass, 15" mid compression horns, sell separately, \$800; BES 255 Mark II 3-way bipolar home mons, 4" x 22" x 32", orig box, \$400+shipping. Philip, Big Red Sound, 172-28 Henley Rd, Jamaica NY 11432. 718-523-2815.

Shure M67 remote audio mixer, balanced terminal post output, adjustable metering & Shure M68 4-chnl 1-ax mixer w/balanced I/O, (2) ORK 3-speed TT w/one arm & cartridge, \$250. J. Brown, CAV Corp, POB 3471, Charlottesville VA 22903. 804-979-0402.

JBL 4350 w/crossover 5234A, new cones, \$2100; JBL 4343, new cones, \$1500; Altec 604A w/time align crossover, \$750. R. Nelson, Tropical Brdcstg, 14093 SW 142 St, Miami, FL 33186.

Dolby A301 2-chnl NR, \$300/BO. R. Rhodes, Rhodes Music, POB 1550, NY NY 10101. 212-245-5045.

EMU Emulator II+ sampling keyboard, \$1000; Foxtex 4030/4035 sync system, w/remote & cables, \$1000; Foxtex 4010 SMPTE reader/gen, \$500. B. Seifried, Elclair Eng, 101 Prospect St, Northampton MA 01060. 413-584-6767.

API 553 EQ (10), 3-band proj, \$175; APSI 559 graphic EQ, \$325; Langevin AM-16 discrete mic preamps, \$150 ea; Universal Audio 100B tube mic preamps, \$200. M. Linett, Your Place or Mine, 818-244-1909.

JVC NR-1020 NR (3); call for prices. D. Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

AKG BX-10 reverb w/rack mount panel, like new; call for price. D. Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

Urei 813B studio mons, \$1600. R. Tegen, Plum Sound, 335 Merrimac St, Newburyport MA 01950. 508-465-5653.

JBL 4312 (2), latest version of L-100, 4311, etc, deluxe studio 3-way mon, new, under warranty, will ship UPS, \$550/pair; Yamaha NS-104 2-way studio mons, pair avail, will ship UPS, \$280/both. C. Keith, ALI, POB 313, Keane NH 03431. 603-352-8960.

Want to Buy

Rane MT-6 multi-chnl 7025 V former system, M. Nardella, Nards Inc, 1446 Emerson Ave, McLean VA 22101. 703-821-8629.

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Orban Optimod 8000A w/Chris Hood audio mods & manuals, sounds grt, \$1700. S. Schweiger, WXLO, 146 Worcester Ctr, Worcester MA 01608. 508-752-1045.

CBS 411 Stereo Volumax, vgc, \$300; CRL PMC300 AM limiter, vgc, \$400; (2) Dorrrough DAP-610 triband processor, vgc, \$1250; Elcom Bauer Level Guard AGC gain controller, gd cond, \$150; Harris MSP-90 AGC/limiter, gd cond, \$500; Inovonics 705 stereo gen w/FMX, excel cond, \$1000; many more, call for details. B. Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

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API 525, vgc, \$375; (2) Audiotronics 201, excel cond, \$500 ea. M. Linett, Your Place or Mine, 818-244-1909.

Gates Solid Statesman limiter, \$275. P. Wells, KJQY, San Diego, 619-238-1037. FAX: 619-238-6157.

Gregg Labs FM stereo processor, extremely rare, mint cond, serious inq only, \$8600. P. Christensen, WXXL-FM, 337 S Northlake, Altamonte Springs FL 32701. 904-721-9111.

Moseley FTL-280 audio limiter (2), \$300/both. R. Ness, WGEN, 1003 S Oakwood Box 67, Geneseo IL 61254. 309-944-4633.

Century D-70 limiter (2); call for price. D. Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

Want to Buy

Tube limiters, compressors & EQs: Fairchild 660/670; Teletronix/UREI LA2A, LA3A; Pultec; MAVEIC; Lang; API; etc.; also, other tube signal processing gear. J. Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Optimod 8000A, will pay cash, leave message at 703-276-0125.

MICROPHONES

Want to Sell

RCA 77-DX vintage ribbon mic, excel cond, BO. R. Kaufman, Pams Prod, POB 462247, Garland TX 75046. After 3PM: 214-271-7625.

RCA classic ribbon mics, others, send for list. B. Davies, Virgo Prod, 5548 Elmer Ave, N. Hollywood CA 91601. 818-761-9831.

AKG 414B ULS condenser, shock mount, new, \$995. P. Accardi, Evangelistic Ministries, 1521 Upper Fords Pond Rd, Clarks Summit PA 18411. 717-587-2382.

Neumann TLM 170 mics, rare pair of consecutively serial numbered mics, \$3350/pair. R. McMillen, 503-239-6070.

Saba stereo mic, vgc, \$10; Shure 565SD, vgc, \$50. B. Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Sony ECM-50 lavalier mic, \$50. P. Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

Electro Voice 666 variable D cardioid dynamic, '60s type, gd cond, \$65/BO; Electro Voice 666 variable D dynamic, '50s type, fair cond, \$50/BO; Electro Voice 635A dynamic omni-directional, fair cond, \$40. M. Saady, First City Rec, 141-60 84 Rd #3E, Briarwood NY 11435. 718-846-2062.

Sony ECM-50 lavalier mic, \$50. P. Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

Shure 51 (*1) & 555W (*5) antique mics, \$300/both+shipping. D. Besler, 207 Fort St Rm 312, Winnipeg Manitoba CN R3C-1E2.

Neumann M-250 w/cable & pwr supply, vgc, \$4500. M. Linett, Your Place or Mine, 818-244-1909.

Sony ECM-22P condenser mic (5); Sycron S-10 condenser mic for pipe organ only; (4) Atlas mic stand & misc cable; call for prices. D. Curtis, Creative Sound, 2810 W 4th St, Appleton WI 54914. 414-733-2299.

Electro Voice 644 shotgun mic, \$140; Electro Voice 664A variable D dynamic, indust standard, \$100; AKG D-310 dynamic, \$100; all like new, complete, no blems. C. Keith, ALI, POB 313, Keane NH 03431. 603-352-8960.

Altec 639 classic ribbon dynamic (2), w/yokes & straight mount, \$450 ea. L. Beigel, On Cue Rcrding, POB 85032, Iowa CA 90072. 800-726-9813.

Altec 639B, vgc w/bag, \$400. C. Bucy, Cisco Sound, POB 16583, Lubbock TX 79400. 806-792-1662.

RCA/Altec/Telefunken: RCA 44-BX, 77-D, BK-5, KU3A 10,0001, SK-46, WE 639, Altec M-11 system, Altec M30 tube mic, Altec M49 & M50, (2) absolutely mint Telefunken U47's, will trade for other high quality mics & equipment. Tracy Eaves, 615-821-6099 (evenings).

Liquidating audio test equipment, parts, electronics, microphones, etc. Call for list. 406-333-4029.

Presto 45 rpm adapter sleeve for 6N disc cutter, new; manuals: Sencore tube conductance analyzer, Sams transistor sub book #8 & #6, RCA tube manual. Mr. Oliver, 212-874-7660.

EV 630/635 w/cable; RE10 EV-desk mics, EV & Shure all very reasonable; baby booms (3). Mr. Oliver, 212-874-7660.

EV 635A (6), mint, \$75.00 each. G. Mundkowsky, 12918 Smalley, Grandview MO 64030. 816-966-0731.

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RCA 44BX/77DX; WE & RCA velocity mics. D. deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

Desk mount flex mic arm, heavy duty, & shock mount for heavy RCA mic. T. Heathwood, Heritage Radio Classics, POB 16, Boston MA 02167. 617-969-9966.

Neumann U-67 pwr supply, cable connectors, shockmount, will pay cash/trade other vintage mics. W. Kremer, 301 SW 16th St, Ft Lauderdale FL 33315. 305-524-5652.

RCA, Neumann, WE & other vintage mics; also, parts, flags & stands. R. Van Dyke, Caffrey House, 2 Squires Ave, E Quogue NY 11942. 516-728-9835.

HP 15109, 15108, 15119, 15118 laboratory reference mics, any cond. S. Dorsey, WCWM, 173-7 Merrimac, Williamsburg VA 23185. 804-864-4056.

RCA 44BX/77DX; WE & RCA velocity mics. D. deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

Tube condenser mics: Telefunken ELAM 250/251; AKG C12/C24; Neumann U47, M49, KM54, U64, U67, SM2, SM69; also, other pro condenser mics, wrecked mics, any cond. J. Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

MISCELLANEOUS

Want to Sell

Jobo CPE-2 small/indiv color film & print photo processor, access, Jobolift, \$450/BO; Edison Standard B cylinder phonograph, 1905 model, plays 2 & 4 min cylinders, works fine, w/H & C reproducers, BO; Toyol/Omega 45E 4x5 view camera, f6.8 210mm lens, many access, gd cond, BO. V. Gray, 6840 Sterling, Raytown MO 64133. 816-358-8929.

Gentner FBTRB prewire bay (loupas), (8) \$225; Gentner GEC-FB-100 Flexiblock, SIE-MF2250, (50) \$10; Jim Long digital Dyaxis 320 MEG, w/Apple IICX, for digital editing, used 6 mths, \$7500. B. Lord, Lord Brdcstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Elafior elevated floor, 1382 sq ft, 2' x 2' squares for studio, all hardware incl, gd cond, \$1200+shipping. K. Eyerman, Trell Brdcstg, POB 18181, Columbus OH 43216.

AM dummy load, 1 kW, typical of those inside Gates BC-1G & H series xmtrs, BO+shipping. D. Kelley, KISZ-FM, POB 740, Cortez CO 81321. 303-565-1212.

Symetrix T-101 telephone interface, \$250; Audio Digital TC4 digital delay unit, \$800. T. Pless, WHVY, 112 Main, Annapolis MD 21401. 301-626-0103.

WE patch panel (12), T/R/S normaled, 6 rows, 24 jacks/row, 19" x 7", wire wrap or solder connections, \$35/ea+shipping. R. Kerbaway, WTNJ FM, Box 1127, Beckley WV 25802. 304-877-5592.

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Blackbourn 1200 (363), black vinyl page for 3-ring binder holds 4 cassettes w/boxes, compl sale preferred, \$250+shipping. B. Strapko, 708-830-0701.

Telex Audiocom IF-1 interface unit, interfaces headset intercom system w/2, 3 or 4 wire communications systems, excel cond w/manual, \$150. S. Hofmann, Cameron Univ Theatre, 2800 W Gore Blvd, Lawton OK 73505. 405-581-2428.

McMartin TG-2 EBS encoder, vgc, \$125; Ford mono AM/FM car radio, vgc, \$15; Gates on-air light, gd cond, \$40; Spolmaster cart winder, gd cond, \$100; (2) WE KS19645-L2 recorder coupler, gd cond, \$50; various racks; call for details. B. Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Orban ACC11 1-34" security cover (6), \$15 ea; Pitney Bowes A-120 postage scale, 6200 postage meter & A215 printer, \$1500/all; Broadcast Supply 6" mounting rail (5), \$30 ea; (3) 3-1/2" rail, \$20 ea. B. Lord, Lord Brdcstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

M-Print Central, manual pad printer, used to print directly onto audio cassettes & other items, winstruct video, \$900. F. Scheidt, Frank Scheidt Audio, 15 Charlotte St, Rochester NY 14607. 716-232-5210.

Gentner FBTRB prewire bay (8), \$225 ea; Gentner GEC-FB-100 Flexiblock (50), SIE-MF2250, \$10 ea; Gentner GEC-50DR pre-wired patch bay, 52DR w/TRS jacks #8 & approx 15" wire, \$90. B. Lord, Lord Brdcstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

TMC deluxe pushbutton switches, 31 new, w/hardware, \$30/lot. Mel Crosby, Sequoia Electronics, 408-866-8434.

Bird 4600/460 ThruLine 3-1/8 line section w/25 W slug, ThruLine wattmeter, 25 kW full scale, \$600. C. Benner, WUSL-FM, 440 Domino Ln, Philadelphia PA. 215-483-8900.

Money maker/P.R. Telephone based time/temperature/weather announcer. Starting at \$3495. Demo: 605-343-7300. Info: FAX 605-892-2669.

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Want to Buy

Broadcasting yearbooks, 40s & 50s, must be vgc; programming digest LPs from 70s; WLS silver dollar survey LPs from 60s; John Rider textbooks no manuals. L. Spivey, WLLS AM/FM, Hwy 231 S, Narford KY 42347. 502-298-3268.

Western Union Naval Observ clock. T. Heathwood, Heritage Radio Classics, POB 16, Boston MA 02167. 617-969-9966.

Alden C-2000-R & C-2000-M weather radar receiver, leave name, number & asking price. S. Voros, Voros Ent, 1537 S 81, Milwaukee WI 53214. 414-475-6200.

Jazz record collections, 10" LP/12" LP bebop, swing, dixie, highest prices paid. B. Rose, Program Recdgs, 228 East 10th, N.Y.N.Y. 10003. 212-674-3060.

MONITORS

Want to Sell

McMartin 3000A digital freq mon, never worked properly, gd for parts, as-is w/manual, \$50 incl UPS ground. L. Spivey, WLLS AM/FM, Hwy 231 S, Narford KY 42347. 502-298-3268.

General Radio 1931-A AM mon, wrkg when removed, \$45+shipping; Motorola DS9660 Conradal mon, as is, you ship, \$30. P. Mueller, KUTA-AM, N Hwy 191 G-1, Blanding UT 84511. 801-678-2261.

HP 500A freq mon, used, \$100; McMartin 3005 freq mon, gd cond, \$200; McMartin AMR1 AM fixed freq tuner, gd cond, \$125; HP 335B FM mod/freq mon, gd cond, \$275; Belar RFA-1 FM RF amp, new, \$400; many more, call for details. B. Williamson, WWWK/WELV, Ellenville, NY. 914-858-2941.

Complete FM monitor package, stereo, mono & SCA. Will sell all or part tuned & tested on your frequency; also have several extra SCA's priced low. Goodrich Enterprises Inc, 11435 Manderson St, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

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Want to Buy

Arriflex, Bolex, CP. Elclair & Mitchell cameras, lenses & access; film sound equip, esp Stelavox rcrdrs & access; old film magazines, literature, etc. SMPTE Journals; old copies ACS & others like The Filmmaker. H. Biller, 108 Hamilton Ave, Silver Spring MD 20901. 301-565-2798.

Mitchell 16/35mm, other pro 16/35mm incl Arri, Aaton, CP; optical prntrs esp Research Products 1000, 1001, Acme, Oxberry; cine lab equip incl sensitometers; sm to med 16 or 16/35mm processing machines; optical rcrdrs; Steenbecks; gd cine optics, Zeiss, Ultra-T, Angenieux, Cooke; Zeiss 9.5mm Distagon, reasonable, fair cond; will consider any film equip. J. Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Javelin sm night vision device, or equiv, prefer 2nd generation C-mount, anything considered. J. Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

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Ford '86 car radio, AM/FM stereo, w/factory connectors, never used, no cassette, \$90 incl UPS ground. L. Spivey, WLLS AM/FM, Hwy 231 S, Narford KY 42347. 502-298-3268.

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Mark P-972 6' parabolis grid for 944-952 MHz STL, (2) avail 10/91, BO+shipping. D Kelley, KISZ-FM, POB 740, Cortez CO 81321. 303-565-1212.

Wegener 1602 & 1601 mainframes w/these cards: 1621, 1645, 1646, 1606-21, 1683-08 & 1605-12, used for SMN; also, TFT 7610 xmtr remote w/relay panel, needs some work. J Galanes, WAVI, POB 25016, St Croix WI 00824. 809-773-3693.

Scientific Atlanta DAT-32 receiver, 15 kHz stereo audio card for use w/all major networks, like new cond, \$1000/BO. Chip, KCPS, pOB 946, Burlington IA 52601. 319-754-6693.

Scientific Atlanta DAT-32 system, w/7300 & 7325 modules, w/(2) 15 kHz stereo demod cards, voice cue card, etc, need to sell now at \$3500. A Morris, KSWM, Aurora MO. 417-678-0416.

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FT C&W station, to 1850 W, new automation, in VA, on air since '60, owner anxious to retire, financing avail after sm down payment. A Terry, WODY, POB 545, Bassett VA 24055. 703-629-2509.

AM, 1 kW, 1480 kHz, w/PSAA, covers city plus gd equip, gd terms, \$139,000. B Ludwig, KRRV, 4211 N Elizabeth, Pueblo CO 81008. 719-542-2121.

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Generator & Transfer Switch, 55 kW, 120/240 volt, natural gas engine, 417 hours, \$8500. Polly Electric Co., 314-443-7054.

Want to Buy

Optimod 8000A, will pay cash, leave message at 703-276-0125.

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JVC KM2000U switcher, 8 inputs, DSK, RGB chroma keyer, 13 wipes, auto transition, \$4000. H Larson, Matrix TV, 615 Tank Farm Rd, San Luis Obispo CA 93401. 805-544-2445.

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Scotch 176 10" reels (34), 2500'x14", used once, \$125/BO. D Pulwers, Daves Price Audio, 310 N Howard St, Alexandria VA 22304. 703-751-9346.

Adult contemporary library w/2200 songs on CD & cart, incl 93 Goldiscs & 230 misc CDs, add'l 170 songs dubbed on Scotchcart IIs, \$6500; country library w/1500 songs on 66 CD Goldiscs & 500 add'l Scotchcart IIs, \$5000; (380) 3.5 min Scotchcart IIs w/country songs, \$2 ea; all used 6 mths. B Lord, Lord Brcdstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Dynamax, Gold Master, & Red Master carts (135), 100s-5.5s, some Reds unused rebuilds, \$250 as-is/\$325 cleaned, bulked & splice-found. M Friend, WTJU Radio, Box 711 Newcomb Hall St, Charlottesville VA 22901. 804-924-0885.

Pepper-Tanner & TM Prod library records (200?), variety avail. P Wells, KJQY San Diego, 619-238-1037. FAX: 619-238-6157.

Audiopak AA4 (1000), 2.5-5.5 min carts, loaded w/new tape, \$4 ea lots of 100, \$3250/all, incl shipping. S Cassidy, Radio Program Services, Box 472, Manitou CO 80829. 719-661-1744.

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Circle 104 On Reader Service Card

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Want to Buy

American Top 40 shows w/Casey Kasem, 4-record set or 3-piece set, no finders fees, must be gd cond, will pay \$25. B Davis, BDMZ Prod, 408 N 11 St, St Joe MO 64501. 816-279-6851.

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Monte Vista Christian School, would appreciate any donations of used TV broadcast equipment. T Quinn, 408-475-0423.

Eng student desiring donation of old bcdt equip (anything) in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

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Telco 88 EBS encoder/decoder, new w/warranty, \$388. M Jones, WJVK, 6711 Kingstone Pk, Knoxville TN 37939. 615-588-6511.

Leader LFR-5600 audio response test unit w/recorder, \$1500. C Bucy, Cisco Sound, POB 16583, Lubbock TX 79490. 806-792-1662.

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B&W 410 distortion meter; B&W 210 audio oscillator; Leader Elec LBO-53B oscilloscope; BO ea. R Ness, WGEN, 1003 S Oakwood Box 67, Geneseo IL 61254. 309-944-4633.

Sencore FC45 freq counter, range 30 Hz-230 MHz, w/Sencore PR47 UH7 prescaler, extends counter to 600 MHz, \$350. L Stone, Sereno Eng, 843 Wilcox Rd, Poplar Bluff MO 63901. 314-785-1956.

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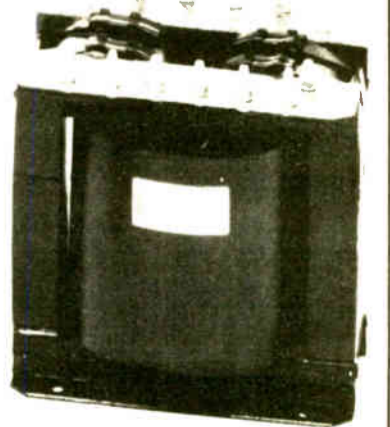
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Broadcast Equipment Exchange

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The Closer You Get...

WE MEAN IT—we really DO provide the quality, performance, technical support, and innovation we promise!

Our model A-500 is a thoroughly engineered on-air console: it delivers the level of performance your clients now expect, and DAB demands. All components are selected for long life—gold bus connectors, gold I/O connectors, all gold contact switches, gas-filled relays, triple burned-in integrated circuits, solid state ON/OFF lamps, and precision laminated Lexan control surfaces for a lasting, wearproof finish. And we back that up with a 3-year parts and labor warranty, complete with

factory support from a technically competent and responsive staff.

We've also handled your special requirements as well with a super family of accessories, including a choice of three different telephone modules, an intercom module, an off-line mixer module for your remote feeds, talent control stations, accessory panels, failsafe power supplies, and auto cart and CD sequencing options.

So take a close look: we've got the quality, we've got the innovations, and you've got our commitment to top-notch support.



The Better We Look!

A-500

The New Wheatstone Production – Air Console



In Fact, a Whole New Console Family...

These consoles give you full multitrack production capability while at the same time providing familiar program and audition busing so your production room can double as a back-up on-air facility. They free up your primary Air studio for routine calibration and maintenance sessions. They are a perfect solution for complex talk or news formats.

Beyond its on-air capability the SP-4 is a powerful production console offered in 2, 4 and 8-track formats. Production crews will love the smooth sounding equalization, the auxiliary send buses, and, of course, the full on-air type machine and console logic. There's also plenty of room for those special functions: like a phone module that can handle multiple callers, yet

doesn't tie up your line inputs: an intercom module that lets you communicate with other Wheatstone consoles and rackmount locations throughout your facility; plus a studio control module, line preselectors, tape controllers, and automatic timers.

And, of course, there's the componentry: all gold contact switches for the ultimate in reliability, gold bus connectors, gold I/O connectors, solid state on/off lamps, and triple burned-in ICs. Naturally, each console is also triple-tested.

The fact is, Wheatstone's got the features, the componentry, the reliability, the performance and the reputation you can depend on.

Call us.

SP-44/4-Track