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FOCUS ON TRANSMISSION
 RW's Special RF Section,
 pp. 16-22.

Radio World®

Vol 15, No 13

Radio's Best Read Newspaper

July 10, 1991

FCC Vacillates on L-Band

by Judith Gross

WASHINGTON The radio industry can probably expect some amount of L-band for a U.S. DAB allocation request at the World Administrative Radio Conference (WARC), but just how much remains a mystery after action by the FCC.

The Commission had set its June meeting as the day of decision on spectrum recommendations in preparation for the State Department's WARC position.

While the WARC meeting doesn't take place until February 1992, countries' positions must be finalized by August for translation into other languages.

In its second Notice of Inquiry (NOI), the FCC proposed several blocks of spectrum for DAB, or BSS (sound), as it's referred to on the WARC agenda. These included UHF-TV spectrum, which is opposed by HDTV interests; a block at L-band (1500 MHz) and two possible blocks at S-band (2300 MHz).

Questions unanswered

At the June meeting, the FCC eliminated UHF spectrum from consideration and proposed spectrum at L-band and S-band for DAB. But the FCC refused to specify an exact amount of spectrum to be allocated, pending "further consultations with the Executive Branch."

The lack of a specific request was prompted by NTIA and Executive Branch objections to reallocating L-band from aeronautical telemetry to broadcast interests.

Following the FCC's decision, Bruce Franca, of the Commission's Chief Engineer office, said that communications between the FCC and the Executive Branch and NTIA would now "begin in earnest" to work out exactly how much L-band could be spared for DAB.

An Air Force paper, quoted by the Aerospace and Flight Test Radio Coordinating Council in its comments to the Commission, said L-band is crucial for national defense purposes and that the military's needs for radio spectrum are

increasing.

Commissioner Ervin Duggan seemed to acknowledge the military and Executive Branch opposition to L-band when he said just before the Commission action, "I, myself, am a bloodthirsty hawk. We are all supporters of national security and defense and we would do nothing to undermine it."

Objections and hopes

The NAB, satellite interests and most commenters to the NOI support L-band for DAB use. But many radio engineers question whether building and foliage attenuation and power requirements at L-band might make it unfeasible for DAB

(continued on page 9)

FCC Plans EBS Revamp

WASHINGTON Recent action by the FCC has pointed toward what has become a growing realization in the radio industry: The Emergency Broadcast System (EBS) needs to be reevaluated.

At its June meeting, the Commission began a Notice of Inquiry (NOI) into the EBS, to determine whether new technology might be used to create a different kind of alerting system, one where "receivers are activated only for emer-

gencies of a certain type or in a certain area."

The NOI will ask whether there is a need for an updated automatic alerting system and if so, what type of new equipment or technology is appropriate. The FCC will also seek to determine if new technologies could ease the burden on licensees with respect to current EBS rules.

One additional area of interest in the NOI is whether the current 20-25 second two-tone alerting system should be replaced with smarter circuitry that can specify the exact nature and area of the emergency and trigger automatic receivers.

The Commission suggests that two types of systems are possible. One would use in-band audio as in the present two-tone alerting system; the other would use a non-audio band system such as a subcarrier.

One new subcarrier technology that may lend itself to emergency alerting use is the Radio Data System, or RDS, which uses an FM station's 57 kHz subcarrier. One RDS proponent, Sage Alerting, has already begun testing its system for emergency use near chemical plants in Texas.

Sage President Gerry Lebow has said his company intends to file information on the Commission's NOI to suggest using RDS technology as a replacement for the current EBS system.

The current EBS system in use at radio stations dates back to 1951 and the two-tone signal was added in 1975. Recent disasters such as 1990's Hurricane Hugo and the 1989 San Francisco area earthquake pointed to weaknesses in the methods used to activate EBS. Many stations have been cited by the Commission for non-essential activation of the system as well.

Rock 'n'

Russia:

The first FM station in Moscow hits the airwaves in October, courtesy of the U.S.A. See p. 12.

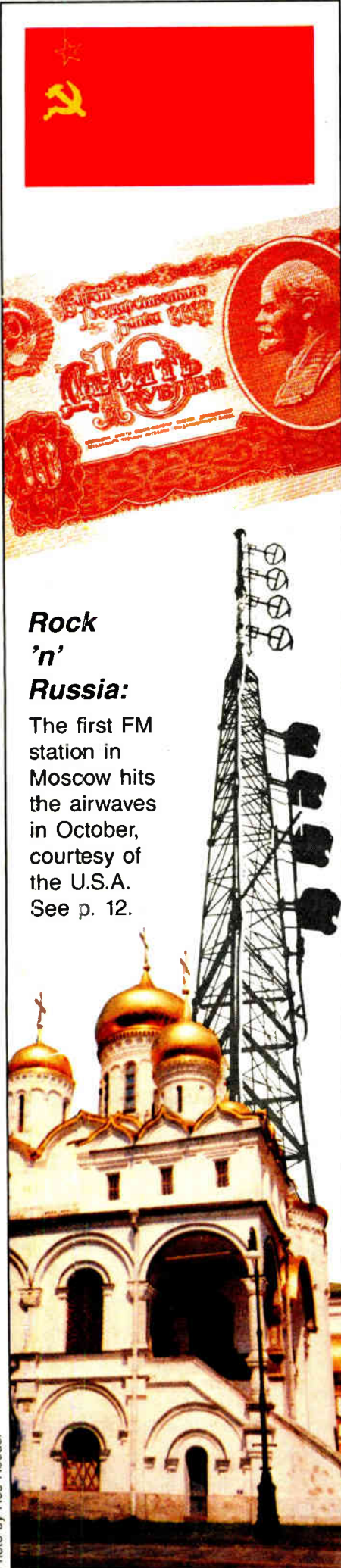


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NEWS BRIEFS

Women, Minorities Gain Slightly

WASHINGTON The number of stations having five or more full time employees declined in 1990, but women and minorities gained slightly, according to the FCC's just-released 1990 Broadcast and Cable Report.

The report spans 1986-1990 and includes state-by-state infor-

mation.

Of all full-time broadcast employees, women increased from 41.1 percent in 1989 to 41.4 percent in 1990. Minority representation increased from 17.0 to 17.5 percent over the same period.

Women increased from 31.1 percent to 32.1 percent in the upper four levels of broadcast employment (officials and managers,

professionals, technicians, and sales) while minorities increased from 14.9 percent to 15.4 percent.

The report can be purchased from the FCC by contacting the Downtown Copy Center in Washington: 202-452-1423.

Quello Renominated

WASHINGTON FCC Commissioner James Quello has been renominated for another term before the Senate Communications Subcommittee.

Quello, a native of Michigan,

has been a FCC commissioner since 1974.

Prior to his selection to the FCC, Quello was a broadcast consultant in Detroit and Washington. He also has served as VP/GM for WJR in Detroit, and publicity director for WXYZ, also in Detroit.

Digital Encryption for ENG

WASHINGTON The FCC has approved a Notice of Proposed Rulemaking (NPRM) that will allow use of digital voice (F3Y)

emission for encrypting communications between remote pickup stations.

This action will amend Subpart D of Part 74 rules. The new rule is designed to prevent third parties from eavesdropping and perhaps using the information, such as a news story, for its own use.

Main Studio Rule Enforced

COLUMBIA, S.C. The FCC has upheld a recent Mass Media Bureau decision to require WRSF-FM to take steps to ensure that its main studio is operated from its city of license.

In 1987, the station had requested, but was denied, permission to relocate its main facilities to Nags Head, which is 51 miles from Columbia.

Subsequently, the FCC received a complaint that WRSF was operating its main studio from Nags Head anyway. An investigation revealed the Columbia studio "did not constitute a main studio" because the station "did not maintain a meaningful management and staff presence."

The Mass Media Bureau then required the station to take steps to make it the main facility and provide a progress report.

Station owner, Jones Eastern of Outerbanks, Inc., however, asked the FCC to review the Mass Media Bureau's finding, which eventually was upheld.

Salek Resigns from NAB

WASHINGTON NAB Director of Radio Engineering Stan Salek resigned his post, effective June 14, to join the consulting engineering firm of Hammett and Edison, in San Francisco.

Salek worked for the NAB for three years and was involved in such technologies as RDS, DAB and the AM certification mark.

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Circle 60 On Reader Service Card

FCC: Firmly Down the Middle

by Judith Gross

FALLS CHURCH, Va. Feet tap out a tired refrain on the hot, brittle asphalt ... the heat is so excruciating the sidewalk sizzles ... eyes hold that vacant stare ...



A million stories in the nation's capital, a million decisive moments ... and this is not one of them.

So, you thought the FCC was going to settle the L-band question by asking for a specific amount of it for DAB, right? You thought a government agency could get together and serve the industry by taking a decisive stand either for or against, right? Well so did I.

But think again, digital-breath, because the FCC took the opportunity to eke out a WARC policy on DAB by boldly not deciding anything at all.

Oh, all right. If you want to get picky, they did eliminate UHF-TV spectrum from consideration, surprise, surprise. And they did say they'd like to see some spectrum in L-band and S-band allocated for it. That's right: no specific amount, just "some" spectrum.

So I pressed Bruce Franca from the Chief Engineer's office on just how much we might be looking at, exactly, and he said it depends on the outcome of communications with the Executive Branch.

Oh yes, communications. Wouldn't you just love to be a fly on the wall for that one?

"Can broadcasters have some of your L-band for DAB, pretty please with sugar on top?"

"No."

"Not even a teensy-weensy bit?"

"No."

"But why not?"

"Two words. Patriot and Tomahawk. Now don't make me say it again. No."

Well, maybe I'm being a mite pessimistic here. Word before the Commission took its, um, action, was that a small amount of L-band might go to satellite and terrestrial interests to share, maybe 20 or 30 MHz.

But at this moment, with about a month before the State Department is to decide on a WARC policy, nobody knows.

But here's some industry speculation, by engineers and non-engineers alike. How about, the U.S. doesn't ask for anything for DAB, doesn't bother with DAB at all?

I think that's a bit far-fetched because we were the ones who got terrestrial included on the BSS (sound) item on the WARC agenda in the first place.

Also, Canada, Mexico and other Region 2 countries are looking to us for leadership. So how would it look if we asked for nothing in the hopes of working it all out domestically later?

Another piece of speculation. Let's say we end up with only a small amount of L-band, say 30 MHz. That's not enough to accommodate every existing licensee with the Eureka system, according to the NAB's spectrum study.

OK, so the Eureka folks, they're pretty flexible. They modify their system, either by changing the error correction, or squeezing the compression algorithm even further; then, quicker than you can yell "Eureka" they can fit every station into whatever amount of L-band we get. Pretty tricky, huh?

Couple of things about Eureka 147. Did you know that the project ends at the end of this year? Those who have been working on it so diligently for the past four years hope to see some follow-up funds come from the countries and the companies to keep it going.

And an agreement with the NAB to try to make it the world DAB standard, well, as they say in Brooklyn, it couldn't hoit.

Then, I thought we were going to see Eureka again at the NAB's radio convention in San Francisco. Seemed like a good place to prove its multipath canceling abilities, since 'Frisco is full of that kind of interference.

Plus, if NAB wants to continue to get support for it, this would seem like a golden opportunity. But it may not happen.



British buses show good musical taste.

Eureka's Egon Meier-Engelen—who, by the way, is a really affable guy to chat with—pointed out that there's a big electronics show in Berlin the week just before the radio show.

There aren't enough receivers and some of the other equipment to be at both places and not enough time to ship it. So if you didn't catch it in Vegas, you may not see it for a while.

Also on the subject of Eureka and DAB and NAB, I'm not going to be-

labor this, because it's already gotten too much exposure, but geez, the battle is getting hotter.

Radio groups writing the FCC to say their trade association most definitely doesn't represent them on DAB or Eureka; the Radio Board Chairman and a DAB Task Force member embroiled in a public battle through the trade press?

Come on now, fellas, this isn't AM stereo. I didn't realize it was such an emotional issue. Next thing you know we'll be shouting at each other in an engineering session and then where will we be?

Seriously, several engineers confided to me that they thought it was all in bad taste, seeing the near mud-slinging that had started.

But DAB is an issue that stands to rock the foundations, both economically and technically, of the radio industry. And if those who disagree just sit back and let the power plays happen in their absence, who will be complaining the loudest if a decision is made that might be contrary to their interests?

It's unfortunate when it takes a duke-out to bring the issues out in the open. But if that's what it takes ...

A few international notes. Kudos to correspondent Frank Beacham, whose radio program *The Orangeburg Massacre* just won a gold medal at the International Radio Competition of The New York Festivals. Can I have your autograph, Frank?

And RW International just traveled to London for the APRS and brought back incontrovertible proof that double-decker buses really are a mainstay and that they sport radio station posters.

And with that Doors poster, it shows that the Brits also still have great taste in music.

Have a juicy morsel of info for J.G.? Fax it to 703-998-2966 or mail to P.O. Box 1214, Falls Church, VA 22041. Or break on through with it and win a coveted mug.

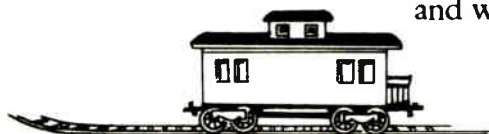


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World Radio History

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AM stereo rallying cry

Dear RW,

It's pretty sad, ya know, the way AM stereo is being allowed to wither on the vine. It was such a great idea, too.

Better fidelity, better sound. Stereo separation. Heck, even a little light to tell people it was stereo even if they were deaf in one ear and could hardly hear out the other.

I believe it may still make it, but it won't blast in the way color TV overtook black & white.

Hey FCC: Go . . . or get off the pot, huh? The "marketplace" decision isn't working. Not the way it should, anyway. Get a hundred, no ten people in a room and ask them their favorite group, or TV show, or pizza . . . there won't be a unanimous decision. There almost always isn't, except sometimes on "LA Law."

Much of the blame is with operators, though. Everybody was waiting to see which system would win. They waited and waited. They lost money, and more money. Now they couldn't afford the equipment even if it were free!

Then there are those who *did* have foresight. They chose one system, or

the other. Then they shouted "Now in AM Stereo." The only problem is they didn't explain that listeners needed new radios to hear it. Joe and Jane Average turned on the base model Delco that came with their '84 Celebrity and said, "hey, this is the same-sounding station (the audio's not very good, either) . . . and it's *not* stereo!"

Then I bought my new Firebird (license number 89 WLS, after the "Rock of Chicago," not "Talk of Chicago") and found the standard Delco in it wasn't AM Stereo, like the salesman said. After explaining the difference, they still wouldn't let me swap to a better radio for less than \$500. I went to the local K-Mart and bought a Kraco ETR-1084, spent a few hours installing it and, wow! WHAS sounded great! When it came in.

See, there were only two DC AM stereo stations and one in Baltimore. Now one is simulcast Country, one is news and one is Gospel. Nothin' against you, Lord, but not much of a musical choice. I wonder why no one listens for music on AM . . . hmmm.

Oh, one thing about that Kraco. Beware if you pick up one now, buyer. The new ones are the ETR-1084D. Looks exactly the same, but is not AM stereo. The box has a little N/A in the AM Stereo Separation column. Gee, and I told a friend to buy one. *He's* probably saying "Sounds like the same station," too.

I'm worried. I like AM stereo . . . when it's set up right. Even in 1977 (before AM stereo), Terry Grieger, then with WOWO, cranked up the wide band mono receiver in his office and I was blown away! All the sound was there! I knew AM had more to offer.

I'm worried, when even someone

In these days of rapidly advancing technology, it's fitting that the FCC should consider a reevaluation of the Emergency Broadcasting System (EBS).

For decades, the EBS was the official means of spreading news and information to areas stricken by crisis. In recent times, however—particularly since the 1989 San Francisco earthquake and 1990's Hurricane Hugo—some in the industry have begun to wonder whether a more up-to-date technology might be better.

One new technology is already being touted as an appropriate replacement for the aging EBS. Radio Data System (RDS), for example, uses an FM station's 57 kHz subcarrier to transmit information; one RDS proponent is testing the system as an emergency alerting measure in Texas.

Among broadcasters concerned about revamping EBS, another point of debate is whether the 20- to 25-second two-tone alerting system should be replaced. The FCC is examining replacement of that system with "smarter" circuitry (such as RDS) and looking at whether tones of that duration are required.

EBS Needs Evaluation

If a better system with shorter duration tones can be had, it will come as a relief to some broadcasters who have long complained that the tests represent more of a tune-out factor than anything else.

This is not to say that public safety is less important than holding an audience, but think about it: How many of us look for another place on the dial as soon as we hear, "This is a test"—to say nothing of the tones themselves?

The fact is, the current EBS test is *meant* to be intrusive—it's as much of a drill for listeners as it is for stations. But decades of such tests have made the audience immune to their deeper implications, and many stations are starting to feel saddled with a system they believe is outmoded.

Are there problems with the system? No doubt. Is there a better technology? Perhaps—certainly, some already have been proposed.

The current EBS system has been in place since 1951; that's 40 years with no real change. In that same time, look at what's happened with the rest of broadcast technology. Whether a better system exists or not, a reevaluation of EBS is in the best interests of broadcasters and listeners alike.

—RW

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Next Issue
Radio World
July 24, 1991

Art Silver: In Memory of a Silent Key

by Tom Osenkowsky

BROOKFIELD, Conn. It is with deep regret that I note the passing of one of our industry's distinguished members. Arthur A. Silver, recently retired RF Radio district sales manager for Harris-Allied, succumbed to cancer on June 13, 1991. The loss to me is that of a fellow engineer as well as a close friend.

Art's broadcasting career spanned 30 years, with positions ranging from station owner, sales representative for several equipment manufacturers, and broadcast engineer. Art had been with Harris-Allied since 1982 and was also with Gates Radio in the 1970s.

Broadcasters who had business dealings with Art knew that when they made a purchase through him they not only were buying equipment, they were receiving Art's personal commitment to the product. Art was always there to stand by the products he sold.

I can think of no better example than

the evening of April 22, 1988, when fire completely destroyed the transmitter facility of WLAD-AM/WDAQ-FM in Danbury, Conn. I immediately called Art to place an emergency order for new Harris AM and FM transmitters and accessories.

GUEST EDITORIAL

Although Art was at a dinner engagement in New Jersey, he left there at once and arranged for the order to be driven to Connecticut. Art rolled up his sleeves and pitched in, helping us to get back on the air seven hours later using 1940s vintage equipment.

Two new Harris AM and FM transmitters and accessories were on the air 24 hours later, broadcasting from inside a U-Haul truck. Art's dedication in that project, and countless others, will not be forgotten.

Over the years, time and time again, Art set an example for the industry

acts together, promise. Why build good roads if there are no cars to drive on them?

Hey, Mr. Owner: Let some of us program consultant types, who still believe in AM, help you. Not the ones who just say "simulcast," "no news/talk" or "put it on the bird." I mean the ones with real, fight-it-out ideas.

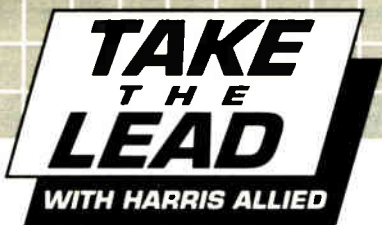
Newton Minow's "vast wasteland" might just be coming to the AM band . . . but I believe it ain't over yet.

J.R. Russ, President
J.R. Russ Programming & Research
Laurel, Md.

J.R. Russ, President
J.R. Russ Programming & Research
Laurel, Md.

The New Jersey Broadcasters Association has established the Art Silver Scholarship Fund. Contributions may be sent to the association at 9 Davidson Avenue, Jamesburg, N.J. 08831.

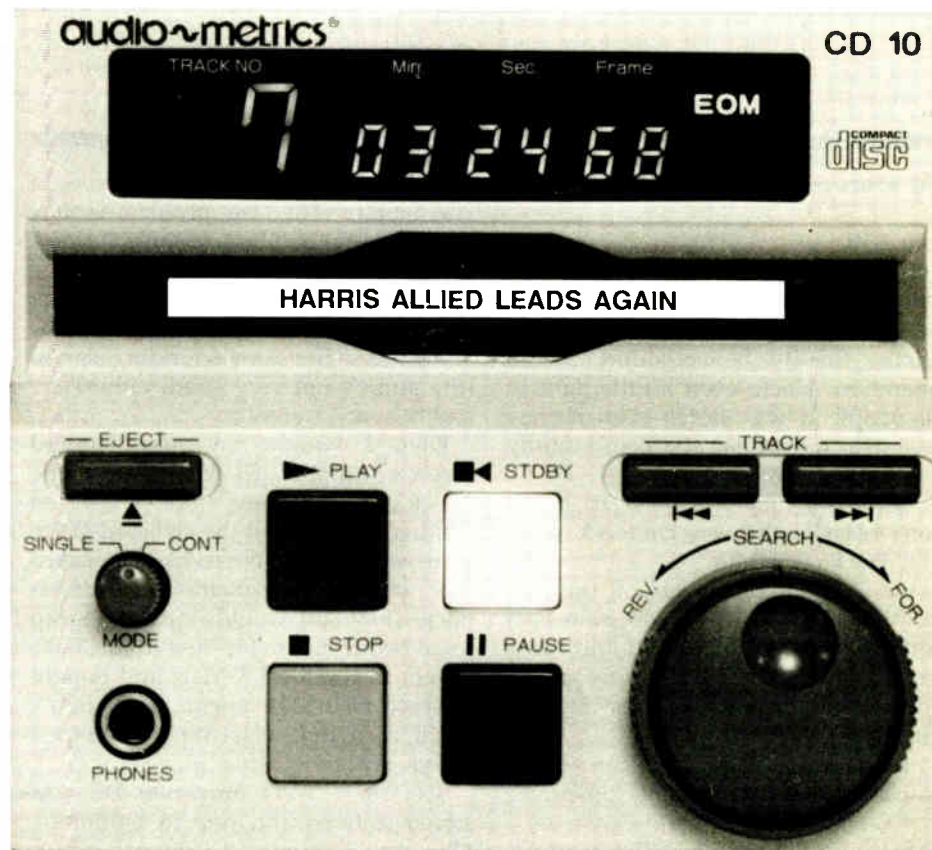
Tom Osenkowsky is a consulting engineer based in Brookfield, Conn.



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Summer CES Debuts New Digital Format

by John Gatski

CHICAGO Although the 1991 Summer Consumer Electronic Show (SCES) had fewer exhibitors, a number of new audio products attracted a lot of attention, including RDS receivers, CD recorders, higher-spec digital tuners and the Sony Mini Disc system.

The June 1-4 show attracted a few more attendees over 1990, but there were nine percent fewer exhibitors and there is talk that the show may be moved, perhaps to Atlanta.

Nonetheless, there were plenty of interesting products that could appeal to professionals as well as consumers.

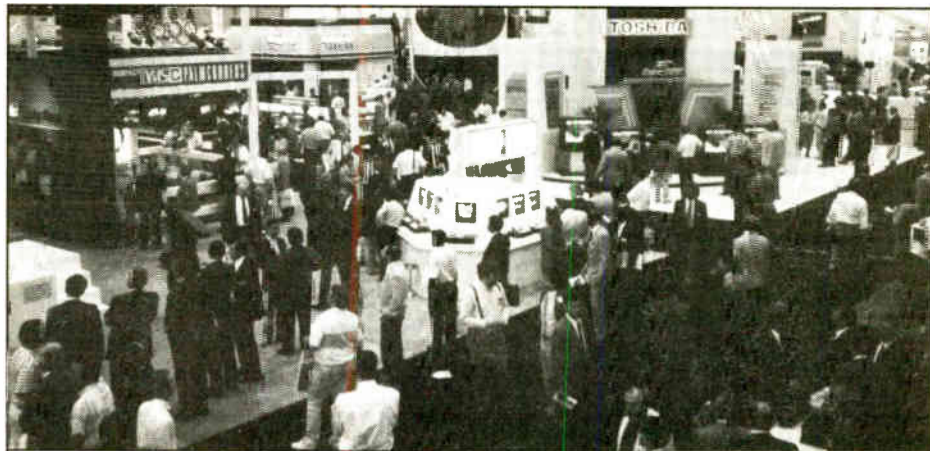
Sony was one of the companies not officially at SCES, but its suite at the Four

capacity, but with "digital quality sound," a Sony spokesman said.

The format's compression scheme is similar to that used in Digital Compact Cassettes (DCC); it is five times as efficient as conventional 16-bit CD technology.

Known as Adaptive Transform Acoustic Coding (ATRAC), the scheme is based on the psychoacoustic principle that the human ear cannot detect sounds below a certain level of a louder sound. Sony said that sound below that level can be removed without significantly affecting sound quality.

The Mini Disc system also has a unique shock absorption system that makes it much more resistant to jolts than CD players, according to Sony.



Attendance was up, but exhibitors were down at SCES in Chicago.



Blaupunkt exhibited an RDS receiver that can display a station's call letters.

Seasons Hotel was busy during the four days of the show as the company demonstrated its new Mini Disc (MD). The MD had its debut a few weeks earlier in New York.

Sony demonstrated a non-production play-only model; the player/recorder on display was not operational.

In a small package

The 2.5-inch magneto-optical disc allows 74 minutes of music that can be recorded and erased simultaneously. The Mini Disc uses a compression scheme that allows its high storage ca-

A memory chip stores up to three seconds of real-time music in a buffer. If the pickup is jolted, the music continues to play—uninterrupted—while the pickup returns to the correct position.

A great memory

At the demo, a disc was actually removed for a few seconds. The unit continued to play while the disc was reinserted, inaudibly picking up at the point when it was taken out. The Sony representative also threw the unit into the air several times, without causing it

to shut down or even to skip.

Pricing on the unit is expected to cost \$500-\$600 when it hits the market in late 1992, according to Sony.

To further muddy the format waters, Denon brought along its Quad Density CD player. A Quad Density CD is a 3-inch disc that contains the same amount of information as a five-inch CD (78 minutes of audio).

Unlike the DCC or Mini Disc, music recorded on a Quad Density disc is full, uncompressed digital sound, according to Denon spokesman Mark Knox. Recording on the smaller disc is made possible by narrow laser technology that allows the bits to be burned into a smaller track.

Barring any political complications (which is unlikely), Knox said the Quad Density Disc could find its way into computer applications by late 1992 and eventually in music and laser disc recordings.

Marantz displayed a variety of products suited for professional or audiophile use at its Chicago Hilton suite. This Philips-owned company demonstrated its DCC recorder, a technology introduced by Philips in January. DCC machines can play and record analog as well as the new digital tape. It will retail for "under a \$1,000" when it hits the market in 1992, according to company marketing spokesman David Burch Jones.

Compression and DCC

DCC uses a compression scheme enabling the format to become tape efficient

through psychoacoustic sound masking, which Burch Jones demonstrated.

Marantz also showed a write-once CD (continued on page 10)



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Shortwave Stressed at CSIS

Panel Discusses Options to Ensure that New Technologies Don't Alienate Shortwave Users

by Debra Green

WASHINGTON While engineers may be clamoring for new technology, a symposium on international radio suggested that shortwave is the mainstay medium and changing it would alienate the audience.

The Washington-based Center for Strategic and International Studies (CSIS) hosted an informative symposium on the growing, ever-changing face of international radio.

"Turning Up the Volume on International Radio" drew panelists from worldwide state and private radio to discuss the medium's programming and technological future.

Keeping listeners

The first panel, titled "State Broadcasters: New Programs and New Politics," was a timely forum for state-owned radio executives to discuss radio's changing role in world events.

Among the issues discussed was "audience migration," the phenomenon recently observed during the Persian Gulf war, that draws an audience to radio

in crisis situations. The difficulty is in maintaining the audience when the crisis is over.

Whatever renewed popularity radio received during the war is tempered by shrinking budgets and fierce competition for a shrinking audience. In addition to competing with television, more than 100 countries are currently

A BBC study concluded that any new technology requiring a new receiver would cause a "disintegration of the audience."

competing for an international radio audience.

John Tusa, director of World Service for the British Broadcasting Corp. (BBC), said he believes the privatization of radio in Europe also will bring intense competition in the news arena.

Presently, news coverage is seen as international radio's most important asset. Robert Coonrad, deputy director for the Voice of America, echoed this

sentiment, citing "international news for a global audience" as the focus of future VOA programming.

"Our role is to be impartial, authoritative and comprehensive," added Eugene Pell, president of Radio Free Europe and Radio Liberty.

Global radio network

To further its news coverage, Radio Japan, a division of NHK, intends to form a global radio news network inspired by Cable News Network (CNN), according to director Hiroshi Iwamoto.

The program would include one network from each of the three major world areas: the U.S., Europe and Asia, responsible for eight hours of programming daily. As the world rotates, so would the network coverage. Editorial content, he said, would be up to the individual networks.

Executives from the VOA, BBC and Radio France International also agreed upon shortwave as the mainstay medium for international radio.

"It is there, listeners know about it, governments can't stop it, it has done a good job and if it did not exist, I rather suspect that somebody would invent it," said Tusa.

Shortwave's importance was further highlighted by the fear that newer technology would alienate the audience, if it progressed faster than the market for it.

A BBC study on radio ownership in India and Sri Lanka cited by Tusa concluded the introduction of any new technology requiring the listener to purchase a new receiver would cause a "disintegration of the audience."

Technological innovations

In "Broadcast Technologies: The Future is Now," panelists explored technological advances and their potential

effect on international radio.

Among the new technologies being explored are digital and satellite transmission.

Worldspace Inc. is a satellite broadcasting company responsible for several global projects including Afrispace. The premise, explained President Noah Samara, is to reach distant audiences in buried rural areas of the globe. Samara said Afrispace broadcasts were responsible for educating many people in underdeveloped regions of Africa about AIDS.

When completed, Worldspace will send FM and CD quality broadcasts to their subsidiaries via \$14 million "light" satellites. These satellites will deliver nine 300 kHz channels of CD quality sound or up to 36 channels of FM quality.

Tom Rogers, chief scientist for Radio Satellite Corp., said UHF transmitters in the L-band with 100-channel capacity would be the best new system for reliability and sound quality.

Stay with shortwave

However, other panelists including John Ballard, president of Technology for Communications International (TCI), expressed a hesitancy to move out of shortwave for the fear it will alienate the audience.

Both Ballard and the BBC posed questions concerning spectrum allocation and regulations on satellite or digital transmissions across international borders.

According to Leonard Raish, a telecommunications law partner with Fletcher, Heald & Hildreth, International Telecommunications Union (ITU) regulations leave shortwave transmissions across international borders unrestricted, but satellite delivery would be different.

Raish said shortwave transmissions are only restricted by frequency and are exempt from quality and legality rules. Satellite transmissions, he said, are presently restricted for foreign broadcasts by a 1963 rule designed for television.

The panelists raised as many, if not more, questions than they answered. Most questions about spectrum allocation and international broadcast transmissions will be up for debate at the 1992 World Administrative Radio Conference.

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Updated Receiver Standards Likely

by John Gatski

CHICAGO Members of an Electronic Industries Association (EIA) committee hope to convene a subcommittee this

There is a need to update the receiver standards for both bands because the technologies have changed.

month to update AM and FM receiver technical standards.

During the Summer Consumer Electronics Show (SCES), EIA Audio Engineering Committee R-3 member Len Feldman said there is a need to update the standards for both bands because the technologies have changed a lot since the last updates.

"There has been no update on the AM standard since 1958," Feldman said. The standard actually dates back to the days of IHF standards, he added.

Feldman said the changes are needed

because the old standard does not include AM stereo measurements, NRSC standards and the need to integrate with FM standards.

The National Radio Systems Committee (NRSC) and the EIA recently approved an AM certification mark that calls for high standard AM receivers, and that is likely to become part of the overall standards update.

Although FM was last updated in 1975, "again, there is justification and a need for another update," Feldman said.

Factors that necessitate an FM update include expanded use of subcarriers, the advent of RDS and expanded mobile use. Feldman also noted that an update would integrate with an AM receiver standards update.

The new subcommittee should also keep the international aspect in mind, Feldman said. "Any standard should harmonize with the international standard," he said. "It is extremely important for the standards to harmonize."

International standards work is undertaken through IEC International TC-84. EIA receivers standards are voluntary, Feldman said, but most companies eventually adhere to them.

FCC Wavers on L-Band

(continued from page 1)

use. The concerns are even greater at S-band.

Tests on L-band still need to be done, and for its proposal of Eureka 147 DAB as a U.S. standard, the NAB estimates at least 60 MHz of new spectrum is needed to accommodate all existing AM and FM stations.

Satellite interests have also eyed L-band as being particularly suitable for DAB. Requests by companies such as Satellite CD Radio are for about 30 MHz of L-band.

The NAB has pushed for co-primary status for any DAB spectrum request, meaning that both satellite and terrestrial interests would need to be accommodated whatever the amount of spectrum allocated.

In addition, commenters opposed S-band as cost prohibitive and voiced concern over interference from microwave ovens, which operate in that frequency range.

NAB pleased

The NAB, which is about to begin negotiations with Eureka 147 on a possible licensing agreement, seemed heartened by the Commission's action.

DAB Task Force Chairman Alan Box noted that the FCC's action "expressed faith in the future of DAB" and showed that the Commission is "positive" about allocating L-band for it.

But Box conceded that the proposal at the higher frequencies was not as encouraging, saying "S-band is unacceptable spectrum for terrestrial DAB."

With an August deadline for the U.S. WARC position, it may be 30 to 60 days before the NAB finds out whether the Commission can procure enough L-

band spectrum to accommodate all stations in an out-of-band DAB system like Eureka 147.

When the Commission's WARC advisory group subcommittee recommended 60 MHz of L-band for DAB, its chairman, Ben Fisher said, "It's our last chance. If we can't get enough L-band for DAB, we may have killed off DAB for at least the next decade."

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Circle 90 On Reader Service Card

Digital Formats Shown in Chicago

(continued from page 7)

recorder, which will be on the market by fall. The \$10,000 unit is based on the write-once technology several other companies are using in their recordable CD units.

An incompletely recorded CD can be played only in the Marantz recorder until the final table of contents is written. After the final table of contents is written, it can be played in any player.



Denon's DTR-80P portable DAT recorder

Perhaps as interesting as the DCC and recordable CD was the AX-1000 audio computer, also from Marantz. This \$15,000, advanced digital signal processing unit performs functions including automatic equalization of a listening room to give optimum flat response,

recreation of various musical environments (jazz clubs, Carnegie Hall), digital surround decoding, dynamic compression and expansion, and digital test measurements.

Another feature of the AX-1000 is a digital interpolation system that removes deep scratch audibility from records without affecting the overall sound.

Denon showed its DN-77R CD recorder, introduced at the NAB convention in April. The \$14,000 recorder, when used in conjunction with a \$4,000 A/D and D/A converter, allows write-once direct-to-disc recording of digital and analog sources.

Mostly portable DAT

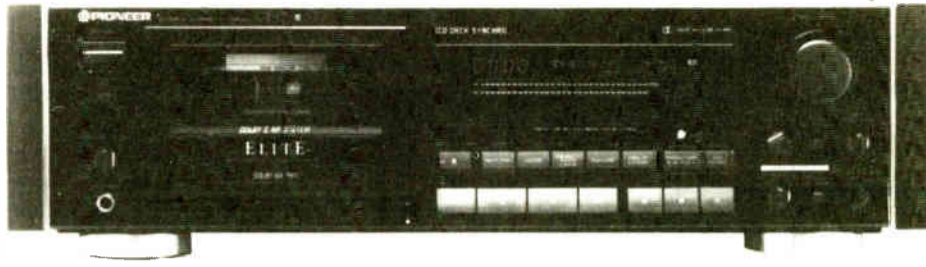
Denon's DTR-80P portable DAT recorder, a CES Innovations '91 winner, also was on display. Several other companies, including Aiwa and Sharp, also had portable DAT players on hand. A few car DAT players also were on exhibit.

With the predicted success of DCC, however, companies seemed to have fewer home DAT decks on display, based on a sampling of various booths.

The Radio Data System (RDS) remains an infant technology in the U.S., but appears on the verge of a breakthrough within the next couple of years. There were a few domestic version RDS units at SCES.

Blaupunkt showed its prototype

Heidelberg RCM-40. RDS has become very popular in Europe, and U.S. stations are interested because of the tech-



Pioneer showed its new line of Dolby S-equipped tape decks.

nology's ability to allow stations to send text and switch receivers to particular formats.

According to Blaupunkt, the company will be providing Heidelberg samples to stations that experiment with RDS this year. Currently, about a dozen stations are trying out RDS. The company said it will introduce a RDS line in 1992.

Pioneer's F-93 Elite digital AM/FM home tuner is a high-dollar unit (\$900) that boasts a direct digital decoder for improved performance. It also has improved front end, AM wide/narrow bandwidth, and advanced MPX filter for lower noise. It is said to be the "finest tuner available," according to Pioneer.

Analog cassettes still strong

There were plenty of analog cassette decks to be found at SCES, indicating

that analog is not dead yet. Showgoers got a chance to hear the new Dolby S analog cassette decks, including the CT-93 from Pioneer and the Harman Kardon TD 4600 and TD 4800, the first Dolby S decks to reach U.S. shore. Denon showed a horizontally-loading deck and

several companies had double decks with improved specs.

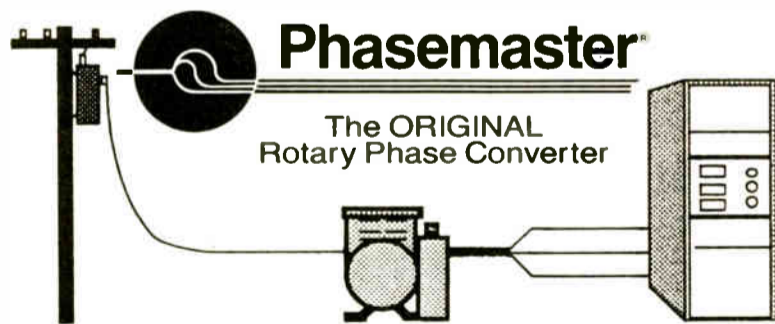
Hughes Aircraft's SRS (Sound Retrieval System) stand-alone unit also was demonstrated. SRS is said to enhance the stereo soundstage of recordings and AM and FM stereo without the use of additional speakers.

In actual listening tests, the unit seemed to convey an increase in depth with a lesser increase in the soundstage's width—without having to sit in the "sweet spot."

Other interesting products at SCES included NSM's 100-disc CD changing system that interfaces to a computer for control of up to 16 machines, Panasonic's ID Logic radio that automatically selects format based on software programming, and Blaupunkt's Travelpilot navigation system and Phased Array antenna system.

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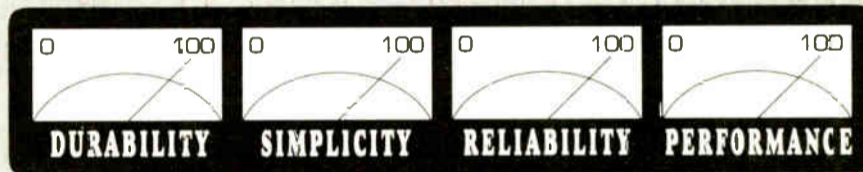
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Interactive DAB: The Next Step

by James Careless

TORONTO Radio broadcaster John Kares and TV producer Errol Bruce Knapp, are patenting a new technology that they believe could make digital radio into a two-way interactive medium.

Called "Cellular Data Retrieval" (CDR), the system is, in essence, a form of two-way communication between computers with the digital data transmissions broadcast over radio waves.

Both Bell Telephone and its competitor, Unitel, offer similar services to other Canadian businesses. In short, "mobile digital communication," (MDC) as it is called, already exists—complete with spectrum allocation.

The difference

Cellular data retrieval differs from existing MDC technologies in two respects. First, Kares and Knapp want to reduce the current "RF Modem"—the device that links the computer to the radio network—from a brick-sized box to a microchip. They also want investor capital to help pay for this development.

Secondly, the two propose that this microchip be installed in a range of electronics, to make them into addressable, two-way units.

For the inventors, the area that offers the most potential for interactivity is the up-and-coming technology of digital radio. If Kares and Knapp have their way, every digital audio broadcasting (DAB) receiver would have a CDR chip built in. Thus, all DAB sets would be "addressable digital radios," or ADRs.

"What we are offering here is a set of opportunities for broadcasters and radio listeners alike that make radio more involving, more participative, and more revenue-generating," Kares said.

"Most broadcasters consider DAB to be a major improvement. And there is no denying that is the case," Kares said. "The demonstrations we saw last summer (in Canada) clearly indicated that. However, from the point of view of the regular consumer of radio—particularly of FM radio—DAB will not make that much of an appreciable difference.

"Unless you are a diehard AM listener, DAB is not going to make that much difference to you. All it means is I have got to go out and buy a new radio."

But CDR technology "can create greater consumer acceptance of DAB," Kares said, and he may have a point. Certainly two-way radio, offering all the services that ADR entails,

would be a far more exciting marketing concept than DAB alone.

In addition to being addressable, each ADR would have a unique identification number assigned to it. This would be a personal code that a central computer broadcasting from a radio station, ratings service, or other commercial transmitter would take note of every time it contacted the ADR.

Using these codes, it is possible for the central computer to know which receivers are tuned

in at any time. As well, it also would have a basic grasp of who is listening because those buyers wanting access to ADR services would register when they bought or rented their receivers.

The investment value

So much for the structure. What do the listeners get to justify their investment? Plenty, according to Kares and Knapp.

There is "Digital Pay Radio," a radio-version of pay-per-view television. For a monthly fee,

the central computer will instruct subscribers' radios to unscramble certain frequencies, thus giving them access to live concerts and special programming.

Another possible use is "private radio networks," for occasional broadcasts. For instance, a union can keep its members up-to-date on contract negotiations over such a system, or a retailer can brief its staff on next week's specials.

"Digital Pay Music Delivery" is also a possibility. Under this

scenario, record companies could release their new recordings over the air to ADR users, who, in turn, will simply record the CD-quality audio on their home DAT equipment.

A third benefit, for listeners, is that they could find out what song they are hearing at any time. A "buy" button offers a fourth option for users as well: home shopping. Listeners could purchase any item they hear advertised over the airwaves, just by pushing that button.

Finally, the inclusion of a "yes" and "no" button on each ADR would allow listeners to take part in "interactive programming," such as polls, and contests.

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U.S. Firm Ready to Launch Moscow FM

by Alan Carter

MOSCOW Pump up the volume . . . It's your Moscow Morning Zoo.

Lately, the impact of the West on the Soviet Union has been greater than ever, whether in political reform, economic structure or the lifestyle of its people. But is the U.S.S.R. ready for Western-style radio inside its borders?

Moscow and the surrounding 80 kilometers—a population of 16 million—will be introduced to contemporary commercial FM radio when Radio 7 goes on the air at 60 kW with a target date of Oct. 1.

All the hits

Radio 7 is a joint project of the Soviet government and a Gillette, Wyo., businessman, Ben Doud, who is president of Top 40 KGWY-FM. For the past year and a half, Doud negotiated with the Soviets for a 10-year transmitter and tower lease to operate the station. The agreement, finalized in May, splits the ownership 50-50.

What Doud believes made this deal attractive to the Soviets is that it will bring them international currency from advertising revenue. The Soviet Ruble cannot be exchanged for foreign currency; hence, the government wants currency

with which it can trade.

The Soviets, who are issuing radio licenses in the FM frequency that until now was reserved for the military, approached Doud about the project when a video company he owns, Video Communications, shot a Rand McNally travel series on the U.S.S.R.

Radio 7 is the seventh license the Soviets have issued in the FM band—a number that Doud noted is lucky in both the U.S. and the U.S.S.R. This will be the second commercial station in the Soviet Union; the first is licensed to a European operator.

The Soviets also gave Doud authority to operate in the shortwave frequency until his FM station is on the air, but he said he is not sure whether he will put that on the air—except maybe to promote Radio 7.

While the transmitter, tower and antenna for the FM station will be Soviet built, Doud will design and build the studio with equipment from the international market. No decisions have been made yet on what equipment will be installed.

As for programming, Doud expects a contemporary approach with all the tricks of the trade. There will be a morning show, but the music will range from Top 40 to jazz—all directed at a demographic of 25 to 44.

Doud projects that in about five years,

New Fees for Towers

by Art Cole

WASHINGTON Fees paid to the U.S. Forest Service for broadcast towers located on federal land would rise 22 percent next year, and not the 8,000 percent proposed in an earlier version, according to a compromise plan approved by a House of Representatives subcommittee last month.

The House Interior Appropriations Subcommittee approved an amendment offered by Rep. Norman Dicks (D-Wash.) in June that would reduce the proposed increase from what could be as much as 8,000 percent in some cases. One station under the unamended version would have faced an increase from \$500 to \$14,000 annually.

The amended bill was to be taken up by the full House Appropriations Committee June 19.

Currently, different U.S. Forest Service regions charge different rates and impose increases on different schedules. However, the service has been banned from imposing increases for the past two years.

"We think some increases are in order," said a Forest Service spokesman who spoke on condition of anonymity.

Currently, the Forest Service bases its fees on two-tenths of a percent of the cost of the tower, with fees ranging from \$100 to \$1,000.

"One of the problems is our fees haven't been increased in some cases for 25 or 30 years," the Forest Service official said. "And based on our appraisals, some fees are \$700 when they should be \$8,000."

Revenues from the fees go to the U.S. Treasury.

While the fees issue has been somewhat touchy for the past two years, an NAB spokesman said the amendment is a reasonable solution.

"This is a compromise of sorts in that it allows percentage increases where no increases were allowed before," the spokesman said. "More than likely, it will get through (pass into law)."

Radio 7 will be formatted very similarly to modern-day radio. But in the beginning, there will be no spot advertising; instead, programs will be sponsored by companies—similar to how radio was done in the U.S. in the early days.

Sampling buying habits

Radio 7 will contain a significant amount of on-air sampling, Doud said, to determine the tastes of Soviet listeners.

He noted that Soviet buying habits are different from those in the West, but the question is whether that is because they have never had the choices they are now being given. "We've got to learn those things," Doud said.

When Radio 7 is up and running, Doud said he and a pool of partners will

have invested "in the low seven figures." Advertising rates have not been established, but Doud said he wishes he could charge based on the 16 million potential audience members.

Doud said he is not worried about the possibility of political unrest causing him to lose the station. He also has authority to operate Radio 7 on a repeater in Leningrad or to build another station. Doud said he is leaning toward building a separate station for Leningrad, a city of six million.

He said he is more concerned about the Soviets restricting the import of products into the U.S.S.R., reducing the effectiveness of advertising. At this time, he added, anything from Italy, France, Germany and Korea is "hot."

The Soviet government has not put any restrictions on programming, Doud said. "We've been told we can program and play anything we want."

While there has been a crackdown on some freedoms initially given the press, Doud downplays the government action. "A lot of what's going on is like turning a kid loose in a candy store," he said. "They are trying to see where the limits are."

But he added, "If it got to the point that the tanks rolled up out front, you would take requests. You don't have much choice."

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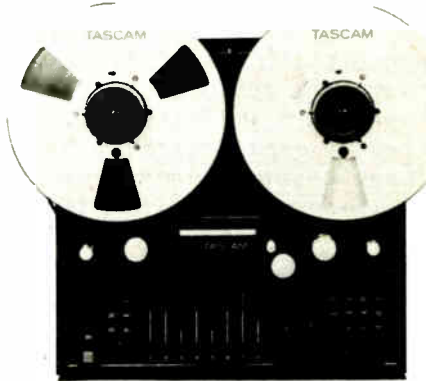
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World Radio History

NAB DAB Stand Fuels Battle

by Judith Gross

WASHINGTON It started with a letter to group owners urging those who might oppose the NAB's policies on DAB to make their feelings known by writing the FCC.

By now it's spawned an angry back and forth, a public relations effort by the NAB and uncomfortable feelings in the rest of the industry. And most of it took place just prior to the NAB's semi-annual Board meeting.

The furor began when Randy Odeneal of Sconnix Broadcasting, who has represented the opposing viewpoint on

the NAB's DAB Task Force, wrote to stations with his concerns about the NAB's support for obtaining L-band spectrum for DAB.

NEWS ANALYSIS

The letter accused the NAB of working "diligently, contrary to our interests, to build its case for L-band" and of having "teamed up with satellite proponents to petition for L-band spectrum."

Odeneal also noted that since the FCC

has only heard from the NAB and not individual broadcasters, there's a false perception of industry unity behind the NAB's position. "You know as well as I do that this is not true," he wrote, urging written messages to the FCC to dispel the perception.

Opposition to NAB

Several groups responded to Odeneal's request with letters to the FCC. Saul Levine, president of KJQI/KKGO, expressed vigorous opposition to the NAB's DAB position, urging the Commission to reject the request for L-band.

"The NAB's position is not supported by the rank and file of the radio industry. I have yet to come across a single radio broadcaster who is in favor of current NAB policies concerning DAB," Levine wrote.

American Media Inc., which owns nine stations, also wrote to the FCC opposing the NAB's position and the concept of an out-of-band DAB approach.

"It makes even less sense to use up valuable new spectrum space, change the entire infrastructure of the world's most diverse radio industry and ask listeners to wean themselves on to a new radio band while throwing out 500 million receivers over time," AmericanMedia wrote.

The letter also suggested that "NAB probably cares more about the quantity than the quality of its membership" and that Eureka looked like a "surefire way to appeal to both its AM and FM members and earn a profit for the NAB at the same time."

A letter from Cook Inlet Radio Partners, also an owner of nine radio stations, concentrated more on the possible benefits of in-band systems but did not level any direct criticism at the NAB.

NAB replies

NAB Radio Board chairman David Hicks responded angrily to Odeneal's letter-writing campaign. He sent a letter of his own to radio group heads and the trade press, but did not send a direct response to Odeneal.

Hicks accused Odeneal of "mis-

The NAB's position on DAB has been questioned by others in the industry.

representations, innuendo and misleading appraisals of technology and policy." He denied that NAB had teamed up with satellite interests in requesting L-band spectrum and said that maximum flexibility on DAB policy was the best course.

"Should the radio industry abandon any DAB options today? In the fast-changing technological world, we don't think so," Hicks wrote. He said that NAB's policy on DAB will "insure that you, and all broadcasters, will have enough time to carefully sort out the available technologies and policies, and determine for yourselves which ones to support."

In addition to Hicks' response, the NAB initiated a several-times-a-week DAB fax to its members reiterating its policies on DAB.

Aftermath of letters

Broadcasters who received the letters and commented on them did so wishing to remain anonymous. But the general feeling was one of discomfort that the radio industry and its trade association were "airing dirty laundry in public."

"I think it's unfortunate that it's gotten to this point," an engineer said.

In addition, the letters stirred up DAB controversies just before the Radio Board was to meet in Washington in mid-June. There was no specific DAB agenda item requiring action by the Board, and it was unclear at that point if any of the items in the letter would be discussed.

"It's either going to be a shouting match or you won't hear a word about DAB at all," one board member said.

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"Signals of Excellence"

Even a Digital War Can Be Hell

by John Gatski

WASHINGTON The term "mother of all battles" doesn't apply just to the Persian Gulf War or the CHR fight in New York anymore. This fight could just as easily relate to digital audio.

After the recent Summer Consumer Electronics Show (SCES) in Chicago where two new digital infants—Digital Compact Cassette (DCC) and the Sony Mini Disc—vied for attention, the digital format war has really gotten hot.

You may recall I talked about format uncertainty several months ago when DCC was about to be introduced. Well, now the format stakes have been raised once again.

Along with DAT, the CD, the recordable CD and DCC, we now have the Sony Mini Disc. I can't recall a time when audio had so many high-quality formats to consider. We had eight track, the fledgling cassette and the mature reel-to-reel in the late 1960s and early 1970s, but the cassette quickly won out on the consumer side.

I think the digital audio market combat will be more heated than the format war of the '70s. It is more reminiscent of videotape with all its formats now battling for market share.

In this corner

Who is going to win the audio battle? Allow me to speculate on how each of these products will play out in the con-

sumer and perhaps professional markets.

First, let's talk about the standard five-inch CD. On the pre-recorded side, its place seems assured. (It should be noted that Denon is working on a new system that allows a laser to burn in the same 78

minutes of material allowed on five-inch disc—uncompressed—on a three-inch disc. I have not yet heard any talk about making such a disc the CD standard.)

CUE and REVIEW



The five-inch CD has not yet displaced the analog cassette, but it is closing the gap and has dealt the death blow to the vinyl record. CD's rapid acceptance by consumers and standards makers, its quality, convenience and its high-tech image will ensure its survival (even if it shrinks in size) as the digital standard for years to come.

Unlike analog cassette tape's eventual complementary relationship to the LP, however, there does not yet appear to be a clear choice for such a companion for CDs.

Digital warrior number two: recordable CDs. Based on write-once technol-

ogy, the equipment is still very expensive. A Marantz unit due to hit the market later this year will sell for a mere \$10,000. At that price, it is not likely to be the cassette's replacement. For serious (and rich) audiophiles and pros only.

Analog warrior number one (and only one): How about the analog cassette? After all, it is still number one in sales and its performance continues to be improved. Dolby S is said to give analog tape digital-like quality. It is not, however, likely to remain on top. People are too fixed on digital. Analog is fast becoming a dirty word—even though it provides high quality and is preferred by many professionals.

A digital dark horse

That leads us to DAT. I used to believe that DAT would become the standard bearer for digital recording among professionals and consumers. But the copyright/recording artist royalty fight has hindered the format to the point where economy of scales has not been realized. Consumer DAT machines remain expensive and the technology has not pushed pre-recorded duplication costs down. DAT's future prognosis? Again, pro and serious audiophile use only.

As a cheaper alternative to DAT, the

DCC looked like the answer—at least in January. The format is backward compatible with analog cassettes and has digital sound. Also, people are used to recording on tape and DCC is still tape.

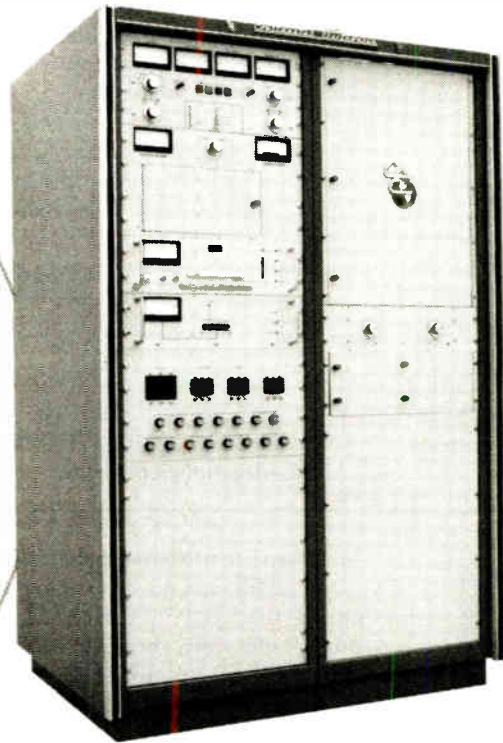
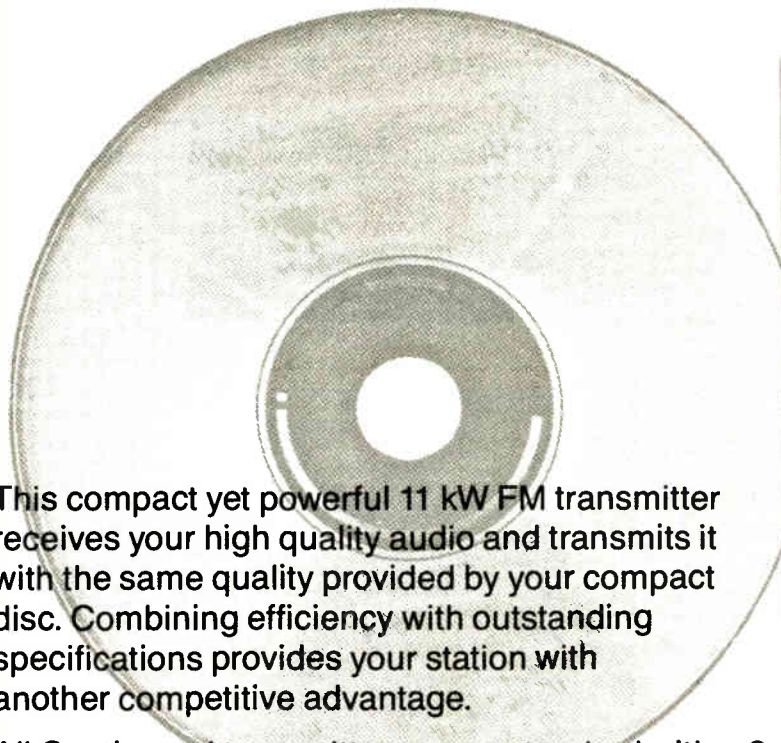
But the new Mini Disc also has its virtues—maybe more than DCC. It is a 2.5-inch digital disc that holds 74 minutes of music, with near-instant access to tracks and perfect shock resistance. I think people will go for it because it has the high-tech appeal, like the CD, and will be small and relatively inexpensive.

Professionals have mentioned that whether or not a pro model is developed, the Mini Disc could be a useful tool for them as well. One audio writer even remarked that it could be a replacement for the cart machine—at least for spot recording or ENG applications.

Of course, it is possible that the Mini Disc may get lost in the battle and will not reach its potential. Sony could decide only to target it toward Walkman-like players and recorders, which was the configuration of the company's prototypes. Mini Disc also could be hindered by its projected late 1992 market intro—the same time as DCC's planned launch.

Battles of any kind often are unpredictable and this "mother" is likely to be quite a war, judging by the number of participants. What side am I on? Right now, I'm flying the Mini Disc flag.

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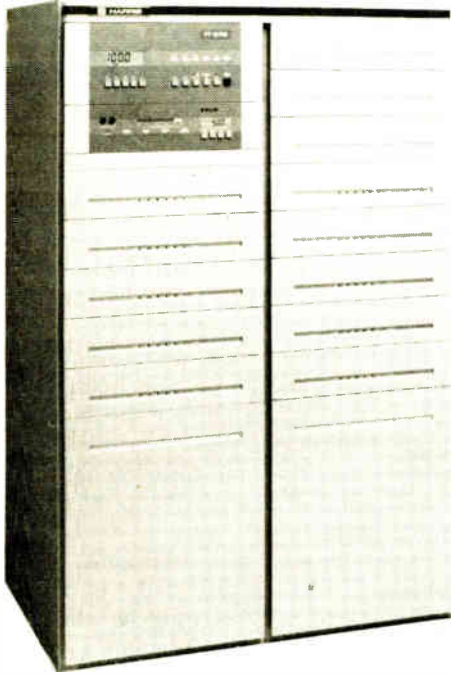
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TRANSMITTERS



Harris Platinum PT

Harris Corporation has introduced its new Platinum PT line. Adapted from Harris' solid state TV transmitter designs, the PT FM series is built around additive 1350 watt FET RF modules, each with its own internal driver and VSWR protection.

Modules operate in a broadband parallel redundant configuration with no tuning required, so the transmitter will continue to operate should one of the modules fail. They can be removed or reinserted hot while operating. The transmitters feature positive pressure air cooling with multiple drive fans and self-protected, regulated non-switching power supply.

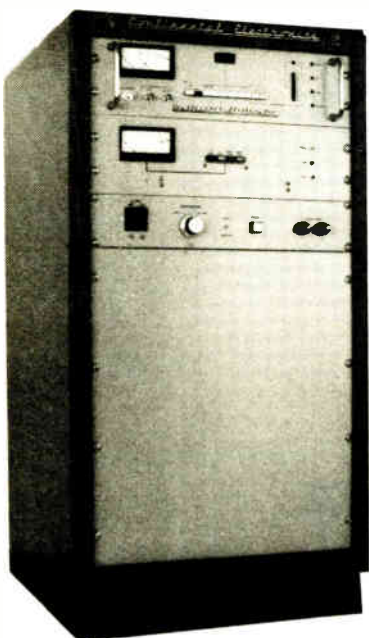
Power levels up to 10 kW for a single transmitter will be available from Harris this fall with two 10 kW units combined internally to make 20 kW output.

For more information, contact **Dave Burns at Harris-Allied: 217-222-8200, or circle Reader Service 71.**

QEI

QEI Corporation, a manufacturer of solid state FM transmitters up to 500 watts and grounded-grid tube transmitters up to 30 kW, displayed samples of its high power models in addition to self-contained, rack-mounted solid state units.

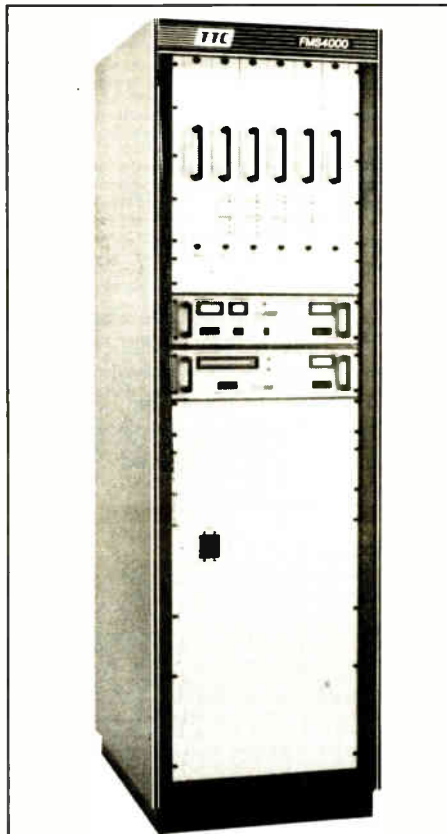
For more information, contact **Jeff Detweiler at QEI: 609-728-2020, FAX: 609-629-1751; or circle Reader Service 153.**



TECHNOLOGY BREAKTHROUGHS



FM TRANSMISSION GEAR



TTC FMS Series

Television Technology Corp. of Colorado featured its solid state FMS series of FM transmitters introduced last year, with single cabinet power levels up to 4 kW. The TTC design uses broadband 1 kW power modules that achieve up to 65 percent overall efficiency.

The transmitter remains on the air automatically, even after failure of a PA module or the control circuitry with the exclusive "fail-on" design.

TTC uses a rugged ferro-resonant power supply, automatic VSWR foldback, and digital metering throughout. Two 4 kW units can be combined for 8 kW output. The FMS series transmitters are available now with a \$32,000 price tag for the FMS-4000, including a two-year warranty.

For more information, contact **Alexander DeLay at TTC: 303-665-8000, FAX: 303-673-9900; or circle Reader Service 59.**

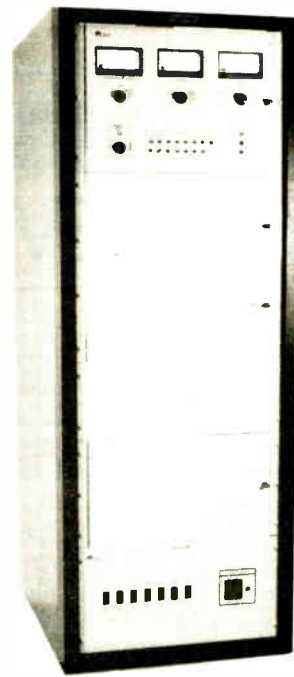
Continental Model 814D

Continental Electronics of Dallas powered up the "mouse that roars" from the 500 watt version (model 813A, left) shown at NAB Radio '90, to a 1,000 watt unit (model 814D). This all solid state transmitter housed in a short rack cabinet includes an 802A exciter and uses two of the MMD 500 watt RF modules.

A digital LED displays true peak level of the modulated signal in five percent increments. Stereo separation is 50 dB minimum; 50 Hz to 15 kHz. The 1 kW mouse retails for just under \$17,000.

Continental also is developing a new 60 kW FM transmitter, designated the 817B. This unit incorporates the reliable high voltage power supply, the RF and IPA stages, the 802 exciter and the control panel of Continental's current 60 kW transmitter.

For more information, contact **Steve Claterbaugh at Continental: 214-381-7161, FAX: 214-381-4949, or circle Reader Service 22.**



Nautel AMPFET

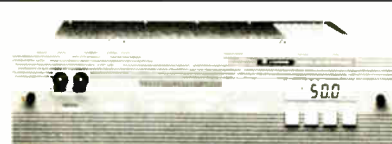
Nautel Electronic Labs unveiled the AMPFET FM7 and FM4 high-power solid state FM transmitters at NAB '91.

Both units use combined 1 kW power modules, which contain four Motorola MRF-151G power FETs delivering 250 watts each. If any device should fail, it becomes isolated from the others and the transmitter continues to operate.

The power supply is single phase self-regulating, and delivers a safe 50 volts DC to the power modules. No routine tuning or adjustments are required and the PA is protected by automatic VSWR foldback. The FM7 7 kW model is slated to retail at \$40,000 with the FM4 4 kW at \$30,000.

For more information, contact **Jorgen Jensen at Nautel: 902-823-2233, FAX: 902-823-3183; or circle Reader Service 141.**

EXCITERS AND AMPS



Harris Digital 50 Exciter

The Harris Digital 50 FM exciter uses direct digital synthesis (DDS) with an 18-bit numerically controlled oscillator (NCO) to produce an FM signal that rivals compact disc specs. The old problems of unstable VCOs and PLLs in traditional FM exciters have been eliminated.

The Digital 50 produces 50 watts of power output with rugged wide-band FET devices. For "N+1" applications, any FM channel can be selected in 10 kHz increments with no output retuning required. The Digital 50 will be available this fall; early estimates put the price at \$10,000.

For more information, contact **Dave Burns at Harris-Allied: 217-222-8200, or circle Reader Service 76.**

Energy-Onix SSA Series

The Energy-Onix SSA line of FM broadcast amplifiers is new this year and features power levels of 100, 300, and 500 watts, all using broadband Motorola FET devices with built-in VSWR protection and auto power control.

The SSA-500 contains a power splitter to drive two 300 series modules and a broadband combiner to join the outputs of both modules to produce the rated 500 watts output. That unit is priced at \$6,200.

For more information, contact **Bernard Wise at Energy-Onix: 518-828-1690, FAX: 518-828-8476, or circle Reader Service 110.**

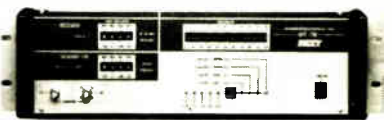


Omnitronix FM10X Exciter

Omnitronix unveiled the FM10X, a ten watt FM exciter with built-in stereo generator and audio processor.

Frequency agile in 100 kHz steps, and broadband from 75-109 MHz, the FM10X features diagnostic LEDs and metering.

For more information, contact **David Solt at Omnitronix: 215-542-9580; FAX: 215-542-9580, or circle Reader Service 21.**



Bext Products

Bext Inc. displayed a line of FM exciters, translators, and transmitters. The Bext FM transmitter line features solid state power levels up to 1 kW and tube models up to 30 kW.

Bext also introduced its new HPT series of translators and boosters. In one compact frame, the HPT includes a 20 watt exciter with built-in options of either an FM composite receiver, a 950 band STL receiver, or a stereo generator.

Also new from Bext a new 6 watt composite STL system priced under \$5,000 and the new PJ250 250 watt solid state amplifier for translators.

For more information, contact **Dina Giannone at Bext: 619-239-8462, FAX: 619-239-8474, or circle Reader Service 118.**

CTE Exciters and Amps

CTE International, an Italian firm, presented an all solid state lineup of FM exciters and power amps up to 5 kW.

Housed in rack style cabinets, the S1000 and VL5000 power amplifiers feature redundant RF output construction for uninterrupted operation in the event of a partial failure, VSWR protection, and an 80 kHz switched mode power supply.

The units achieve better than 52 percent overall efficiency and sport retail price tags of \$25,500 for the S1000 and \$51,500 for the VL5000.

For information, contact **CTE International at 39-522-516660, FAX: 39-522-47448, or circle Reader Service 41.**

GREENBELT, Md. Solid state medium-wave AM transmitters of power levels of 50 kW and beyond have improved in performance, efficiency, and operating cost over the past five years. The challenge of achieving comparable results in the VHF FM arena have been slower and more difficult.

The main stumbling block appears to be the cost of the silicon output devices. New higher efficiency MOS-FET transistors and combiner designs now allow manufacturers to (theoretically, at least) build VHF transmitters beyond 10 kW output, but the costs of the multi-layered PA transistors and combining power losses still make it prohibitively expensive.

The device of choice for most solid state FM transmitter manufacturers is the Motorola MRF-151, and its twin pack or Gemini version, the MRF-151/G. Jorgen Jensen, sales and marketing manager for Nautel, confirms the disparity of cost: "Harris and Nautel can buy the PA devices used in our respective 50 kW AM rigs for \$2 to \$3

TECHNOLOGY BREAKTHROUGHS

NAB91 FM TRANSMISSION GEAR

by Thomas R. McGinley

Solid State for FM Faces Cost Concerns

transmitters. "We are getting lots of power out of an extremely small area of silicon. But higher powers with fewer devices won't become cost effective until cooling designs change."

The other limiting factor with high power solid state is low supply vol-

down. The Nautel output design will work into mismatched loads of up to 1.5:1 VSWR at full power output.

All of the other manufacturers, including Harris, Continental, TTC, NEC, Thomson and Telefunken use the conventional 90 degree "Wilkinson" combiner design, which uses one more stage of combining for equivalent power output plus the equalizing or "reject load" resistors. These balance out gain inequities among the devices and provide more isolation if one or more devices should fail, allowing the transmitter to stay on the air.

If all the devices of each cluster are perfectly matched, there would be no power loss. However, in practice, four to six percent power loss can be expected in each sub-combiner of the total transmitter. According to Harris's Dick Frey, this brings the efficiency of the 5 kW PT line transmitter down from

80 percent at the individual device operating at class C-D+ to 56 percent at the output terminal.

Single channel concerns

With Nautel's design, the transmitter must be "banded" or optimized in the factory to one operating channel. The input stage of each device is frequency optimized by a biasing adjustment. If devices fail in the field, the replacement module must be tuned to the specific channel.

With virtually all solid state FM transmitters on the market, attempting to replace individual devices at board level in the field is not recommended. The entire defective module must be returned to the factory for repair or exchanged for a new or rebuilt unit.

The Harris PT design overcomes the single channel deficiency by using fully broadbanded modules which require no tuning. This is the "N+1" approach popular in Europe, which allows any replacement part—or in this case, a spare module—to be truly generic.

It's like running out of ice: Merely refill the ice trays with tap water and the refrigerator keeps the party going. "Reliability and low maintenance is king in these days of fewer engineers," says Frey. "It is entirely possible that many of these transmitters (the Harris PT line) will never go off the air after they're installed except for primary power outages."

Continental introduced the first "high power" solid state FM transmitter over four years ago with the 3.8 kW model 814C. This unit is also a broadbanded design, using Microwave Modules and

(continued on page 19)

The main stumbling block for FM solid state transmitters appears to be the cost of the silicon output devices.

each in large quantities. The same quantity price for the MRF-151/G is about \$125 each." The output power for a pair of devices is 250 to 350 watts for both applications.

Getting rid of the heat

The higher FM frequencies and switching speeds place a much greater demand on the efficiency performance of the silicon in the power MOSFETs. Getting rid of the heat is a real problem.

Dick Frey, project engineer for the new Harris Platinum or "PT" line of high power all solid state FM transmitters, points out that while air is free and easy to use, it is not a very good heat exchanging medium for VHF

tages and very high currents that force very low impedances with numerous devices operating in series-parallel. Matching a few ohms back up to a 50 ohm output can create significant bandwidth restrictions.

Nautel presently claims the highest overall operating efficiency of 65 percent (AC in to RF out) with the FM-4 4 kW and FM-7 7 kW models shown at the NAB convention this April. A new 10 kW model is being developed and will be shown at next spring's NAB. This efficiency is achieved with Nautel's patented 60 degree "zero-loss" combiner architecture. The PA devices run at Class C-E; up to half of them can fail before the transmitter will shut

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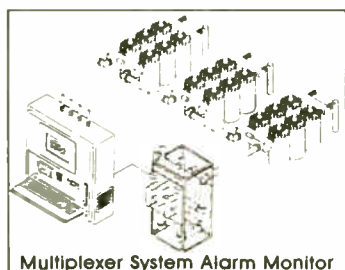
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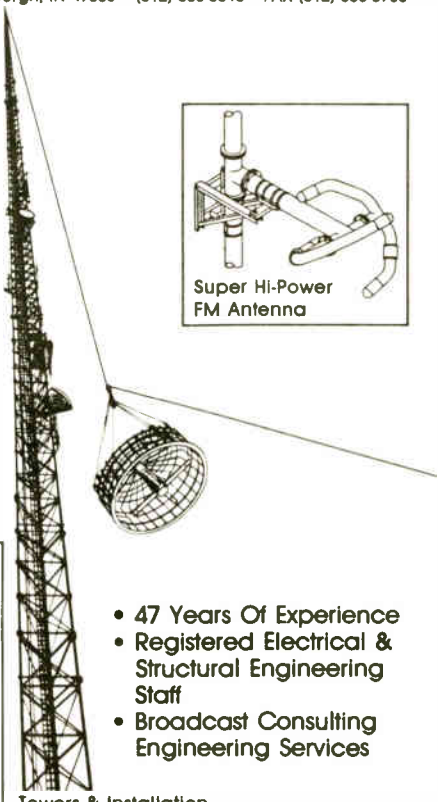
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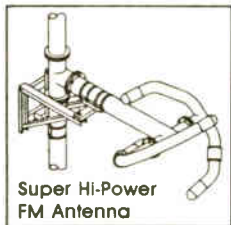
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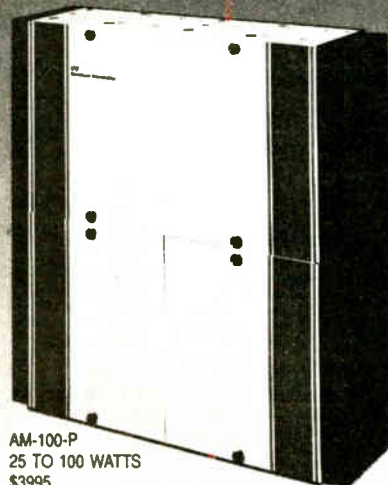
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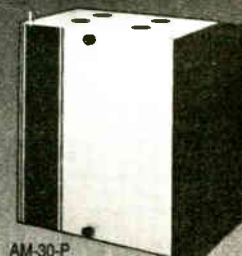
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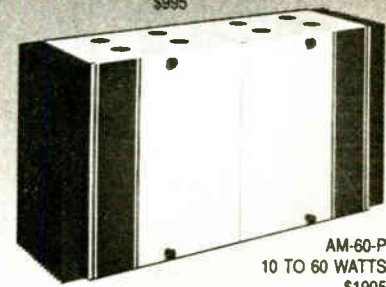
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Purchasing Used Transmitters

by Jerry Kautz, President
Imperial Transmitter

McCOOK, Neb. There's a story of a company in South America that ordered a "rebuilt late model" 25 kW radio transmitter from a well-known U.S. firm.

What arrived on the ship were five broken-down 5 kW FM transmitters from the 1950s. The company had no recourse but long litigation and endless anguish—and learned a valuable lesson.

Then there's the tale of a station in Mississippi that purchased a rebuilt transmitter, only to have it arrive with two dead mice, a dead snake and a burned-up wiring harness. The company tried to claim the critters must have gotten in during shipment. I can only imagine that they were smoking cigarettes in there and burned up the harness and themselves.

These accounts back up the realization that buying a used radio transmitter can be risky business.

There are few major sellers of used broadcast transmitting equipment. Unfortunately, as with used car lots, some firms have the tarnished reputation of being crooks. How does one find out who he is dealing with—friend or shark?

Risks can be worth it

Good values can be found in used equipment in places such as the classifieds of RW and even sometimes from

brokers if one knows what to look for. Sometimes the risks are worth it, if they can be minimized.

At Imperial Transmitter, we like to believe we're a friend to those in the market for a used transmitter. As a rule, we tune, test and refurbish equipment as ordered before selling it, then offer warranty and installation service.

But as a buyer, there are numerous safeguards and check points you should study before accepting the word that your transmitter will arrive refurbished and working.

There are few major sellers of used broadcast transmitting equipment. Unfortunately, some firms have the tarnished reputation of being crooks.

Rule Number 1 is to actually see the transmitter you're considering buying. Alternately, you may hire a qualified engineer to inspect it for you. Ask questions of the engineer in charge of the transmitter on neutral ground (i.e., not in front of the salesman or GM). Most engineers will be quite candid about the condition of their transmitter.

Ask hard questions of the broker or rebuilders of any transmitter you desire to purchase. Who will be tuning your transmitter? What kind of experience

have they? What tools and equipment are available for tuning and testing? Ask for references if you have any doubts.

Check out the particular model with those who have experience with that model. Ask other engineers who may have the same unit. A quick call to the manufacturer can help you know where to look for trouble.

Don't send money

Be cautious about sending money to anyone before looking at the transmitter and knowing that you want it. If one is

purchasing a tuned and tested transmitter from a company with good references, however, it is normal to expect to pay a down payment—usually half.

We recommend looking at a transmitter being reconditioned only after it is tuned/tested and operating on the new frequency. At this time, you or your engineer may perform any tests desired before delivery.

If you're working through a broker, keep in mind that in most cases, he has never, in fact, seen the transmitter himself. He is there to sell transmitters as-is and nothing more. Therefore, he usually has no working knowledge of the transmitter in question.

It's also a good idea to look for the FCC Identifier nameplate on the transmitter. There is no excuse for not having one attached to the equipment. If it is missing, put your guard up.

There have been some cases in the industry of "musical FCC nameplates." By removing or replacing a nameplate with another similar-looking model number,



the selling value of a transmitter can be increased by thousands of dollars.

One way to figure it out is to ask to see the instruction book for the transmitter. Make sure the book type number agrees with the nameplate of the transmitter. Usually, there are subtle differences between similar-looking but differently named models. Look at the pictures in the book and at the equipment at the same time.

If the schematic shows solid state rectifiers and the equipment has tube sockets with replacement-type rectifiers, it could be (but is not always the case) that an older model has been substituted.

Transmitters whose nameplates have been switched before are the Gates FM-G, H and K Series; the RCA BTF-B and D Series; and the Collins 831G, 1 and 2 Series in their different power ratings. We have inspected supposed 25 kW transmitters that were in fact 20 kW transmitters with new nameplates or no nameplates.

Often the transmitter may be upgraded to a higher power; however, this should be disclosed to the customer. There is nothing wrong with upgrading an older transmitter provided everyone knows what is being done.

Shipping and delivery

Be sure to figure shipping and delivery costs into your budget. It is not uncommon for the shipping expense alone to exceed several thousand dollars on transmitters (though transmitters ordered from companies such as Imperial customarily take care of this task for you).

Large older transmitters may need to be dismantled before they can be moved.

(continued on page 21)

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"RFR.TOWER": COMPUTER ANALYSIS OF ON-TOWER RFR EXPOSURE CONDITIONS

William F. Hammett, P.E.

ADVANCES IN TECHNIQUES FOR AIRBORNE ANTENNA PATTERN MEASUREMENTS

Harrison J. Klein, P.E.

Mr. Hammett's paper discusses a computer technique for calculating on-tower radio-frequency radiation exposure conditions. This technique helps answer the question, "What do I have to do at my transmitter site to comply with FCC rules for occupational RFR exposure when a maintenance worker needs to climb a tower?" The FCC has recently become much more zealous in enforcing the occupational provisions of the ANSI Standard. The paper shows the advantages of computer analysis over field measurements in this situation, and describes how the computer program operates. The results of the computer analysis can be used to develop a program to meet FCC requirements for compliance with the ANSI Standard.

Mr. Klein's paper describes new techniques that can be used to perform airborne measurements of AM, FM, and TV broadcast transmitting antennas. Airborne measurements sometimes offer the only way of finding out, "Is my antenna producing the proper pattern to meet my coverage objectives?" The paper discusses the equipment necessary for accurate airborne measurements and shows the results from two measurement projects.

If you were unable to attend the NAB Convention sessions at which the papers were presented, we will be pleased to send you a complimentary reprint that contains both papers. Please contact us if you have any questions about the topics discussed.



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Circle 16 On Reader Service Card

The Future of Solid State FM

(continued from page 17)

Devices' 700 watt VHF bricks in a conventional combining scheme. According to Harvey Rogers, design engineer for Continental, over 20 units are operating in the field with no reported loss of any output devices.

The only disadvantage with the 814C is efficiency, with overall numbers approaching 40 percent. Rogers acknowledges that his company is looking at higher efficiency designs but that the "resistor-less" combiners are not yet proven in the field.

"The operating specifications and performance of individual RF transistors at FM frequencies vary too much from one device to another of the same type number. Equalizing resistors solve that problem," says Rogers. He also points out that the R&D done in defense industry electronics is responsible for the progress achieved thus far in high power solid state transmitter technology. "The cost per watt is still too high for FM solid state above 5 kW. But the costs will come down in time with increased volume."

Television Technology Corp. (TTC) introduced its model FMS-4000 4 kW FM transmitter two years ago. The FMS-8000 combines two units to make 8 kW output. This design uses the conventional Wilkinson combiner and achieves overall efficiencies of 52-55 percent with the MRF-151/G devices operating at class B-C+.

TTC's Director of Engineering Hal Rabinowitz believes that the combiner design is not the real problem in getting higher operating efficiencies. He is looking at other transistor possibilities to improve performance and reduce costs.

"The only real breakthrough left in this technology will be a reduction in transistor costs," said Rabinowitz. "Keeping productivity costs down is the real priority in this business now in order to stay competitive. The U.S. market will not pay a premium for better performance. They look primarily at initial cost. Whatever works is good enough."

Both Rabinowitz and Don Massa, TTC's director of marketing, believe that the international market is more willing to pay for performance improvements because it is less saturated.

Near-term prospects

The near-term prospects for the solid state FM transmitter market appear brighter as the recession winds down. Nautel's Jensen reports brisk sales, with the first production run of the FM-4 and FM-7 scheduled to ship this fall. He has two orders for the 10 kW model—and it isn't even being marketed yet. Jensen feels that 10 kW is the break-even point with solid state versus tubes in terms of cost. The FM-10G will retail for about \$50,000.

But there are still apprehensions about high power solid state FM transmitters. According to Dick Frey, "We are still living in a vacuum tube culture. Engineers need to learn more about solid state technology. The mindset must change."

Many engineers are still worried about lightning, but when you realize that many antennas have shorted quar-

terwave stubs or the output circuits are looking at DC ground, lightning doesn't have that much of an opportunity to

charging up to 900 joules of pulsed DC across the output terminals with the transmitter running. According to Frey,

The U.S. market will not pay a premium for better performance, TTC's Director of Engineering Hal Rabinowitz said.

wreak havoc. All these transmitters have very quick responding VSWR fold-back protection circuits.

Harris simulates lightning by dis-

they have yet to lose an output device under those tests.

How soon will we see an affordable 20 to 50 kW all solid state FM trans-

mitter? Most of the domestic manufacturers interviewed and quoted in this article believe that cooling methods will have to improve first. Air is not the answer. Fluid cooling techniques are being studied, but not by broadcast companies: Our piece of the technology pie is much too small. The military is doing the bulk of the R&D in this field.

Dick Frey believes that a freon substitute such as glycol flowing in a closed loop heat pump or heat pipe configuration may be a possibility. Beyond that, superconductors will undoubtedly bring substantial improvements in high power solid state technology.

■ ■ ■

Tom McGinley is director of engineering for Cook Inlet Radio Partners, and RW's technical advisor.



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Circle 27 On Reader Service Card

How to Avoid Lightning Strikes

by John "Q" Shepler

Part I

ROCKFORD, Ill. It's a sticky summer afternoon, a typical "dog day." Even the shady areas of the building are uncomfortable. The transmitter room's an inferno.

You'll skip the filter cleaning today in favor of a walk around the guys. The condensation on the pop bottle feels good. You hold it to your cheek as you circle the tower, squinting at the reflections dancing off the bays.

Relief is coming. Those puffy white cumulus clouds are turning darker and becoming more densely packed. Now the wind picks up and shifts directions. Your gaze is drawn from the FM bays to the western horizon, where bright flashes of lightning signal that a storm will soon arrive. It's time to start getting ready.

Most engineers have mixed feelings about summer storms. The same forces that bring refreshment from the heat and humidity can drag you out of bed at 2 a.m. to face a devastated transmitter plant. It's hard to enjoy the sound of rain trickling through the gutters when the control boards are dead, the monitor rack is dark and both transmitters smell like burning insulation.

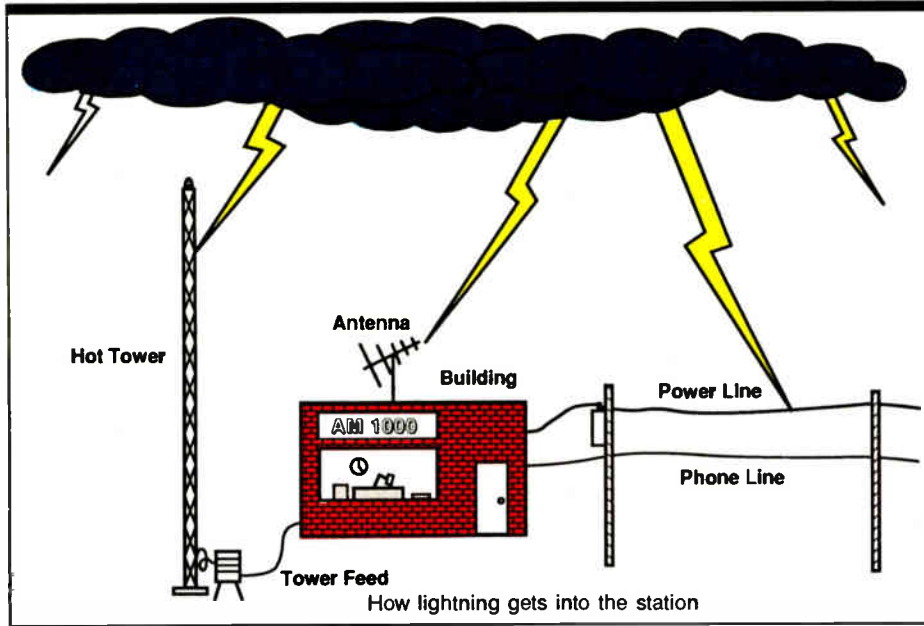
As a broadcaster you're vulnerable. The choices come down to building a

more robust plant or continuing to live the recurring nightmare of lightning damage.

I've fought this battle repeatedly over many years at many stations. If you have one of those stations that is getting clob-

calm and the sun is shining.

Most storm damage to radio stations comes from the lightning, not the wind or rain. Dealing with the brutal winds of hurricanes and tornadoes is another topic entirely, and fortunately a rare



bered every couple of weeks, let me assure you that there is much you can do to gain control of the situation. You can reduce outages from every few days or weeks to every few months—and eventually to only once in years. The time to gain that control is now, while the air is

problem for most stations. It's the electrical discharge of thunderstorms that pops the breakers and blows the chips.

Major electricity

Lightning is major electricity: tens and hundreds of thousands of volts and amperes. We say the station gets "hit" with lightning, but that is rarely the case, expect for tower strikes. You can lose every semiconductor in your station and never find a mark on the building itself. There is so much brute force energy in



a lightning bolt that only a small portion has to find a sneak path into the equipment racks.

Figure 1 shows many avenues for lightning to get into the station. By far the most common paths are down the antenna and through the power lines. Hits to phone lines are also common and provide destruction paths to remote meters, processing gear and control board output amplifiers.

Note that phone and power lines provide a low impedance electrical circuit for many miles. This is why a storm in the next county can take out your high voltage rectifiers when nary a drop of rain has dampened the roof.

Highly sensitive equipment like satellite downconverters and remote pickup receivers are also vulnerable. These installations often are located away from even the protection of the transmitter building.

What is the exact damage mechanism? Generally it's voltage surges. When lightning hits an electrical line, the power within the stroke is looking for the fastest way to get to ground potential. Anything electrical is going to offer some impedance.

Normally, we think of power lines and even phone lines as having pretty good conductivity since they are made of copper wire. However, when 10,000 amps flows through a circuit to ground of even only one ohm, the resultant voltage drop is 10,000 V.

(continued on next page)

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Imperial Transmitter Worldwide

Purchasing Used Transmitters

(continued from page 18)

This includes disconnecting AC power and the antenna feed lines, and separating the cabinets both physically and electrically.

Consider how the transmitter should be shipped. Transmitters should be crated unless shipped by a company that uses its own trucks. Leave the tubes in, but take out loose, heavy iron transformers. Anytime we've received a transmitter that the tubes were removed from for safekeeping, at least one tube arrives broken.

Don't forget all the doors, covers and

books. It was popular in the olden days to have needless doors and hardware. Nine times out of 10, the doors were removed and set aside in the back room and never were on the transmitter. In certain instances these were part of the spurious cabinet radiation shielding, but nonetheless, they're generally not installed and will be forgotten if one isn't careful.

When it gets there

Also, remember to ask for the instruction book and schematic. It is getting harder and more expensive every day to get a book from the factory, and if the model is off-brand or out of business,

you'll be on your own.

On arrival, unload the transmitter and set it in place, assembling the cabinetry and wiring. Sound easy? Not always. If it arrives on a truck that's not equipped with a hydraulic lift, better have a forklift ready. Most professional van lines are equipped to handle the raising and lowering of a transmitter.

Roll the transmitter on steel pipes from the door to the resting place. This is how they built the pyramids and it's a darn good way to move a transmitter. Have one- to two-inch steel pipe cut, some to about eight inches wider than the transmitter being moved and a couple no

longer than the width of any doorway(s) that must be passed through.

Moving a transmitter is about the quickest way to get a hernia that I know of, so have plenty of help on hand.

Fire the unit up in a dummy load, test out the transmitter on the original frequency, make repairs as necessary, then calculate the parts changes required for frequency change. Order parts, receive parts over the next several weeks, retune the transmitter, put the extra doors in the closet and pray the thing holds together. Good luck.

■ ■ ■

Jerry Kautz is the founder of Imperial Transmitter Worldwide. He is an FCC-licensed technician and has built several stations, including his own 100,000 W radio station. Contact him at 308-345-8633, FAX: 308-345-7650, or circle Reader Service 126.

Avoiding Lightning

(continued from previous page)

What's worse, this isn't a nice sine wave or DC power level. Lightning strokes are measured in total durations of milliseconds with high energies even at MHz frequencies. If the circuit had one ohm of DC resistance, the AC impedance to the lightning transient could be tens or hundreds of ohms. This creates even higher voltage drops for the instant of the strike.

Less of a problem

Old timers may recall that lightning damage seemed to be less of a problem decades ago. Are the storms getting worse? No, the circuits are becoming more vulnerable. Because lightning energy is concentrated in a few milliseconds, components that can absorb the shock will survive.

Tubes are relatively resilient; semiconductors are not. Even a few microseconds of voltage spikes above the spec limits can destroy diodes, transistors and integrated circuits. They are not forgiving. Once the crystal lattice is shattered, the semiconductor is destroyed for good.

Transformers and capacitors can have similar damage. In these cases, it's the insulation that is punched through. You may even be able to see pinpoint holes in the insulation of a dismantled transformer. These components are not always destroyed, however. Sometimes they take a zap and go right on working when the line voltage returns to normal.

This can be deceptive. A weakened part that has been stressed repeatedly can look perfectly normal, but can fail suddenly, even some time after the last strike.

In the next installment of this column, we'll look at some easy measures you can take to protect your circuits against damage from voltage spikes on incoming lines. We'll also take a closer look at the other paths where lightning sneaks into the station and talk about how you can effectively block these off, too.

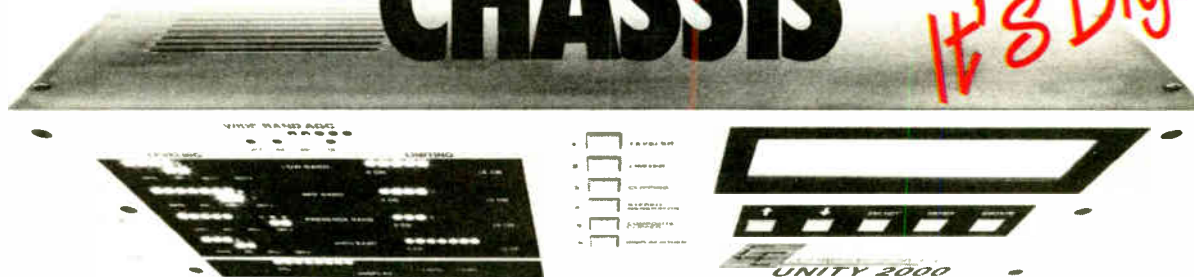
If you're suffering damage *now* and need an immediate fix, do this. Keep an eye out for storms and as they approach, unplug anything not essential. Run the transmitters at low power. Do this before the lightning comes so you don't risk getting hurt from shock. These measures are limited, but they can get you by until real protection can be installed.

■ ■ ■

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

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DAB SCORECARD

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SYSTEM	TYPE OF DAB SERVICE	DESIRED SPECTRUM	AMOUNT NEEDED	MODULATION SCHEME	SOURCE CODING	CHIEF BENEFIT CLAIMED	STATUS
Eureka 147	Broadcast CD-quality	NAB seeks L-band	6 stations in 1.5 MHz	Coded Orthogonal Frequency Division Multiplexing	MUSICAM	Eliminates multipath & interference	NAB endorsed and trying to license
Stanford-Telecom	Broadcast CD-quality	L-band	12 stations in 4 MHz	Dynamic Single Channel Per Carrier	Dolby AC-2	Eliminates multipath	Testing slated for 4th Q. 1991. Interest by Sat. CD Radio
Satellite CD Radio	Broadcast CD quality	L-band & MSS	32 MHz	(Stanford-Telecom's) Dynamic Single Channel Per Carrier	Dolby AC-2	Wide coverage area; remote area reach	Modified petition to FCC asking to build & launch satellite
RadioSat Corp.	Broadcast & subscriber, not necessarily CD-quality (flexible)	MSS	32 MHz	Quadrature Phase Shift Keying	unknown	Early launch date; low-cost very small portable receivers	Satellite launch planned for 1994
Gannett-Stanford Research (Acorn)	Broadcast CD-quality for FM, 15 kHz stereo for AM	Current FM & AM bands	200 kHz for FM 40 kHz for AM	Coded Polyvector Digital Modulation	MUSICAM	No new spectrum needed; working on AM system	Prototype FM was shown at NAB '91 in 1st adjacent; Working on mobile demo; AM in development
Kintel	Broadcast CD-quality	Current FM band	200 kHz	Power Multiplexing	unknown	No new spectrum needed	Still in planning stage
Mercury Digital	Broadcast CD-quality	Current FM band	200 kHz	Multi-Frequency Modulation	none	No new spectrum needed	Still in planning stage
American Digital Radio	Broadcast CD-quality	Current FM band & unused TV	400 kHz	Time Interleaving Shared Spectrum Spreading	ASPEC	No new spectrum needed; allows for a tiered phase-in	Still in planning stage
Synetcom	Broadcast CD-quality	Current FM & AM bands &	FM: subcarrier; AM: unknown	FM-S with Adaptive Excision of interference	unknown	Uses existing sub-carriers; "nulls" interference	Still in planning stage
Lincom	Broadcast CD-quality for FM; Voice-grade for AM	Current FM & AM bands unused UHF TV	FM: 200 kHz AM: 64 kHz (32 KBPS)	Binary Frequency Shift Keying	unknown	Uses existing sub-carriers; flexible quality for non-music	Still in planning stage

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Bill Gordon

It's tough comparing apples to oranges, but the radio industry needs some way to evaluate the DAB systems currently being proposed—thus, this DAB Scorecard.

So far eight systems have emerged, with many of them still on the drawing board and only two—Eureka and USA Digital—having had any actual demonstrations.

Note that in the scorecard the extended band systems requiring new spectrum are listed first with the in-band systems toward the bottom. Eureka 147 and Stanford Telecom were systems originally developed for satellite DAB.

But the NAB's endorsement of Eureka 147 means it is now mainly under consideration in the U.S. for terrestrial use. Stanford Telecom's system, favored by Satellite CD Radio, can be used for both satellite and terrestrial DAB as well.

There are two parts to any DAB system: modulation scheme and source coding, better known as compression algorithms. Some DAB system proponents have not chosen a source coding scheme as of this date.

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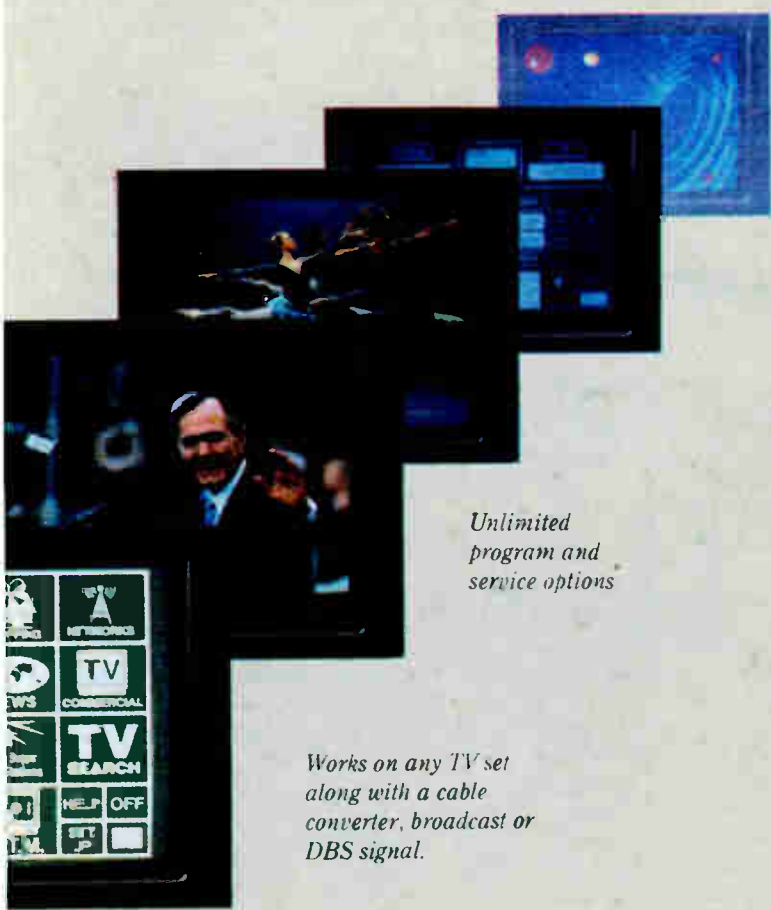
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Nashville AM Keeps the Beat

by George Riggins

LONG BEACH, Calif. Recently, my wife Helen and I spent an enjoyable half day touring the facilities at WSM-AM/FM in Nashville, Tenn.

Studio Engineering Supervisor George Stephenson showed us everything from the front desk to the darkest recesses of the back closet where signals go off into the nether world on their way to the AM or FM transmitter. Both signals go by way of STL rather than by wire.



To complicate matters, there are several off-premises studios that must be maintained. The studios are scattered over the expanse of the Grand Ole Opry Theme Park and Hotel and in downtown Nashville. All but one studio is capable of doing air duty for either AM or FM programming. The one exception to the standard interconnect theory is a small but fully equipped production studio.

The isolated production studio is kept on the outside looking in. There is no way to get a signal into the studio other than

taking it in on tape, record or CD. Anything taken out must be on tape.

New thoughts and techniques

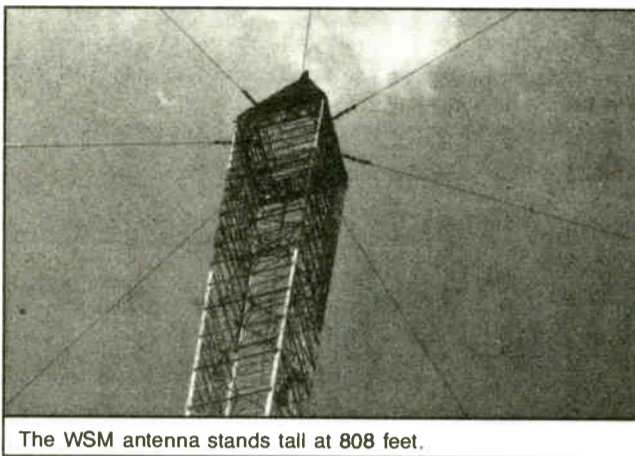
This allows new thoughts and techniques to be tried with no possibility of the signal accidentally getting on the air, while giving the person or persons uninterrupted use of a facility. George reports that the facility is much appreciated by all of the production and air staff.

WSM maintains two studios nearby, one at the Grand Ole Opry Park entrance and the other in the adjacent Opryland Hotel. The latter is used for the AM programming, except when the park is open to the public. During normal Opryland hours the studio at the park entrance is used as a showcase for the public. This showcase studio allows interaction with the crowd on the outside via microphones and monitor speakers.

One of the design problems with the Theme Park Studio was lighting and reflections from the windows on the curved window wall. George says that several glass angles and lighting combinations were tried before a design was developed that allowed the inside operator

to see what and who was on the outside, and for those on the outside looking in to be able to see what was happening.

One of the features of the Opryland Hotel studio is the very complete telephone system for interviews and panel discussions. On several occasions, interviews



The WSM antenna stands tall at 808 feet.

have been conducted with panel members located as far away as the West Coast. Incoming calls are selected in Nashville, fed to the panel, and the final audio mix is done in Nashville.

Want to know more? Call George in Nashville at 615-889-6595 for the technical details.

My main reason for visiting the WSM facilities was to get a first-hand look at the AM antenna. Yes, it is a monster. The base insulator is stressed for four million pounds of vertical thrust and the antenna weighs about two million pounds. That's a lot of weight to be placed on a piece of fired vitreous material.

Looking up

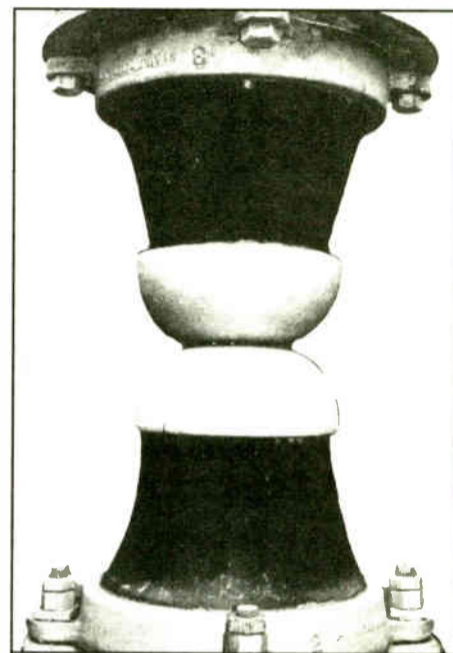
Standing at the base of the antenna and looking up, one must bend over backwards just a little to see the "bustle" (38 feet across each face) at the middle of the structure. A total of eight guy wires hold the tower at mid point.

Total height of the antenna as originally

installed was 878 feet. Interestingly, the original spike from the top is now a flag-pole in front of a nearby school. The original spike was replaced by the first FM antenna used by WSM-FM. (The antenna is still in place, but no longer is in use.)

The total height of the WSM antenna at present is 808 feet. The beacon is set at 758 feet with the "old" FM antenna adding the other 50 feet.

An interesting souvenir of our visit was a reprint of a presentation done by Mr. J. W. Dewitt, Jr. former CE at WSM, presented to the Tennessee Academy of Science on Nov. 24, 1932. The paper was one of the first studies on the use of the 5/8 wave vertical radiator presented to the young broadcast industry.



WSM's base insulator is stressed for four million pounds of vertical thrust.

A study of the inverted L antenna, the 1/4 wave vertical and the 5/8 vertical was reported with field measurements of the received signals of the three antenna systems. The graphed distances for received signal strength of both ground wave and skywave signals is most revealing. The 1/4 wave and the 5/8 wave antenna were measured out to the same distance, but

(continued on page 34)

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Circle 116 On Reader Service Card

WWWE Relives Deja Vu—Again

by Dee McVicker

CLEVELAND The more things change in radio, the more they stay the same. Case in point: the recent and not-so-recent events at WWWE-AM.

WWWE-AM of Cleveland is owned by Booth American Co. Last year, the 50 kW clear channel was owned by Independent Group Ltd. This change in ownership coincided with a change of ownership at Cleveland's WRMR-AM, a 10 kW that was owned by Booth American last year and is now owned by Independent Group. WWWE, of course, swapped owners. And, it wasn't the first time.

In fact, the station—as well as Cleveland radio in general—has had more than its share of *deja vu*, according to Ted Alexander, who recently traded in his duties as CE at WWWE for those at WRMR. It's amazing, he commented, how "things have gone around and around in circles," including ownerships, personnel and even buildings.

The first time

The first station exchange involving WWWE took place in 1957. In that year, Alexander said, NBC-owned WWWE was traded for Westinghouse's Philadelphia AM—a deal that was never quite cemented in the eyes of the Commission.

Then, in 1978, Ohio Broadcasting exchanged WWWE for a local 5 kW AM. Ironically, one of the partners of Ohio Broadcasting was the uncle of a gentleman who would eventually help found Independent Group. Twelve years later, on June 25, 1990, WWWE-AM would be at the bargaining table again—this time swapped for WRMR-AM by Independent Group.

Ted Alexander clearly recalls both events. In addition to engineering, he does a mid-day show for Independent's WDOK-FM, as well as voice work nationwide. He has

spent most of his radio career in Cleveland and has chiefted four of the six major AMs in the market—sometimes twice. In fact, he had two stints with WWWE, one between 1975 and 1977 when Ohio Communications owned the 50 kW and again from 1987 until midnight on June 25, 1990, when Independent Group relinquished ownership of WWWE-AM and acquired WRMR-AM.

OFFBEAT RADIO

What's more, it's not the first time Alexander had engineered WRMR. When Booth American Co.—the very same that recently traded WRMR-AM for WWWE-AM—purchased WRMR in 1985, Alexander decided to join WRMR's staff as an engineer. Previously, he had been engineering WMJI-FM, which had been WWWE-AM's sister FM some 10 years back.

There's more. Several months after the 1990 WRMR/WWWE swap, Alexander went in search of a new studio for Independent Group's newly traded WRMR. Even before the trade, Alexander was keeping a hopeful eye open for a new studio. Independent's studio on 1250 Superior St., which supplied WWWE's transmission feed prior to the swap and then fed WRMR's feed after the swap, was leased. The group wanted to own its own studios.

Radio Lane empty

Meanwhile, Booth American's studio facility on Radio Lane, which had housed WRMR's studios before the swap, was unoccupied. Booth American had set up a temporary studio for its newly traded WWWE until its new facility was completed on Ninth Street.

In what is perhaps the most ironic twist

of fate yet, Independent Group purchased the building on Radio Lane. More to the point, Independent moved its newly traded WRMR-AM into the very same building that WRMR-AM had occupied while under the ownership of Booth American just seven months earlier.

Then, there's the WWWE tower. According to Alexander, the tower was built in the late 1930s for WWWE—at that time known as WTAM. The station ran on the tower with a 1920s vintage transmitter until 1957. It was in this year, said Alexander, that the NBC-owned WWWE was swapped for what was most probably the first time.

Shortly after Westinghouse traded its Philadelphia station for the Cleveland 50 kW, it promptly moved WWWE's signal to a Franklin tower elsewhere in Ohio. But, true to the adage that the more things change in radio the more they stay the same, NBC ended up with WWWE again some eight years later when the Commission unraveled the NBC/Westinghouse deal.

In the early 1970s, when NBC sold the station to local owners Ohio Communications, the WWWE signal was promptly moved back to its original tower—13 years after its departure.

Today, WWWE continues to live at its original tower, along with 15 two-way services, an FM and a UHF TV channel, Alexander said. Even WRMR-AM's signal makes a stop at the old, 1930s-era tower. "The (STL) microwave backup we use for WRMR goes out to the WWWE transmitter and then is taken on phone line over to the WRMR transmitter," Alexander pointed out.

This wouldn't be the only link between the two stations. When WRMR-AM and WWWE-AM swapped owners at midnight on June 25, 1990, it was at that precise moment that WWWE began its CBS news affiliation and WRMR ended its

CBS news affiliation.

Alexander, a witness to Cleveland radio's buying and selling frenzy of the late 1970s and early 1980s, was hardly surprised. Nor was he shocked when, ordering a QEI CAT-Link for the WRMR/WWWE swap, he heard a voice familiar to the Cleveland market on the other end of the phone line. It was Jeff Detweiler, who once engineered WWWE-AM but now works for QEI ...

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

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WORKBENCH

Summer Remote Maladies

by John Bisset

FAIRFAX, Va. We've all experienced the mad search for a fuse. More often than not, it's a critical piece of gear we're trying to resurrect and the fuse is always the one value we don't have on hand.

Ben Umberger, CE for WHBO/WNLT in Tampa, Fla., offers the ideal solution.

In Ben's case, he would occasionally lose a fuse on one of his cart machines. Being awakened from sleep to change a fuse so the machine would be functional for the morning show got a little old, so Ben bought a supply of fuses in the little metal and plastic case and attached the case to the back of the cart machine turret with Velcro.

Not only are the fuses readily available, he can depend on a jock to change the blown fuse, and by affixing the Velcro to the metal side of the box, it's easy to check inventory by looking at the clear half of the box and counting the fuses left. Perhaps the best part is the extra sleep this little tip affords. Ben Umberger can be reached at 813-446-0957.

The cries of pain can be heard nationwide as the summer remote season kicks into high gear. Tim Hawks of RF Specialties in Texas reminds stations to check their RPU connectors.

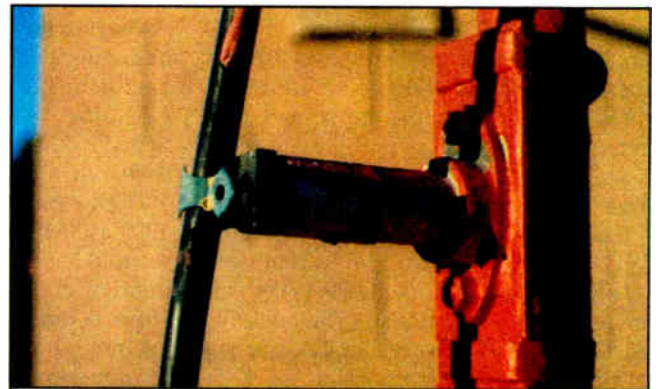
Operating efficiency is greatly reduced when water contaminates these connectors. Although black plastic electrical tape will work, don't be stingy—use plenty. Even better is the black waterproofing "putty" that forms a waterproof seal around most any kind of fitting.

If your connector problems are a little higher up the band, RF Specialties has a technical program diskette available. This diskette has a very useful program that will analyze the complete STL system for losses. For information on this free applications diskette, contact your local RF

Specialties sales office.

Remotes bring with them other ills, like plenty of snaking cables. Larry Albert is vying for the title "King of Remotes Done Cheaply." You may recall Larry's tip about using WD-40 to remove the sticky goo from cables that have been held in place with duct tape.

Larry's latest suggestion is just as unique (and as inexpensive). Next remote, take along a few C-clamps. Use them to prevent doors from closing on cables. Larry suggests using pads made of scrap wood or carpet pieces to prevent marring a client's door. Attach the C-Clamp only to metal or wood—never glass—and locate it high enough so as not to snag people or their clothes.



Missing hardware, cracked insulators, and peeling paint should be noted and corrected during a quarterly tower inspection.

Before taking your C-clamps on their first remote, paint them a bright color and mark your call letters on them. The identification is for obvious reasons, but the bright color will help others see why the door doesn't close, as well as making it harder for talent to overlook when packing up. Larry Albert is the TV Engineer for Murray State University in Murray, Ken. He can be reached at 502-762-4664.

Speaking of doing things cheaply, there must be 50 different ways to identify cables, but most of them cost money. If you've ever pulled a triple deck machine for maintenance, and then lost your mind trying to get the right cable in the right connector, help is on the way. First, for the audio connectors, grab your Sharpie marking pen. This indelible marker comes in broad, medium and fine points.

The fine point is great for marking "CART 1—LEFT" on an XLR. If your cables are already labeled with numbers or letters, duplicate this identification on the connector with the Sharpie marking pen. But until the Sharpie comes in white ink, you're still stuck with labeling the black Remote Connector—or are you? Grab your soldering iron and slip in an old tip. Then melt the cart designation into the shell by writing with the soldering iron

(continued on page 37)

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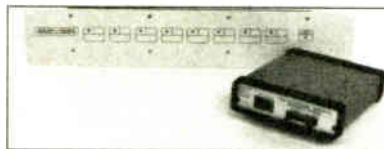
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Clarification

In Figure 3 of the June 26 Workbench, 16.6 μ should have been 16.6 Ω , in each case.

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"How to Find a Big Paying Radio Job"

by Barry Mishkind

TUCSON, Ariz. A few weeks ago I found myself in a radio station in Hilo, Hawaii. My attention was initially attracted by the satellite dish out in front of the studio. Due to the western location, the dish was almost exactly perpendicular to the ground.

ECLECTIC ENGINEER

Talking to some of the staffers, I found out that that's not the only challenge for the station engineer. Although the island is only about 40 by 30 miles, suitable FM transmission sites are difficult to come by, due to an observatory on the highest peak.

If that isn't enough, one engineer told me of a state law on radiation that makes antenna sites nearly impossible to locate anywhere there are people. Oddly, most stations need people around in order to have an audience.

AM propagation wasn't a lot better, due to the lava rock formations. Even ground systems in the water have a hard time covering the island. I noticed this while driving around; sometimes it was easier to hear stations from other islands than one much closer.

Parts acquisition also is a bit more complex than on the mainland, as is shipping in equipment. Time and costs multiply to bust budgets. I saw a lot of technical talent down there, as the engineers struggled to improvise to keep stations going.

Myriad of duties

While reflecting on this necessary sort of effort, I began to consider the myriad of "additional" duties and problems that sur-

round a small to medium market engineer.

In those places where stations often struggle just to survive, technical budgets are, of necessity, smaller. So, equipment must be made to last, sometimes longer than the manufacturer expected.

It's not uncommon to meet some of these engineers who have all sorts of "tips" and "tricks" filed away in their memory to keep those old transmitters cooking. You just can't get that kind of knowledge at the local TV repair shop.

When going to the transmitter, few stations provide a second person for safety backup. Sometimes, even monitor point readings can expose the engineer to danger. Also, few small and medium market engineers get through an average week without a request to clean the air filters on the air conditioning system, mow the grass at the transmitter site or help someone with a computer problem.

Or, let's have a show of hands: How many of you have recently changed the ribbon on the news wire because the news staff either couldn't or wouldn't do it themselves? Or put toner in the copy machine?

True, to some extent, we engineers bring it upon ourselves. We come to work in jeans. So the GM thinks it's natural to assign the grubby work to us.

Some engineers have fought the image issue by coming to work in dressier clothes, having coveralls in the office for the messier jobs. Some GMs have cooperated by hiring part-time help for the "domestic" needs. However, this is the exceptional case.

With such a work environment waiting, no wonder there is no crowd of young engineers beating down the doors to enter the broadcast profession. Indeed, if you open the door and look out, there's often just an empty doorway.

Opportunities galore

While recently browsing through a magazine, I found an advertisement. The screaming headline jumped out at me: "I will train you at home to fill a Big Pay Radio Job!"

With all the discussion about the changes in the industry, deregulation and the rise of contract engineers, you can imagine I was very interested in the pitch. So I read on.

The next page spoke further about "Big Pay Jobs now open for every radio trained man." Further information indicated these "hands on" courses would lead to radio and television jobs paying up to \$200 a week.

This seemed like a good deal. Being able to "get in on the ground floor" might just be the ticket to a nice career in broadcasting. Perhaps here was the training ground many are seeking.

All right now, you top 10 market people. Stop it with the smirking. This is a no smirking zone!

The point is that there are hundreds of radio engineers out there, right now, making \$200 a week or less. And many of these pull an air shift in addition to their technical duties.

These are radio engineers capable of diagnosing and quickly repairing the things that put radio stations off the air, so the

(continued on page 37)

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Circle 17 On Reader Service Card

Data 'Til the Cows Come Home

by Harold Hallikainen

SAN LUIS OBISPO, Calif. Bill Sepmeier of the National Supervisory Network and I have been exchanging a lot of electronic mail. We're running anywhere between 10K and 20K each way a week.

We recently considered an interesting approach to broadcast interference protection. A summary is presented here for discussion.

The basic purpose of all the technical regulation we deal with is interference protection. The allocations system, power limits, DA limits, modulation limits and occupied bandwidth limits are supposed to guarantee you and your neighbors a certain coverage area with a certain desired to undesired signal ratio.

INSIGHT ON RULES

In the past few years, the FCC has brought up the idea of negotiated interference, where one station might accept more interference from another station for some consideration (money). I don't know whether the FCC has allowed any station to accept more interference (over the existing limits), but I think some stations may have been bought out and shut down, which is similar.

The county recorder

From this point, we might consider the FCC to be the "county recorder" of frequency use. The Commission oversees who has what right to what frequency, yet does nothing to enforce the frequencies. The local county recorder does not come and arrest you for walking across someone's land. Enforcement could possibly be left to civil suits.

If someone is causing interference (radiating above authorized field strength or beyond authorized bandwidth), the one receiving the interference could sue for damages. Damages would probably be based on lost revenue due to lost audience share over the interference area. How much interference is actually caused by operating 10 percent over power? How much audience will the "interferee" lose?

There also is the problem of the FCC having a very vague definition as to what constitutes overmodulation (they have said that monitors meeting rules that have been deleted are acceptable, possibly implying that deleted rules are still in effect). I wonder if the stations receiving interference from overmodulating stations could bring a civil suit.

It appears that interference has been considered an "injury to society" instead of an "injury to an individual," making it the subject of criminal (or administrative) instead of civil cases. If an individual can show injury due to interference, perhaps a civil suit can also be brought. If this were done, it might encourage more station licensees to "stay on their own property" by staying within FCC tolerances on station operation.

It might be argued that vigorous enforcement of the rules by the FCC is a preferable method of preventing interference as opposed to waiting for it to happen, then starting a civil suit. We get safer highways by having the Highway Patrol

cite those who exceed the speed limit instead of waiting for an injured person (or that person's estate) to sue for damages. Your comments?

Send in the cows

After spending weeks driving around gathering field strength measurements for DA proofs, I thought it would be great to hook up a Loran receiver, a field strength meter and a data recorder, and strap the whole assembly to a cow. We'd find the cow a week later, download the data and have a complete DA proof!

This could perhaps be adapted to pro-

vide continuous monitoring of field strengths and occupied bandwidth for all stations in the vicinity by adding a data radio link. Bill has suggested equipping the cow with a VSAT link. This would allow a daily download of all the field data for analysis. Hmm . . .

A friend last night proudly showed me her new "touch dimmer" on a bedroom lamp. Right next to the lamp is a table radio. The radio was set to FM. I tried flipping it to AM. No matter how the lamp was set (other than unplugging it), AM was not listenable due to the noise generated by the light dimmer. The light dim-

mer has no FCC Part 15 warning regarding radiation. Many people just assume there is nothing on AM but hum. Have we given up on this band?

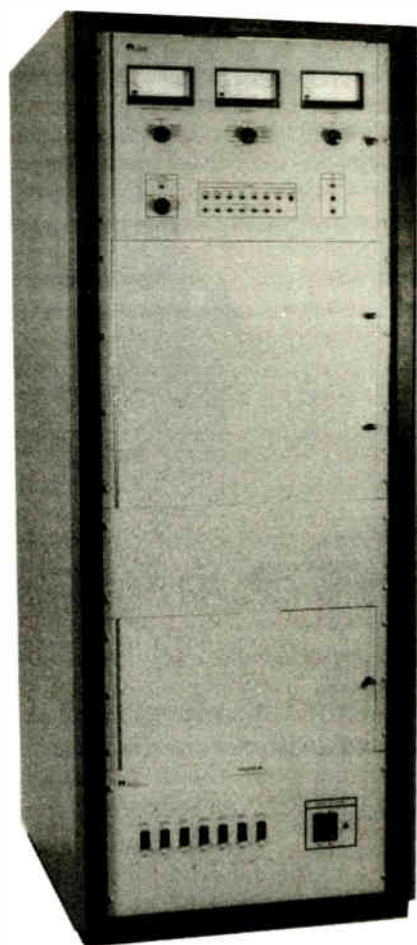
FCC violation notices

Thanks to those stations and individuals that have called or written with their questions and opinions on FCC technical regulations. I'd be especially interested in seeing copies of any recent FCC violation notices and related correspondence.

I have been gathering this information
(continued on page 34)



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FCC Clarifies Class A Upgrades

by Lex Felker

WASHINGTON A couple of years ago, the FCC instituted two changes to its rules, both intending to improve the financial lot of Class A FM licensees and enhance service to listeners.

First, a new intermediate class of FM facilities (Class C-3) was created for region 2, to which many Class A allotments could be upgraded. In addition, the agency increased the Class A radiated power limit from 3 kW to 6 kW.

The new rules are relatively complex, especially those that specify the conditions

under which 3 kW Class A stations can upgrade to higher powers. In a recent order, the FCC has refined, clarified—and, in at least one instance, relaxed—certain of these regulations in the hope of further aiding Class A licensees and their listeners.

Reconsideration petitions

A variety of requests for clarification or reconsideration of the Class A power upgrade rules, and comments regarding such, were submitted to the Commission. Some parties urged the Commission to further alter its rules to give Class A licensees greater freedom to increase powers.

Others recommended that the FCC maintain and even strengthen its rules to ensure that FM service is not degraded.

In its reconsideration order, the Commission addressed several specific issues raised by commenters and clarified and otherwise refined several of its Class A power increase policies. Three changes in

processing power increase requests from Class A licensees, the FCC also has elected to modify its procedures and permit mutually short-spaced Class A stations to stagger the timing of their power increases.

Rules would handicap

These changes were made because of realization that in cases where these power increases could not be effected simultaneously (because of financial or practical factors affecting only one of the stations), the rules would handicap those stations electing to increase power at a later date.

Under the new policy, a short-spaced station may unilaterally increase power to something less than 6 kW (or its equivalent), and may complete its upgrade at the time the station to which it is short spaced upgrades its facility.

Finally, the Commission expanded its definition of grandfathered short-spaced Class A stations to include all short-spaced stations authorized prior to the effective date of the 6 kW rules. This change will give this category of FM station licensee more flexibility to increase power.

The Commission addressed these and a variety of other issues with the goal of ensuring that listeners continue to experience high quality, interference-free, FM reception.

From my perspective, the agency has done a fine job in taking a good idea—a Class A power increase—and making it better by giving more licensees an opportunity to take advantage of the rule change.

Lex Felker is VP/Technology, Time Warner Telecommunications and is a former chief of the FCC's Mass Media Bureau.

FELKER'S FORUM

particular could provide opportunities for some stations to increase power that might not otherwise have been possible.

In cases involving requests to employ short-spaced transmitter sites, the Commission historically has required a showing that alternative fully spaced or less short-spaced sites are not available. Consequently, such a showing is required of short-spaced Class A stations wishing to increase power.

On reconsideration, however, the Commission reasoned that nearly every Class A station wishes to upgrade its facilities at its existing transmitter site and relocation is simply not cost-effective in most situations. Accordingly, it has modified its rules to no longer require an "alternative site" showing from short-spaced Class A stations. Consent from all potentially affected licensees still is required, however.

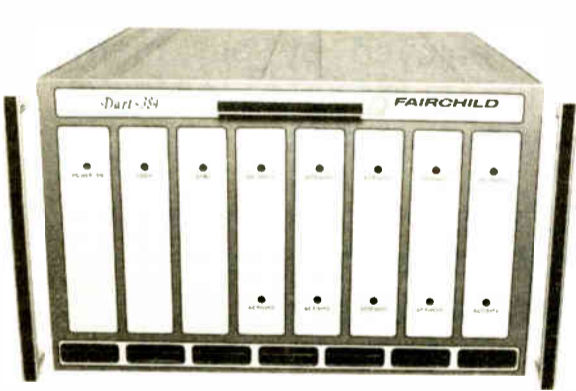
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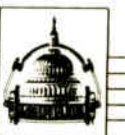
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Circle 121 On Reader Service Card

Refining Digital I/Os

by Mel Lambert

STUDIO CITY, Calif. As I have pointed out on more than one occasion, a truly versatile interface should allow digital systems from different manufacturers to exchange digital and other data as transparently as possible, over the typical distances encountered within today's on-air and production environments.

Of the various digital I/O configurations found on broadcast and recording hardware, there can be no denying that, with a few important reservations, the AES/EBU format has proved the most reliable for the majority of users. But there are several operational areas in which it has been acknowledged that the original AES3-1985 standard might be improved.

DIGITAL DOMAIN

This is exactly what the AES Working Group on Digital Input/Output Interfacing has recognized. Under its chairman, Robert Finger of Matsushita Electric Corp., the group has released a new draft for publication within the "Journal of The Audio Engineering Society."

After a six-month period for comment and industry feedback, the document will be ratified as the new AES3-199X two-channel interface standard. (The "199X" designation will become either 1991 or 1992, depending upon the year of its formal publication.)

As the draft says in its foreword, "The revision is designed to . . . simplify and clarify language, improve electrical performance, minimize confusion with IEC 958 'consumer use' specifications, allocate certain previously reserved bits to new applications and improve compatibility by improving uniformity of transmitter implementation in regards to validity, use, channel status and parity bits."

As with all developments, these new revisions should be seen as an extension, rather than a criticism of the original AES standard. In the six years since its drafting and ratification, the AES format has greatly simplified the often confusing and frustrating practice of connecting two channels of digital audio between two different devices.

However, during that time we have expanded our expectations of what a truly versatile interface should achieve—including the transmission of increasing amounts of non-audio data. It hardly is surprising, therefore, that our industry continues to push the outside of the digital I/O envelope, with the result that upgrades and enhancements become a natural and inevitable way of life.

And let's not forget that the new AES3-199X two-channel interface standard isn't a completely new format; it is intended to enhance and not replace the existing configurations. In many respects, the new standard really is a clarification of the original proposal, with clearer definitions of technical terms and tighter specifications of important parameters.

Of course, few broadcasters will need to concern themselves with the intricate details of each bit being carried across a correctly implemented AES3-format digital interface—as long as it works consistently and reliably.

In essence, the new AES3-199X standard provides more specific definitions of 16-, 20- and 24-bit data transfers, along with techniques for utilizing unassigned bits for auxiliary data (and even a voice-grade cueing or coordination channel). Also stereo, mono and primary/secondary transmissions are re-defined to allow mixed use of the interface.

With synchronization of digital equipment becoming such a hot topic of discussion during recent months, various data within the I/O format's Channel Status area have now been defined to signify the stability of the source's sampling/clock frequency—Grade 1, 2 or "unspecified." These designations will allow following equipment to identify a master source for sync purposes.

Other bits within the Channel Status will comprise a special alphanumeric data channel that can be used to label the source of a digital transmission.

Also available within the Channel Status area are bytes that can be used to carry a time-of-day sample address code, which would be laid down during the recording stages and remain unchanged during subsequent operations. Such data might be used to identify the stop/start times of various digital sources, and for other cueing or identification purposes.

There is one major area in which the new I/O format has moved forward in a dramatic way. Now, three Levels of Interface Implementation have been defined, which will indicate to receiving units the exact nature of important data being carried across the digital port. Definitions of "Minimum," "Standard" and "Enhanced Implementation" designate a base set of information that must be carried within the bitstream, and which will remove a great deal of ambiguity from current interfaces.

Another region of potential confusion lies in the types of cable that should be used for AES/EBU connections. The

(continued on page 34)

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Nashville AM Keeps the Beat

(continued from page 26)

the 5/8 wave antenna exhibited a stronger groundwave signal at all measurement distances. The maximum distance at which measurements were taken was 200 miles.

Low angle benefits

The conclusion was that the low angle of maximum radiation would be most beneficial for a station seeking national coverage. The area of fading caused by the reception of out-of-phase groundwave and skywave reception being further from the station was attributed to the fact that the minor lobe of skywave at an angle of about 58 degrees was much weaker than

the main energy lobe that was radiated along the ground.

The point of skywave and groundwave reception causing fading for the inverted "L" antenna was given as being about 35 miles to 40 miles from the antenna. The 1/4 wave antenna interference point starts at about the same distance and has almost the same fade characteristics as the "L." The 5/8 wave antenna is shown to push the minor fade distance out to about twice the distance, indicating that the day time coverage area would be greatly increased.

There are at least two more installations of this type of antenna in the U.S. The most famous is WLW in Cincinnati, Ohio.

Another installation is at WBT in Charlotte, N.C. The WBT installation is a three-tower array with towers of about 400 feet. The tower face size is given as 20 feet. There was one installation in Europe that was larger and taller than the WSM tower, but it did not survive World War II. So far, no technical data is available for the European installation.

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

Send in The Cows

(continued from page 31)

through Freedom of Information Act requests with the FCC, but the process is slow. I also have access to proposed rules in the Federal Register. FCC Reports and the FCC Record also are locally available, but they show only cases that get appealed to the full Commission. These seem primarily to be obscenity cases.

Reviewing the information I have received, it appears that sometimes the FCC inspector cites a station for violation of a rule section that does not really even exist.

For example, a station was cited for not being able to adjust the transmitter power by remote control (section 73.1410(a) was cited). The rule requiring this capability, however, was deleted in the "reregulation" of remote control. If a station can keep its power within limits without giving the operator control over this function, it appears there was no rule violation. If the station had been operating outside authorized power limits, it should have been cited for that. It wasn't.

So, it would be interesting to see how the FCC interprets the rules during today's inspections. Any examples you can give would be appreciated.

Harold Hallikainen is president of Hallikainen and Friends and teaches electronics at Cuesta College, San Luis Obispo. He can be reached at 805-541-0200. He can also be reached on Internet at ap621@cleveland.freenet.edu or hhallika@pan.calpoly.edu.

Digital I/O

(continued from page 33)

previous standard specified a balanced output impedance of 100 ohms and an input impedance of 250 ohms (to allow a 4:1 fanout between a single transmitter and multiple receivers); the new proposal calls for matching 110 ohm impedances over the operating frequency range of 100 kHz to 6 MHz, and single transmitter/receiver configurations.

And while many users of digital equipment have suggested a move from three-pin, male/female XLR-type connectors to video-style BNCs and 75-ohm source and terminating loads—or even fiber optics—the new format retains the original XLR proposal.

While I can recognize arguments from both sides, I agree with the working group's decision to retain the previously specified connectors and balanced cable. Good-quality, 110-ohm, twisted-pair cable is available from several suppliers—such as Belden 9271—and should be used in preference to conventional audio cable.

These new proposals contained within AES3-199X will only help simplify the interfacing of digital equipment for a great number of broadcasters.

Mel Lambert is principal of Media&Marketing, a consulting service for the professional audio industry. He can be reached at 818-753-9510.

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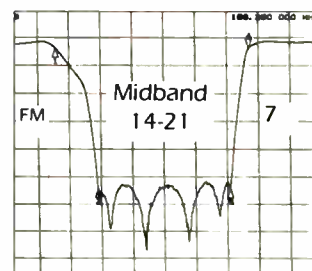
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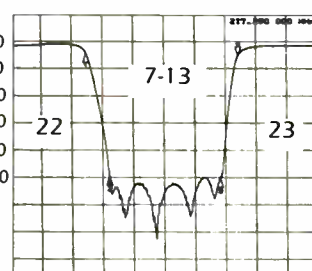
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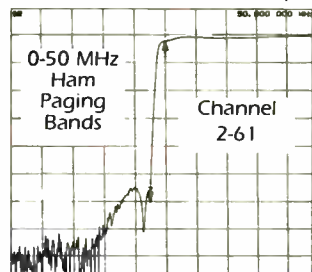
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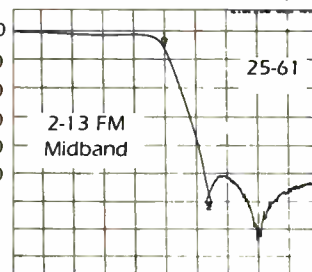
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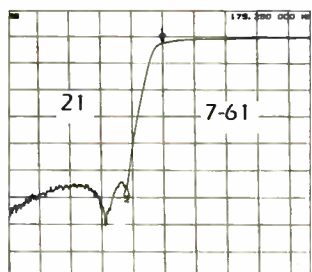
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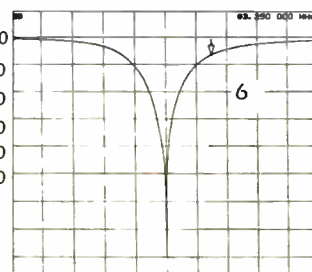
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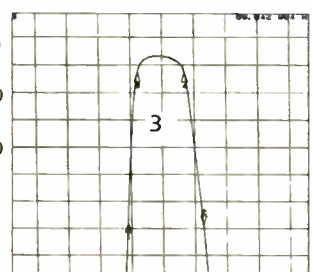
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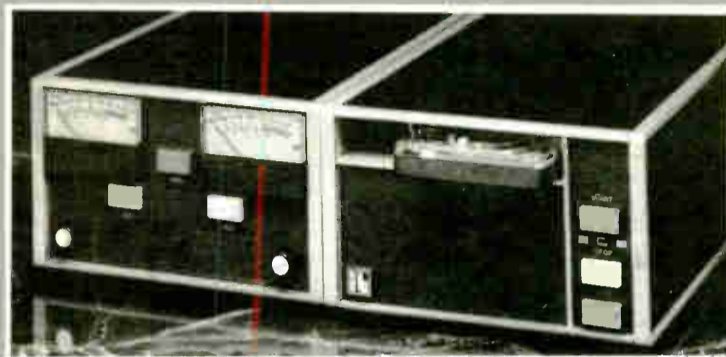
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A Line on Audio Nightmares

by Bruce Bartlett

ELKHART, Ind. These true stories will make me look like a dunce. But we've all been there—made mistakes that could have been prevented.

I hope you can benefit from my hindsight and avoid some audio traumas of your own. Most of these stories are from my experiences as a recording engineer, but they also apply to remote broadcasts.

At my first professional recording gig, for example, I was taping a high school choral concert in stereo with two microphones mounted high up on stands. At

the intermission, a choral member tripped over a mic stand and sent the microphone crashing to the floor. I recorded the rest of the concert in mono.

LINE OUT

The moral: Take along spare mics. Tape down stands and cables that are in vulnerable positions. And warn the performers to watch out for the mic stands.

Another horrible experience was the time I recorded a spot for a client. The

recording was done live to a two-track recorder. He was delighted until he heard the playback: Nothing but distortion. The cause? A loose circuit card in the recorder. I had to scramble to find a working machine and re-record the spot, red-faced.

The moral

The moral: Check equipment before the client arrives. Don't assume that it will work reliably just because it has in the past.

At a newly built recording studio, I installed some quality monitor speakers, thinking that they would provide accurate monitoring. Although the mixes sounded great in the control room, they were bassy and muddy when played on almost any other system, such as a home stereo or a radio.

The control room was built by someone who cared more about saving money than doing things right. The walls were thin wood paneling on studs. This is a good way to make a bass trap. The vibrating walls soaked up low-frequency energy from the monitors, making them sound weak in the bass. I compensated by boosting the lows on the mixing console, which made every recording boomy.

The moral: Read a book or two on studio acoustics before building a studio. Or use near-field monitors. Or equalize the monitor speakers to sound like good headphones.

One Spring evening I was running the sound reinforcement system for a bluegrass festival. Everything was going fine until the last group got on stage. Several singers leaned into the mics at unpredictable times and yelled, distorting the mic preamps and risking tweeter burn-out.

The moral: Carry a compressor/limiter to handle unexpected level changes.

No licks

At a rehearsal for a rock concert, I was making a multitrack recording by patching into various busses from the house reinforcement console. Buss one contained bass; I patched it to track one. Buss two contained lead guitar; I patched it to track two, and so on. But when the concert started, the lead guitar signal was missing. The house engineer had re-routed the guitar to another buss without telling me.

The moral: When working with another engineer, agree to inform each other about any changes in signal routing (or grounding).

One evening I was hired to record a celebrity speaking at a lectern. I put a mic on a boom stand about eight inches from the speaker's mouth. That worked fine—until the speaker wandered off-mic. I had to re-record the tape, riding gain whenever the speaker walked around. But he still sounded close and distant. And whenever the speaker wanted to make a point, he leaned into the mic and popped it.

The moral: Don't assume that people know how to use microphones. Bring along a lavalier mic and a pop filter.

Later on I recorded another speaker at the lectern. During the tape-editing session a week later, she wanted to correct some stuttered lines by re-recording and splicing them in. But the original recording had reverb from the hall and the

Recording Reminders

Find yourself doing more remotes and recorded spots for your station? You can prevent unnecessary headaches and costly re-recordings if you follow these simple pointers:

- ✓ When recording remotes, take along spare mics. Tape down mic stands and cables.
- ✓ Carry a compressor/limiter on remotes to handle unexpected level changes.
- ✓ Make sure all engineers on a project inform each other about any changes in signal routing or grounding.
- ✓ Don't assume that people know how to use microphones. Bring along a lavalier mic and a pop filter to remotes.
- ✓ If you find you have to re-record segments of a remote, try to do it on the same day in the same place.
- ✓ Carry a microphone pad to prevent input overload distortion. Keep a variety of problem-solving circuits and adapters on hand in case of emergencies.
- ✓ When recording directly to DAT, set the DAT tape's write-protect tab immediately after recording. And make a safety copy.
- ✓ When recording spots, check all equipment before the client arrives.
- ✓ Make sure you understand room acoustics before you undertake a studio design. This will ensure a true representation of the audio over your monitors. Near-field monitors are also an option.

P.A., so the inserts didn't match. I had to simulate the hall with digital reverb. Also, the speaker had a cold on the day she re-recorded, so her voice didn't match the original.

The moral: Ask the speaker at the event if they might want to re-record anything. If so, try to do it on the same day in the same place.

Too hot

Then there was the time I recorded a rock concert with two mics in the audience. The recording was to be background music to accompany narration about the concert. Even though I didn't exceed a 0 VU recording level, the tape was distorted. The band was so loud, the mic put out a signal hot enough to overload the recorder's mic preamps.

The moral: Carry a microphone pad to prevent input overload distortion (one was described in the *Line Out* article, "Simple Circuits Solve Mic Woes.") In general, have lots of problem-solver circuits and adapters ready to use in emergencies.

Here's one last tale. I had recorded several multitrack mixes onto a DAT tape. When I took a lunch break, I left the tape in the machine and shut off the power on my outlet strip. After lunch I flipped on the power. While I wasn't looking, the DAT recorder had gone into record mode and erased a third of the tape. I had to re-do the mixes.

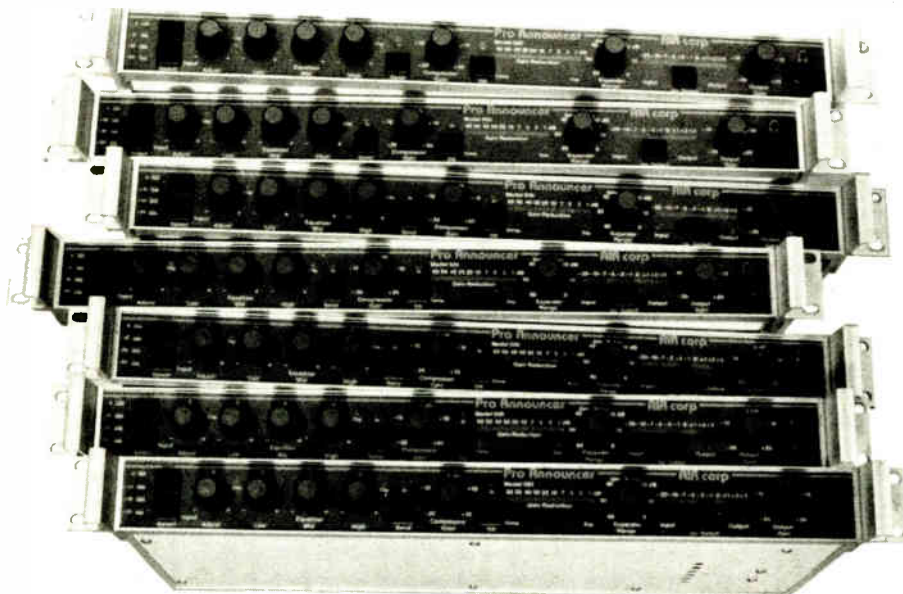
The moral: Set the DAT tape's write-protect tab immediately after recording. And make a safety copy.

If you have audio nightmares you'd like to relate for the benefit of our readers, drop me a letter at RW. It'll make me feel better to know someone else goofed up.

■ ■ ■
Bruce Bartlett is a microphone design engineer and technical writer for Crown International. He also is author of the just-published "Stereo Microphone Techniques" from Focal Press. Bruce can be reached at 219-294-8388.

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A Big Paying Job

(continued from page 30)

station can get back to making money again.

These are professionals who save stations a lot of money as they do preventive maintenance and continually "tweak" the equipment for the most efficient operation.

And for all this, salaries often are in the range of \$200 a week. Yes, right now, in 1991.

At any rate, I thought you'd appreciate knowing that the advertisement I quoted came from the January 1931 issue of a magazine called "Amazing Stories."

Broadcast engineers have come a long way in these 50 years, haven't we?

Keeping up with the times

Upon reflection, you may agree that the value the marketplace has put upon our services clearly hasn't kept up with the times.

So, it won't surprise you to hear

about a young fellow who came to me a few years back, asking if he could intern at my station. He seemed quite interested in broadcasting, until he asked at what kind of income he could expect to start.

Well, \$5 an hour (\$200 per week) didn't make it for him. He went elsewhere and broadcasting lost another talented individual.

Until an industry-wide answer for this situation is found, it will continue to be hard to find the new engineers needed in our industry.

BBS Update: The link that existed between all the engineering echoes has been broken, apparently permanently. MediaNet and RelayNet are still linked, but FidoNet has fallen out of the link.

■ ■ ■

Barry Mishkind is a consultant and contract engineer in Tucson. He can be reached at 602-296-3797; or on MCI Mail at 325-9883.

Hot Remote Maladies

(continued from page 28)

tip. The identification will ensure that the cables are not mixed up again.

★★★

Joe Schloss, CE at KICD in Spencer, Iowa, sent in a satellite solution that has its place in both warm and cold climates. Joe was growing weary of middle-of-the-night calls that the satellite sounded bad, only to find ice on the feed horn of the Cassegrain dish.

Joe solved the problem by placing a clear, non-conductive plastic bag over the feed assembly and securing it with tie wraps. When ice forms, you just shake the plastic bag and the frozen stuff falls off. Joe has had great luck using this same technique on "micro-sats," the 0.75 meter to 1 meter dishes. For those, he wraps the entire dish in a bag.

The reason I mentioned that this idea is great for warmer climates is that the plastic covering discourages bees' nests. We had a station whose satellite signal became unusable right around sunset each day.

You guessed it—the wasps came home to their nest at that time.

The nest alone didn't seem to pose a problem, but the added mass of all those wasps made a great RF attenuator. If you've experienced weird satellite problems, before renting the spectrum analyzer and looking for terrestrial interference, don your beekeeper's suit and look for tenants in the feed horn.

While you're in the transmitter field, the end of June marked the end of the second quarter—have you completed your quarterly tower inspection? Take a few minutes to really inspect your site. Look for things like cracked insulators or missing hardware (Figure 1), as well as the condition of the paint. If the tower paint job is beginning to fade or peel, make a note to budget for re-painting in the 1992 budget.

■ ■ ■

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



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Transparent digital transmission

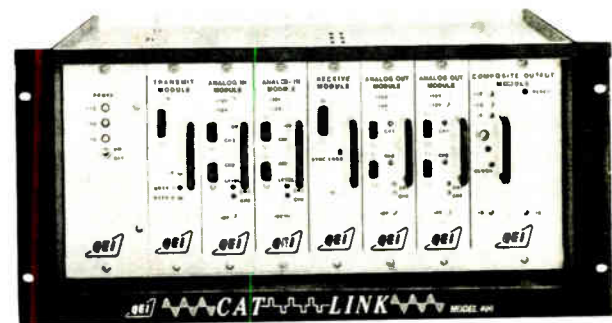
CAT-LINK encodes the fully processed composite signal, then decodes it at the transmitter. You always get full stereo separation, without the phase or amplitude variations that plague two-channel STLs. Dynamic range is up to 84 dB, and your processed composite signal can use virtually all of it. You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

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- 017 039 061 083 105 127 149
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AMPLIFIERS

Want to Sell

Ramko Primus P-8S/16M distribution amps (8), w/meter and headphone option, never used, \$400 ea. M Sadacca, KCKC-KBON, 740 W 4th St, San Bernardino CA 92410. 714-882-2575.

Carvin FET 900 Mosfet stereo pwr amp, 200 Wchnl at 8 ohms, sub and ultrasonic switches, variable compressors, bridge mode switch, 3 rack space, 35 lbs, like new, \$400. B Fisher, KPCK, POB 477, Bowman ND 58623. 701-523-3883.

McCurdy DA-50A 1x12 amps and PS (6), vgc, rack mount, \$550; RCA BA 44 utility amps, vgc w/connector tray, \$70. B Kuhar, 1543 Eaton Ave, Bethlehem PA 18018. 717-645-8814.

Magnecord CM6K tube mon amp, 10 W, rack mount, rebuilt, \$35; Ramko 1x6 mono DA on rack panel, cln & wrkg, \$75. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0880.

Bryston 4B 400 W pwr amp, excel cond, 3 yrs old, \$900. R Tiegen, Plum Sound, 335 Merrimac St, Newburyport MA 01950. 508-465-5653.

Ampex 602 octal plug-in Nuovistor mic preamps 96440-01, (2), \$35 ea; (2) Altec 1588C octal plug-in mic preamps w/xfrmr & phantom, \$20 ea; (2) Altec 1588B octal plug-in mic preamps w/xfrmr, \$10 ea. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

Bozak CMA-150-2 rack mount pwr amp (4), 150/150 into 8, rebuilt, new PS condensers, smooth hi end for CRM bi-amp monitoring, no fans, excel cond, \$450 ea; BGW Systems 500/D rack mount pwr amp, 450/450 into 4 ohms, rebuilt, new PS caps, call soon & will throw in spare amp module, \$500; (2) Hafler P500 VMOSFET pwr amp, 400/400 into 4 ohms, smooth sound, \$1000/pair; all FOB Miami. P Appleson Studios, 1000 NW 159 Dr, Miami FL 33169. 305-625-4435.

McIntosh MC-2500, black, fact sealed, \$3475; (2) MC-240, \$1075 ea; (3) MC-40, (2) MC-225, \$575 ea; Grand Integra M510, \$2975; (2) Spectral DMA50, \$1475 ea; Yamaha B-2 V-fet, \$475; Luxman M4000, \$650/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Phase Linear 400 stereo 400 W pwr amp, \$400. P Rebmann, WEZY, 1412 E Lime St, Lakeland FL 33801. 813-682-4191.

Dynakit SCA35 integrated amp/preamp, \$125; Shurwood S5000 stereo tube amp/preamp, \$125; Bogan DB130 mono integrated tube amp/preamp, \$75; all excel cond. W Kremer, Kremer Kraft, 301 SW 16th St, Ft Lauderdale FL 33315. 305-542-5652.

Magnecorder amp & portable mixer; Ampex amp & spkr; call for prices. J Schramm, 205-826-0390.

Want to Buy

Altec 287-F/287-W, any cond; WE amps; Marantz, Ampro, Westrex vacuum tube audio amps; cutter amps; Marantz 1, 2, 3, 6, 7, 8, 8-B, 9, 10, 10-B, D deForrest, 7441 Wayne Ave #10-D, Miami Beach FL 33141. 305-866-5401.

RCA OP-5, OP-6, OP-7, BN-2, 80 Series, etc, tube amps & remote mixers. B Davies, Virgo Prods, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

McIntosh tube tuners, amps, preamps, tubes, working or not, literature, manuals. R Glenn, WJGR, 1718 Shanna, Wimaia FL 22598. 813-634-1940.

Denon POA8000 (2); Sansui B2301, BA5000, C2301. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

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



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ANTENNAS & TOWERS

Want to Sell

Kintronics 25 W isocoupler tuned to 92.0, \$1500. N Hunter, KTGL, 3201 Pionems Blvd, Lincoln NE 68502. 402-483-6814.

Phelps Dodge CFM-HP-8 8-bay antenna on 93.3, BO. C Springer, KLMR, POB 890, Lamar CO 81052. 719-336-2206.

Phasemaster T-14000-A rotary phase converter, input 230 V, output 230 V, idle amp 30, used 9 months. L Wayne, WVOD, POB 2059, Manteo NC 27954. 919-473-1993.

Collins 37CP 6-bay antenna tuned to 97.1, 1 bay needs repairs, \$150. B Gagne, KTCZ-FM, 100 N 6th, Minneapolis MN 55110. 612-339-0000.

Phelps Dodge CFMHP-5 5-bay FM, 3 1/8" line, 96.1 MHz, all hardware, like new, \$7000; Rohn 55 100' galvanized twr w/guy wires, top and bottom plates, turnbuckles, hardware, anti-twist arms, vgc, \$3000; 60' 1 5/8" air dielectric coax xmission line w/flanges on each end, \$750. Lonnie, KCMB, 1009-C Adams Ave, LaGrande OR 97850. 503-963-3405.

Radio Systems CP-15 couplers (12), wired w/6' 3-phase cable and disconnect plug, excel cond. R Rossman, WEHR, 103 Daniel Bldg, 2766 W College Ave, State College PA 16801. 814-865-9568.

Harris/ERI Sky-Gain FMWH-1AE 1-bay FM antenna, gd cond, used 2 yrs, tuned to 92.7 MHz, \$500, buyer pick up. M Gollub, WMJS, Box 547, Prince Frederick MD 20678. 301-535-2201.

Rohn 25 base insulator, never used, \$300/BO+shipping; LAPP 14855 base insulator, never used, \$300/BO+shipping. B Crusier, WJRZ, 20-6 Jamestowne, Toms River NJ 08753. 908-286-0411.

RCA isocoupler, tuned to 97.7, can return, 1 5/8 EIA flange. G Fuller, WKKR, Box 2329, Opelika AL 36801. 205-745-4656.

DB 224 4-bay, tuned to 155.220, \$250; DB 304 8-bay, tuned to 155.380, \$350; DB 224 4-bay, tuned to 155.880, \$250; DB 201, tuned to 35.060, \$125; all gd cond. H Widsten, KGNB/KNBT, 1540 Loop 337 N, New Braunfels TX 78130. 512-625-7311.

Phelps Dodge CFM-LP-4 4-bay antenna, 94.3 MHz, radomes on tower, \$2000; 490' 1 5/8" coax on tower, 2 yrs old, excel cond, connectors incl, \$5/ft. B Brewer, KOKL, 410 W 6th, Okmulgee OK 74447. 918-756-3646.

Jampro JHPC-5, 5-bay FM antenna, tuned to 104.3 MHz, unused, \$8000 FOB. D Peluso, KJUL-FM, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

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Ampex 350, 351 electronics knobs, excel cond, lrg \$5, small \$2.50. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

Phelps Dodge EC-FM2 CP antenna (3), tuned to 92.1, 98.3, 99.3, w/radomes, BO. NW Ariz Brcdst Eng, 602-753-1995.

Aeromotor 17" face, 195' on ground, ready for pickup, gd cond, wall hardware & some insulators, \$1500. T Edmison, WDKN-FM, 106 E College St, Dickson TN 37055. 615-446-0752.

CP antenna 3-bay tuned to 93.9, 200' 1 5/8" coax, solid dielectric, BO. D Jordan, WDTM, POB 3417, Jackson TN 38503. 901-668-1153.

Rohn 320' tower, 18" face, lighting, hardware, 7 yrs old, excel cond, ready to ship, \$9000. R McBride, KTFA, POB 820, Bridge City TX 77611. 409-735-7173.

Moseley PCL-505, tuned to 94.0 MHz, excel cond, \$1600. R Thomson, KDKB, 1167 W Javelina, Mesa AZ 85202. 602-897-9300.

ARCO rotary 3-phase converter, 208/230 V, will support 3 kW xmt, excel cond, \$275. D Heinan, KYKA-FM, 1214 W Lincoln Ave, Yakima WA 98902. 509-452-7997.

Vacuum CAP ATUs used in 4-tower 50 kW DA, as group or individually, BO; 50 kW 4-tower CSP phasor w/control panel & all vacuum capacitors, new in '83, BO. J Bisset, Multiphase, Falls Church VA. 703-379-1665.

EIA Flanges 3-1/8" rigid coax line, (20) 20' pieces, 50 ohm, stored indoors, \$200 ea; 3-1/8" rigid coax line w/Marmon type flanges (10) 20' lengths, \$180 ea. L Bruce, WBMX, 3 Fenway Plaza, Boston MA 02215. 617-236-6841.

Gates/ERI FMA-8B 8-bay horiz on 94.5 MHz, complete, BO/trade on low pwr FM xmt. F Hollon, Rt 1 Box 72, Plymouth IL 62367. 217-392-2340.

190' self-supporting tower, 150' to platform w/40' of 45G, BO. A Baron, 211 Front, Lynden WA 98264. 206-354-5252.

ERI FML 3-bay tuned to 103.1 FM, 6 yrs old, \$2500. C Cooper, WOSM, 4720 Radio Rd, Ocean Springs MS 39564. 601-432-1032.

Andrew LDF5-50A 150' 7/8" w/(2) female 75AN fittings, \$440; 300' 1/2" Andrew LDF4-50, \$300; Cablewave 130' 1/2" foam, \$130; 60' 7/8" foam w/female 75AN, \$150; 170' Andrew FHJ4-50B 1/2" foam, \$170; 300' 1-5/8" Andrew HJ7-50A air dielectric w/(2) flanged fittings, \$2000. L Bawinkel, WWJQ/WJQK, 5658 143rd Ave, Holland MI 49423. 616-394-1260.

Motorola 22' fiberglass 2-way antenna, \$200/trade for ham rig. J Schloss, KICD, 2600 N Hiway Blvd, Spencer IA 51301. 712-262-1240.

Coaxial Cable, 1-5/8", gas fed, 280'; (1) piece w/connectors, \$1400; Jampro 4-bay, 92.1 MHz, w/standard leg brackets, \$5950. G O'Rear, WZEWD, POB 2608, Mobile AL 36652. 205-432-0102.

Delta Lab DL-4 space rack mount effects processor w/variable delay, flange, double and echo effects and more, \$200/BO; Aphex Type C aural exciter, single rack space, variable controls add brightness and audio intelligibility, unbalanced 1/4" and RCA connectors, excel cond, \$175/BO. B Fisher, KPCK, POB 477, Bowman ND 58623. 701-523-3883.

Radio Systems/Audiometrics TM-2 studio elec timer, to 9:59:59, front panel/remote, manual/machine start, stop & reset, rarely used, mint cond, \$100. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

Howe phase chaser w/manual, \$800. B Downs, KTSR, Box 3248, Bryan TX 77805. 409-846-1150

Orban 424A stereo complimenter/de-esser/noise gate, excel vocal processor, brdcast quality, \$650; Orban 674A para-graphic cross-EQ, \$850; both new cond. Jeff, 15106-A Frederick Rd Box 309, Rockville MD 20850. 301-340-0466.

Eventide Clockworks 1745M digital delay line, balanced outs (2), needs work, \$300. S Russell, 60510 Klett Dr, Decatur MI 49045. 616-782-9258.

UREI 813B studio mons, \$2200. R Tiegen, Plum Sound, 335 Merrimac St, Newburyport MA 01950. 508-465-5653.

Radio Design Labs pods to make (2) control boards, modular design, new, unused, request list, \$14,000 all FOB. D Peluso, KJUL-FM, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Shure SE30 gated mixer, \$185. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

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Postex 3180 stereo reverb, will trade for UREI 920-16 cooper time cube. J Roper, Imperial Sound, 383 N Studio St, Terre Haute IN 47803. 812-877-2663.

Eventide BD-932 stereo brdcast audio delay; Orban 245E stereo synthesizer; both excel cond, w/manual. H Ginsberg, WMEC/WMHK, 2915 Maples Rd, Ft Wayne IN 46816. 219-447-5511.

Tascam 10, 12x4x2 prod console w/add'l input modules, \$1100; Tascam series 70 4-Trk 1/2" R-R, \$900. A Williams, KCKC/CKIT, 306-569-6200.

Valley Gate-X 4-chnl noise gate, like new, BO. J Claybrook, WERC/WMJJ, 530 Beacon Pkwy W, Birmingham AL 35279. 205-942-9600.

Digital LED up timer (5), 2", self-pwr'd, \$5750 ea prepaid, UPS. D Peluso, KJUL FM, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

dbx 21 type II NR decoder, \$35. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Want to Buy

Burwen TNE-7000, state price and cond. A Reis, REIS Inc, 308 Eastgate Ct, New Lenox IL 60451.

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

Teac AN60, AN80, AN100 Dolby noise reduction unit. R McDonald, Mission Rcrding, 5231 Horton, Mission KS 66207. 913-722-2677.

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Auditronics AUD-1100DAGLC distr amps, \$50 ea; Auditronics AUD-1100-MF 10-input mainframe, \$250; Auditronics AUD-PS60 RM external pwr supply, \$210; Henry USDA 3, \$70 ea; all used 6 mths. B Lord, Lord Brcdstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Crown PL-1 pwr amp (2), black, rack mount, 19" w/handles, 150 W-RMS, 3-yr guarantee, \$300. C Keith, 9 Roxbury, Keene NH 03431. 603-352-8460.

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AUDIO ... WTB

Burwen TNE7000A or comparable. T Young, Bible Brcdstng Network, 1300 N Battlefield Blvd, Chesapeake VA 23320. 804-547-7376.

TFT EBS Syst, complete, on-air & prod 5/8" 10 chnl audio console, FM mod mon & SS unit, (2) flanges for 1 5/8 Celwave cable, gas port & gas barrier, limiter, solid state. Spanish Cultural Network, WNZN-FM, Carr Vieja del Vigia #83, Ponca PR 00731. 809/840-1588.

UREI BL-40 modulimeter manual & schematics, will pay postage & copy charges. P Hess, WPPJ, 134 Derwent Dr, Pittsburgh PA 15237. 412-366-1249.

Format Sentry FS12C, compl 24-chnl w/computer, 1 yr old, (4) 350B Carousels, (3) Otari ARA1000 reels, (2) SMC 700 series dual-tray cart machines, BO. Z Huffmaster, KSCC, POB 191, Berryville AR 72616. 501-521-0104.

Conex CS-25 dual 25 Hz tone sensor w/manual, excel cond, \$300. B Watson, KSAK, 1551 E Amhr, W Covina CA 91792. 714-946-6249.

BPI RS-50 random cntrlr for SMC 250 Carousel, \$60; SMC PDC-3 automation clock, cond unknown, \$250. E Stanley, KBTO, Box 12, Bottineau ND 58318. 701-228-2483.

SMC DP-1 mono, w/programmer, AS-16 switcher, (7) 250RS Carousels, (2) Twintape P/Bs, wrkg when removed, sell wholepart, \$1500/BO. B Hollan, KVOX, Box 97 Country Rd 75, Moorhead MN 56561. 218-233-1522.

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Ampex AG-600 stereo, rack mount, \$250. B Kuhar, 1543 Eaton Ave, Bethlehem PA 18018. 717-645-8814.

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Sparta, (4) decks w/(3) tones PB, spare deck, \$600. L Beigel, On-Cue Rcrdrng, POB 85042, Los Angeles CA 90072. 800-726-9813.

Tapemaster 700-P PB, \$100/BO; Harris 90-1 R/P, \$600/BO; Criterion PB, \$150/BO. M McDaniel, WBTO, Linton IN 47441. 812-847-9830.

Harris 994-7995-001, mono, \$250/BO. L Fuss, WDTL, POB 159, Fayetteville GA 30214. 404-460-6159.

Ampex 350 1/2-trk mono, 14" reel transport and Lang SS R/P elec, \$450+freight. N Mishan, POB 335, Lynbrook NY 11563. 516-582-1338.

Magnafax 652-1, 2-trk high speed R-R dupl, very lw hrs, spare set heads, like new, BO; also, Ampex tape. L Schmitz, Soundtrax, 315-C Howard Ave, Rockville MD 20850. 301-279-0666.

Ampex ATR 700, 75/15, in case, \$800/BO; (6) Revox A77 w/rack mounts, \$300/ea/BO; (2) Metrotech 1050 stereo PB, BO; (6) Scully 270 stereo PB, take 14" reels, BO; Schaffer/Teac rack mount stereo R/P, BO. M McDaniel, WBTO, Linton IN 47441. 812-847-9830.

Pioneer RT 701, 14-trk rcrdr, 7" reel capacity, gd cond, excel freq response, heads gd shape, \$150+shipping; Pioneer 700 and 900 series open reel rcrdr parts: main switch assembly, (5) brake bands, (5) push botton knobs, (3) reel holder knobs, (3) reel base screws, (3) reel base springs, \$100/all+shipping. J Heldman, 812-237-3255.

Revox A77 (3), PB only, fair cond, \$225 ea. B Spitzer, KKLK/KMKK, Box 460, Rapid City SD 57701. 605-343-6161.

Scully 270 mon 2-trk, auto-reverse, 3 3/4 or 7 1/2, \$1000. R Evans, Cable Music Network, 156 Prospect St, Wilkes-Barre PA 18702. 800-743-1221.

ITC SP, mono, \$200; (2) ITC SP, mono & stereo, w/out cards or heads, \$50 ea; ITC RP, mono, \$250; ITC RP, mono, w/out case or cue detect card, \$175. P Walkowiak, WWWW, POB 167581, Oregon OH 43616. 419-255-1470.

Sony TC228 8-trk R/P w/16 blank carts, c/n & wrkg, \$50; WE KS19522L1 recorder/coupler, auto answer interface between cart machine & phone line, new, \$50. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0880.

Fidelipac CTR12 stereo play (4), \$1442 ea; Fidelipac ESD10 eraser/splice finder, never used, in box, \$900. K Fink, WZLI-FM, POB 106, Toccoa GA 30577. 404-886-7106.

Audicord A-21 R/P, \$300. G Milstee, WTYN-AM, 1241 E Lakeshore Dr, Landrum SC 29356. 803-457-3588.

Audi-Cord CS26, BO. NW Ariz Brcdst Eng, 602-753-1995.

BE 3000A delay R/P, mono, rack mount, brand new, \$1900; BE 3000, (1) R/P, (2) PB only, mono, excel cond, new heads & pinch rollers, R/P for \$1500, PB for \$1000 ea; Harris Criterion 90 mono cartridge R/P, \$500; Audi-Cord A Series mono R/P, gd cond, on air, \$1000. D Kelly, KWPN, Box 84, West Point NE 68788. 402-372-5423.

Sparta Century (3), w/parts machine & extra boards, \$300/all. B Mayben, WKXJ, POB 91, S Pittsburg TN 37380. 615-837-5544.

ITC ESLIV, gd cond, you ship, \$500/BO. C Cullett, WGAN/WMGX, 200 High St, Portland ME 04101. 207-774-4561.

Sparta cart-delay machine, like new, \$500; Spotmaster 505, (2) R/P & (1) play only, gd cond, \$200 ea. R Meyers, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

BE Spotmaster (2), stereo, primary, secondary, tertiary cue tones, auto fast forward, lw hrs, excel cond: 3200 PS R/P, \$1600; 3200 PS play only, \$850; \$2250/both. L Wagner, ARN, POB 1788, Orlando FL 32802. 407-299-1299.

ITC 3D triple-play deck 1 cue, w/matched WRA record amp, rebuilt & updated pwr supply, heads, bearings, etc. free PR&E interface box if needed, \$2150 FOB Miami. P Apple-Studio Studios, 1000 NW 159 Dr, Miami FL 33169. 305-625-4435.

Audicord 3-deck mono PB; Audicord mono R/P, mint cond; ITC R/P premium delay, mint cond; ITC R/P stereo w/tones; (5) stereo Audicord cart machines. J Phillips, WZOM, 408 1/2 Clinton, Defiance OH 43512. 419-782-8591.

ITC SP stereo 3-cue cart deck, gd cond, \$500. P Rebmann, WEZY, 1412 E Lime St, Lakeland FL 33801. 813-682-4191.

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Ampex 96440-01 plug-in Nuvistor mic preamps for 602 rcrdrs, \$35 ea; Ampex 351 full-trk head stack, complete, excel cond, \$75. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

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dbx 941/942 Type II NR encode/decode module. R Burton, Audio Rents, 7237 Santa Monica Blvd, Hollywood CA 90046. 213-874-1000.

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AUTOMATION EQUIP

Want to Sell
Scully 255 FT (3), new heads, gd cond, \$700; Criterion R/P; FAT wire phone system, BO. R Remington, KMTX, 516 Fuller Ave, Helena MT 59624. 406-442-0400.

Harris 9000 controller, (5) Otari ARS-1000 R-R, (5) SMC 350 Carousels, \$5500. S King, KATP, 7701 I-40 W Ste 660, Amarillo TX 79160. 806-359-5999.

Cetec/Schafer 90Z I/O cards and cables (5), for Revox A77 reel PBs, \$75 ea/\$300 all. B Spitzer, KKLK/KMKK, Box 460, Rapid City SD 57701. 605-343-6161.

Gates SP-10 auto system w/dialer; (2) Gates SC48 seq auto controllers; (2) switchers/mon panels; Carousel 252; (2) Gates 55 stack cart players, one for parts; all BO. M McDaniel, WBTO, Linton IN 47441. 812-847-9830.

Schafer 901 Brain, (3) Audiofiles, (5) Carousels, (5) racks. R Hull, KCOL-KIMN, 1612 W Laporte Ave, Ft Collins CO 80521. 303-482-5991.

Sono-Mag DP-1, complete system, on air, (5) Carousels, (4) reels, delay news rcrdr, (5) racks, logger, printer, CRT mon, remote control, Audicord stereo cart rcrdr w/tones, \$10,000. M Rhoades, KTTK, POB 1232, Lebanon MO 65536. 417-588-1435.

SMC system, (6) 350 RS Carousels, (3) 250 RSC Carousels, (6) racks, DP-1, AS 20, on air and wrkg, \$3500. E Dulaney, KYKK, 619 N Turner, Hobbs NM 88240. 805-297-4969.

Harris System 90, 7-day clock, (2) 48 tray mono instacarts, (2) 750 ITC clear text log, on air, BO/all or part. G Fuller, WKKR, Box 2329, Opelika AL 36801. 205-745-4656.

SMC ESP2, (6) Otari reels, (2) Carousels, (4) racks, control system, dual play cart and printer, excel cond, 2 yrs old, BO. L James, KYQQ-FM, POB 650, Wichita KS 67201. 316-265-1065.

SMC MSP-1 2,000 event cntrlr, USI-1 satellite interface, (4) SMC 450 Carousels, (3) sngl-play decks, in (2) rolling racks, \$13,500. D Kelly, KWPN, Box 84, West Point NE 68788. 402-372-5423.

SMC DS-20 automation switcher, as is, \$250. E Stanley, KBTO, Box 12, Bottineau ND 58318. 701-228-2483.

Schafer 901/902, (2) Carousels, (3) R-R, (3) racks, fair cond, needs minor repairs, \$4500+shipping. R Huckebay, KJLF, 973 N Main St, Butte MT 59701. 406-723-4006.

Format Sentry w/Commodore 64, \$2500; (2) IGM Go Cart 24, \$2000 ea; (3) Audicord S Series cart PB, \$500 ea; (4) Otari ARS-1000 reel reproducers, \$850 ea; reel sensor, \$100; (2) racks for above, \$300 ea; or complete 6-yr-old system, \$11,000+shipping. B Toole, KGVO, 127 N Higgins #107, Missoula MT 59802. 406-721-1290.

IGM 48-tray stereo instacarts (3), plus cables, on-air, \$4250 ea/\$12,000 all. T Hansen, 805-438-3221.

SMC MSP 12, complete satellite/music auto system, dual cart PB, dual SMC 452 stereo cart Carousels, CRT, 2000-event memory, used 6 months, half price. D Carpenter, KKSJ, Box 699, St Cloud MN 56302. 612-253-9600.

BE Control 16, 3,000 events w/(2) 42-tray & (1) 78-tray IGM 60 Cart IIs, (4) Scully playdecks if desired, (3) racks incl CRT, printer, spares, you ship, BO. D Brown, KVLE-FM, POB CC, Page AZ 86040. 303-641-3225.

IGM Basic A control, separate cards, pwr supply reg 5 V at 30 amps, +&- 15 V & 24 V, (2) IGM 42-tray go-carts, equip racks. D Gander, KDUZ/KKJR, Box 10, Hutchinson MN 55350. 612-587-2140.

Schafer 903A automation system, re-built, (4) ITC 750 R-R, (2) Audiofile IIA, keyboard, printer, remote panel w/50" cable, BO. B Bolton, WCBH, Casey IL 62420. 217-932-4900.

Harris System 900, (5) Otari ARS-1000 R/R, (4) Go Cart 24-cart Carousels, (2) ITC Deita II PB carts, (2) Micropolis disk drives, system controller, (4) Audicord PB carts, Audicord R/PB cart, gd working cond, just removed from service, BO. J Bisset, Multiphase, Falls Church VA. 703-379-1665.

Schafer 8000 computer automation controller w/Lear-Stiegler ADM-3A CRT terminal, logging printer, (2) blue Schafer racks, SMC Carousel, many parts, all manuals & documentation, can run 24 total sources, \$1200. G Gaskey, KWHQ, 261 Main St, Weed CA 96094. 916-938-3828.

IGM 48-tray stereo instacarts (3), all cables, currently on air, \$4250 ea/\$12,000 all. T Hansen, KWSP, POB 3810, San Luis Obispo CA 93403. 805-438-3221.

BUSINESS OPPORTUNITIES

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Profitable LPTV group owner w/proven track record seeks debt, debt/equity or lease investment for major expansion, excel collateral. John, Republic Broadcasting, 502-568-4449.

CAMERAS (VIDEO)

Want to Sell
Panasonic AK-7150 3-tube brcdst ENG camera head (2), case, no lens or VF, \$400 ea; Sony DXC-1200 Tricon color cam compl studio pkg (2), \$450 ea; Hitachi 3-tube; Ampex 3-tube; (2) Norelco PC-70 compl. J Krepol, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

Sony M2 3-tube MF Saticon camera, 12x lens, new, very lw hrs, \$2600/BO. R Jensen, Telecable Prod, 5812 21st St, Radue WI 53406. 414-632-3131.

JVC KY-1900, AC pwr & chrgr, 10x1 zoom, vy lw hrs, \$940; JVC GX-5700, sgl tube, 10x1 zoom, batt chrgr, \$570. K Schmidt, Bristol Prod, 2401 Bristol Ct SW, Olympia WA 98502. 206-754-4260.

Want to Buy
Early TV cameras for collection, studio & portable, also need tripods & camera heads. A Weiner, WREM, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

CART MACHINES

Want to Sell
ITC SP stereo cart reproducers (3), w/Straight Wire Audio elec, \$1000 ea/\$1950 all; Audicord DL series cart rcrdr/reproducer stereo, 1 yr old, w/manual, \$1000. B Shannon, WKZA, 5158 Countryside Dr, McKean PA 16426. 814-476-7426.

ITC 750, transport and stereo R/P elec, 2-trk, 7.5 and 3.75, wrkg when removed, \$500. M Friend, WTJV, Box 711, Charlottesville VA 22901. 804-924-0885.

AIWA Excella XD-001 RDAT rcrdr, remote cntrl, 110:100 VAC pwr adptr, Engl instruct manual, records at 44.1 kHz from digital SPDIF input, excel cond, \$935; Tascam DA-50 RDAT rcrdr, remote cntrl, +4 and -10 dBm analog I/O, coaxial and optical digital interfaces, records at 44.1 or 48 kHz from analog and digital inputs, excel cond, \$1350. R Streicher, 818-359-8012.

Scully C-100 series 16-trk 2" tape w/meter bridge and tape counter, \$4500. A Tedecoli, Vault Studios, 106 N Page Ave, Endicott NY 13760. 607-748-4762.

Sony TC-850 2-trk 3-motor reel, \$300/trade pro sound equip; dbx ltx series III range expander, \$125/trade for mics. B Wilson, 212 Southside Ave, Louisville KY 42718. 502-789-1505.

Fostex A-8 LR 14" 8-trk rcrdr/reproducer, new cond, \$850. R Simmons, Stonewall Brcdst, POB 50124, Austin TX 78763. 512-476-5200.

Technics 1506 US 1/2-trk stereo tape machine, new heads, \$600. P Cibley, Cibley Music, 138 E 38 St, NY NY 10016. 212-986-2219.

Tascam T-2640MS and T-2640/2S dupl, forms 8x3 slave duping system, vgc, recently serviced. R Robinson, 203-269-4465.

Revox B-77 open reel rcrdr, 75 and 15 ips 1/2-trk, w/direct-input and tape-edit modification, improved output amp, remote cntrl, van-speed cntrlr, hrd fiber travel case, excel cond, \$1150/BO; Revox B-77, 75 and 15 ips 1/4-trk, direct-input mod, improved output amp, hrd fiber travel case, excel cond, \$750/BO. R Streicher, 818-359-8012.

Stellavox SP-7, stereo & center rack, manual, PSU, flight case, \$1300/trade. C Collins, CI Prod, 30 W 21st St, NY NY 10010. 212-243-1186.

Ampex AG440-2, 351-2 w/Novonics 360 amps, AG 440 R/P amps, new AG 440 50 Hz motor, misc heads, parts & motors, Plus PC 2 video char gen & 16mm film editing gear. B Lindahl, 10680 SW Wedgewood, Portland OR 97225. 503-644-9643.

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Technics RS1506, 14", 1/2-trk, high speed, new heads, \$600. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

Radio Syst ReDat rcrdr, used 6 mths, \$2000. B Lord, Lord Brcdstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Magnecord 1022 stereo open reel, BO; (2) Magnecord 1021 mono open reel, BO. H Widsten, KGNB/KNBT, 1540 Loop 337 N, New Braunfels TX 78130. 512-625-7311.

Ampex 351 bridging input xfrms B-17331-1 (2), \$20 ea; (1) Ampex bridging input 4580116-10, \$20; (5) Ampex 440 bridging input 4580200-01, \$35 ea. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

Revox PR-99 MKII 1/2-trk stereo reproducers (5), new in carton, \$1500 ea FOB. D Peluso, KJUL-FM, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Sony DTC-1000 DAT R/P (4), excel cond, BO. B Evans, KBAC-FM, 740A St Michael, Santa Fe NM. 505/471-7110.

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Technics SLP-550 CD player, pro quality, auto rcrd level, edits cassette recordings, \$325; combo Teac AD-5 CD & auto-reverse cassette deck, auto dub from CD to cassette, \$325. Jeff, 15106-A Frederick Rd Box 309, Rockville MD 20850. 301-340-0466.

Ampex AG-350 mono, \$500; AG-440 mono, \$500; 3M M-56 8-chnl 1" full remote w/tape stock, \$2900; Sony TC854-4S w/dbx 154, \$900; Crown SX-701, \$250; Crown 800TX 4-chnl, \$300; Telex series 235 R-R stereo tape dup syst, (1) master w/spare, (4) slaves, new cond, \$600/BO. J Krepol, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

Ampex 351 FT mono head-stack, housing, gate, cables, excel cond, \$70. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

ITC 99B stereo w/ELSA, 2 yrs old, all tones, \$2800. B Downs, KTSR, Box 3248, Bryan TX 77805. 409-846-1150

Scully 225 reproducer 1/2-trk stereo, BO. NW Ariz Brcdst Eng, 602-753-1995.

Ampex 351, (2), 30667-01-C, Simpson VU meters, excel cond, \$40 ea. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

Tascam 34, like new, \$800; Teac A7300 mastering, 2-trk, gd cond, \$450; Teac A7030S 2-trk, gd cond, \$350; Teac A15004, mint cond, \$300; Tapsonic TR70 2-trk, gd cond, \$300. J Parsons, 10375 Cannas St, N Huntingdon PA 15642. 412-863-9590.

Otari MX5050, older unit in excel cond, \$300+shipping. B Mayben, WKXJ, POB 91, S Pittsburg TN 37380. 615-837-5544.

CASSETTE . . . WTS

Berlant Concertone tube stereo 1/2 trk, 2-speed, excel cond, \$500/BO; Tandberg 5-tube stereo rcrdr w/aux record amp, excel cond, \$250/BO. W Kremer, Kremer Kraft, 301 SW 16th St, Ft Lauderdale FL 33315. 305-524-5652.

Ampex 350/351/400, compl machines plus heads, motors, transports, electronics, \$25-\$250/trade. J McLane, ODDEO, 115 W Gutierrez, Santa Barbara CA 93101. 805-963-3941.

Scully 280-B 2 trk stereo w/remote, \$300; Scully 280-B, 2 trk stereo w/remote, Servo cap, \$350; Scully 280, FT mono, \$200; all come w/Scully roll-around, maintenance records & manuals. A Williams, CKCK/CKIT, 306-569-6200.

Scully 280-B, FT in Ruslang cab, pwr supply prob, gd cond, w/manual, \$275; Pioneer RT-701 1/4" rcrdr (2), 7.5 & 3.75 ips, fair/gd cond w/manuals, \$100 ea. C Hendrix, WMNF, 1210 E Milking Blvd, Tampa FL 33603. 813-238-8001.

Tascam DA-50 DAT rcrdr, \$1800. J Reans, Sunday Pro, 3301 3rd St, Moline IL 61265. 309-797-2510.

Berlant Concertone Stereo 33 open reel deck (2), vintage; Dokorder 7" open reel. Ivan, WCUA, 301-984-1800.

Sony/MCI JH110 B/C 2 trk w/complete spare boards set, gd cond, \$2000. S Beverly, Flamingo Prod, 210 NE 57th St, Ft Lauderdale FL 33334. 305-771-2947.

Tascam 32 R-R/PB (2), w/remote control, in steel blue custom-designed racks, 1.5 yrs old, excel cond, \$1100 ea. G Livingston, WCCO/WQRT, Star Route, Salamanca NY 14779. 716-945-1515.

Auditronics AV123-4TS 1/4 trk R-R duplicator; Ionics RR-1(73M) FT; Ionics RR-2(74M) 2 trk; all gd cond, \$200 ea. R Meyers, Benchmark Comm, 4700 SW 75 Ave, Miami FL 33155. 305-264-5963.

Otari 7308 1" 8 trk deck, 1530 ips, lw hrs, excel cond, w/remote, \$4500; Ampex 612, stereo/mono, PB only, \$50. L Wagner, ARN, POB 1788, Orlando FL 32802. 407-299-1299.

dbx 105X 2-chnl type 1 NR, balanced I/O, 16 chnls avail, \$150/2 chnls. M Baykan, Research Kitchen, 6689 Orchard Lake Rd #151, W Bloomfield MI 43322. 313-737-0751.

Scully 270 (5), some aren't working, \$550/all. M Kestler, KAWZ FM, 208-733-3133.

Studer/Revox HS-77 Mk IV 2 trk, 15/7.5, highly-modified, ultra-analog audiophile mastering, excel cond, \$1375/BO/trade; HS-77 Mk IV FT mono, 10 hrs use, as new, \$475/BO/trade; port case for A77 w/mon spkrs & pwr amps, excel cond, \$375. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Nakamichi 1000-ZXL computer-controlled cassette deck, w/NR-100 Dolby C, rack mount w/rosewood case, low hrs, excel cond, \$1375/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Telex 300 R-R duplicator, cassette slave, rack cabinet, manuals, like new, all parts, BO/trade. D Bobee, 685 S Roys Ave, Columbus OH 43204. 614-279-6163.

Numerous recorders avail incl: UHER, vintage Edison tape voicewriters, Avent w/Dolby, Norelco Square, Grunding, Webcor, Cylinder; Sony dupl, master(3) slaves, hi-speed, excel cond; call for prices. J Schramm, 205-826-0390.

Want to Buy

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

Uher, all models and conds considered, also accessories, manuals, new parts stock, promo items, displays, ads. J Morinelli, J Morinelli Entertain, 901 Fairfax Rd, Drexel Hill PA 19026. 215-789-2742.

Magnecord PT6 reel hold down clamps (2), orig supplied w/rcrdr, silver w/springs, also need (4) reel hold down clamps for Revox A77. B Berry, Karavan Brdct, 13 Montgomery Pl, Conroe TX 77384. 409-273-2801.

Teac A7030SL, GSL; A7300; 3340SX, 3300SX; wrkg or not. J Parsons, 10375 Cannas St, N Huntingdon PA 15642. 412-863-9590.

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

Telex RP85 rcrding electronics. J Parsons, 10375 Cannas St, N Huntingdon PA 15642. 412-863-9590.

Uher taperecorders, all conditions considered, also accessories, manuals, new parts stock, promotional items & advertisements. J Morinelli Entertainments, 901 Fairfax Rd, Drexel Hill PA 19026. 1-800-666-2641.

Ampex 440C, w/servo, gd op cond, w/bout console. B Cummins, 212-219-3670.

Ampex 351 rcrding head stack, any cond. J Schloss, KICD, 2600 N Hiway Blvd, Spencer IA 51301. 712-262-1240.

Tascam/Teac 501 record/reproamp & 705 transport service info, schematics, will pay postage & copy charges. P Hess, WPPJ, 134 Derwent Dr, Pittsburgh PA 15237. 412-366-1249.

Otari 5050 Series, FAX info to 203-634-1478. J Pescatello, WMMW-AM, 900 E Main St, Meriden CT 06450.

Old battery operated R-R's such as, Sony TC800, any condition. Noel 800-223-2360.

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

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

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Sound Ideas Series 1000 compact disc SFX library. D Miller, Airborne Audio, 11647 W 83 Ter, Lenexa KS 66214. 913-494-8822.

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Okidata 82A printers, (1) good, (1) for parts, \$100/both. E Moody, KESE/KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Taligress TG3135 external 35 meg hard drive & 45 meg tape back-up, software, interface card, manuals, \$500. S Kozak, 351 Pinewood, Bay Village OH 44140. 216-871-5887.

Wang 2200 LVP-X, 32 meg internal hard drive, 8" floppy drive, (3) terminals, gd working cond. M Young, WJON/WJQJ, POB 220, St Cloud MN 56302. 612-251-4422.

Want to Buy

Apple IIE WP software; Radio Shack TRS-80 WP software. E Stanley, KBTO, Box 12, Bottineau ND 58318. 701-228-2483.

CONSOLES

Want to Sell

Ramko DC-8M touch control w/books; Gates Yard transistor; BO ea. M McDaniel, WBTO, Linton IN 47441. 812-847-9630.

Altec-Lansing 12-pot 3-chnl board, can run FM stereo and AM mono at same time, BO. J Randolph, WHIR/WMGCE, Box 1230, Danville KY 40422. 606-236-2711.

Quantum 12A cust mixing console, 12 inputs w/indepen pan and assign to 4 output busses, stereo mon section for 4 busses or 8-chnl tape returns, full stereo 2-chnl effects/echo-sends and returns, sep 2-chnl headphone monitoring, indepen headphone cue buss, lots more features, excel cond, \$2800. R Streicher, 818-359-8012.

Allen and Heath CMC-24 24-chnl studio board w/built-in computer patching, excel cond, \$2500. D Hunt, Finestkind Stereo, 284 Maine St, Brunswick ME 04011. 207-729-8815.

Cetec Centurion I audio console, 18 input modules, 3 outputs, \$1100. R Beierle, KFYP-TV, 200 N 4th St, Bismarck ND 58501. 701-255-5757.

Sony MX-16 8x4 mixer, slider pots, mic/line select switch, headphone output, input pad, grt cond, \$150. G Hutchins, WZAP, POB 369, Bristol VA 24203. 703-669-6950.

McCurdy SS8500 series console, (11) stereo faders and machine controls, (4) prog busses and meters, digital clock and up/down counter, (4) EQ chnls, intercom talkback and select, numerous features, clean, \$2950/firm. W Clark, Clark and Assoc, 318 E Calhoun, Macomb IL 61455. 309-837-2244.

Shure M67 mixer & RCA version of same, both in excel cond, \$125 ea. H Biller, 108 Hamilton Ave, Silver Spring MD 20901. 301-565-2798.

Gates Executive stereo 10-chnl console, \$500. G Kneisley, WEOL-WNVV, POB 4006, Elyria OH 44036. 216-322-3761.

Autogram IC-10, well-maintained stereo, 10-chnl, gd cond, \$3250. T McGinley, Cook Inlet, 630 Ivy Ln, Greenbelt MD 20778. 301-441-3332.

Sparta AS30B, fair cond w/few mod; Ramko DC5MS, fair cond; CCA Ultimate III 10-chnl stereo/mono, fair cond w/few mod; all BO by 6/91. B Spitzer, KKLK/KKMK, Box 460, Rapid City SD 57701. 805-343-6161.

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RCA BC-50, stereo/mono operation, 120 inputs, pwr and backup supply, spare parts and components, excel cond, \$400+shipping. W Tinsley, Public TV, 1123 Holcomb St, Watertown NY 13601. 315-788-3549.

Radio Systems ESA 10 stereo, excel cond w/manuals, \$5000/BO; Gates Stereo Statesman, gd cond, \$400; both \$5000. B Shannon, WKZA, 5158 Countryside Dr, McKean PA 16426. 814-478-7426.

Gately, 18 chnls, 2 out, lrg 5" meters, oak frame, \$1000; Pyramid PR8800 echo mixer, 8 chnls, 2 out, new in box, \$400. J Parsons, 10375 Cannas St, N Huntingdon PA 15642. 412-863-9590.

Audix MXT1000 8-chnl master mix down, English quality, \$1500; Yamaha PM700 12x2x2 PA mixer, \$400; Shure 8x1 rack mount audio console, \$180; UREI Cooper time cube & MXR flanger-doubler, \$450. J Krepol, 7 Dustin Dr, Wilmington DE 19703. 302-798-4076.

Henry Dub Center mixer-fastrac, dubs music library to carts w/out tying up board, \$400. B Lord, Lord Brdctg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Tascam M-520 20-chnl prod board, 8 subs, perfect 8 or 16 tk console, excel cond, used 6 months, \$3500. D Miller, Airborne Audio, 11647 W 83 Ter, Lenexa KS 66214. 913-494-8822.

Sparta AC-155 studio ctrl & remote w/(2) TT, BO. A Terry, WODY, Box 545, Bassett VA 24055. 703-629-5900.

BE 250 series 8M mixing board, gd cond, \$1000/BO. Charlie, WRGW, Marvin Ctr Rm 428, Washington DC 20052. 202-994-7314.

Shure M-67 mixer (2), gd cond, \$100 ea. G Jablonski, WHMI, POB 887, Howell MI 48844. 517-546-0860.

McCurdy 8500 custom 10 mixer dual stereo brdct console, \$4995. D Vernier, KUNI, U of N Iowa, Cedar Falls IA 50614. 319-273-6400.

Arrakis 150SC stereo console (2), 6 mixing positions, 12 input, built-in mon amps, many other features, like new, \$1250 ea; (2) BE 4M50A mono consoles, 4 mixing pos, built-in cue & mon amps, like new, \$500 ea; Audio Technica Consolettes AM-500 stereo, 6 mixing pos, 9 input, other features. B Cook, 1412 S 21st St, Colorado Springs CO 80904. 719-594-9464.

BE boards (2), (5) stereo carts, R-R. J Phillips, WZOM, 408 1/2 Clinton, Defiance OH 43512. 419-782-8591.

Opamp Labs 2008-4E, 20 input, 8 subs, stereo mix out, gd prod board, very clean, \$3500. L Wagner, ARN, POB 1788, Orlando FL 32802. 407-299-1299.

2005 AD road board w/spares, 16-chnl, \$450 FOB Miami. P Appleson Studios, 1000 NW 159 Dr, Miami FL 33169. 305-625-4435.

Auditronics 200VC mic compressor modules (3), for 200 series consoles; Auditronics 201PEQ mic equalization modules for 200 series consoles (2), w/personality plug-in modules, xtra plug-in incl; all work fine, gd cond, w/documentation. H Ginsberg, WMEE/WQHK, 2915 Maples Rd, Ft Wayne IN 46816. 219-447-5511.

Shure M67 mixer & M675 production master w/line inputs & cue system, gd cond, \$200/set. S Kowalski, WXXL, 337 S Northlake Blvd # 1067, Altamonte Springs FL 32701. 407-339-1067.

Classic British Hellos 24/16/24, c. '70s, many updates/models w/full documentation, (9) separate pwr supply w/wood rack cab, mahogany desk, \$9500/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Ramko DC 5MS 5 chnl stereo console, several remote inputs, working when removed, \$300. B Mayben, WKXJ, POB 91, S Pittsburg TN 37380. 615-837-5544.

Sparta A-10B monaural console, mint cond, \$300; Ampex AG-350 monaural FT in console, gd cond, \$300; Crown 801 monaural FT portable w/matching spkr/amp, \$200. B Weiss, KLSI, 3101 Broadway #480, Kansas City MO 64111. 816-753-0933.

Ramsa WR-8428 16x4x16x2, as new cond, \$7500/BO. F Baker, Sound Post, 7250 Thornapple River Dr, Caledonia MI 49316. 616-698-0866.

Ambassador mono 5 fader SS console w/step attenuators, modules, pwr supply, new/accurate manual, needs work, \$450/BO+shipping. M McCarthy, McCarthy Radio, 708-640-8965.

JBL 7510 automated mic mixers, rack mount, (1) w/8 inputs, (1) w/12 inputs. S Kozak, 351 Pinewood, Bay Village OH 44140. 216-871-5887.

RCA BC19A stereo console/ette, 4 chnls, no manual, needs work, \$350. W Nauman, WLVI, 400 J Royal Commerce Rd, Royal Palm Beach FL 33411. 407-793-5555.

BE 5S150 w/digital timer, well maintained. Ivan, WCUA, 301-984-1800.

Want to Buy

Collins 212B or Altec 230B, wrkg. R Osborne, WMOV, Box 667, Ravenswood WV 26164. 304-273-2544.

WE, RCA tube mixers and consoles, stock or custom, related brdct and rcrding equip and literature. R Van Dyke, Caffrey House, 2 Squires Ave, E Quogue NY 11942. 516-728-9835.

Sony MX-16, MX20, wrkg or not. J Parsons, 10375 Cannas St, N Huntingdon PA 15642. 412-863-9590.

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

Gates 10 chnl stereo executive, gd cond. J Gunton, WECM, 703 Berryhill Rd, Milton FL 32570. 904-623-1490.

Tangent 3216, I/O, echo, master modules, wrkg cond. B Cummins, 212-219-3670.

Sony MX16 or MX20. J Parsons, 10375 Cannas St, N Huntingdon PA 15642. 412-863-9590.

8 to 10 chnl stereo console. D Van Zandt, WJLU, 2596 State Rd 44, New Smyrna FL 32168. 904-427-9000.

LPB Signature Series S-21, 10 chnl dual mono, 3 inputs/chnl, gd cond. B Pitts, 205-487-6400.

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

Stereo Gates or Harris console for rebuilding. J Schloss, KICD, 2600 N Hiway Blvd, Spencer IA 51301. 712-262-1240.

Mono 8-12 fader, late working model console, prefer BE 8 or 10M150/200 or equiv. FAX specifications to MRE, 708-439-1464.

DISCO & SOUND EQUIPMENT

Want to Sell

Technics 2 TT disco biamped, \$2500; JBL/Crown sound system, Yamaha PM700, (10) mics, snake, 1500 W at 8 ohms, biamped, \$3000. H Bous, WUSC, 1204 Axtell Dr, Cayce SC 29033. 803-791-3804.

JVC SEA-10 (2), 5-band EQ, unbalanced I/O; Bose 802E active EQ for (2) Bose spkrs; all BO by 6/91. B Spitzer, KKLK/KKMK, Box 460, Rapid City SD 57701. 805-343-6161.

Yamaha REV-7 digital signal processor, 90 pre-set and user definable programs for reverb, echo, time-delay, w/remote, like new, \$685/BO. R Streicher, 818-359-8012.

Carvin 973 carpet-covered 3-way PA loudspkrs w/metal corners, steel grill and handles, 15" woofer, 6 1/2" mid, tweeter, 400 W, bi-amp jacks, like new, \$400/pair. B Fisher, KPOK, 122 S Main St, Bowman ND 58623. 701-523-3883.

University spkrs, N-3 crossovers, C63W woofers, HF206 tweeters, T30/H600 midranges, \$30 ea; (2) Ampex/JBL unmounted 12-ohm 7" spkrs for 600 series portable spkr-amps, excel cond, \$50 ea. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

24TK recording studio, fully equip, call for details, \$55,000; fully equip cassette dupl plant, Ampex BLM 200A w/(5) 3400 slaves like new, 32-1 and 64-1, mastering, loading, wrapping, \$55,000. Lundy Tape Duplicators, POB 408, Heidrick KY 40949. 606-546-6650.

Rane MA6, (6) 100 W chnls, like new, \$575; Rane SM6 splitter/mixer, \$225. M Norman, KCCU-FM, 2800 W Gore, Lawton OK 73505. 405-581-2425.

Lexicon PCM-60 digital reverb, gd cond, \$500+shipping. D Glasser, Airshow, 7021 Woodland Dr, Springfield VA 22151. 703-642-9035.

University speaker components, (2) N-3 adjustable L/C networks, \$20 ea; (2) C-63-W adjustable-response 15" woofers, \$20 ea; (2) HF-206 hypersonic tweeters (drvs & horns), \$40 ea; (2) T-30 mid-range drvs & H-600 horns assemblies, \$30 ea. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

dbx RM155 8-chnl NR unit, like new, \$750/BO. D Huettnier, Dynamic Sound, 358 Bell St, Neenah WI 54956. 414-722-7228.

Ampex/JBL unmounted 12-ohm 7" speakers (2) for 600-series portable speaker-amps, excel cond, \$50 ea. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

JBL/Century 4312/L-100, orig & studio mons, all US made, (4) avail, new, \$550 pair. C Keith, 9 Roxbury, Keene NH 03431. 803-352-8460.

Russco Disco 421 compact prod mixer, brdct quality, (2) phono, line & mic inputs, 3-band tone controls, headphone cue & meter

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LIMITERS

Want to Sell

Mod Sciences Stereoamaxx, excel cond, \$1800; Optimid XT2 accessory chassis, \$1300/swap for gd 8000A; Howe 2300 Phase Chaser (2), as-is cond, late models, \$800 ea. M Sadacca, KCKC-KBON, 740 W 4th St, San Bernardino CA 92410. 714-882-2575.

Texar Prizm, stereo, digital controlled processor and Texar Card 5 for Orban Optimid, \$2000; Vigilant Audio Processor, \$1500. G Kneisley, WEOL-WNWW, POB 4006, Elyria OH 44036. 216-322-3761.

Cutting Edge Tech Dividend composite filter processor, new w/manuals, \$1500/BO. D Mettler, WFBO/WNDE, 6161 Fall Creek Rd, Indianapolis IN 46220. 317-257-7565.

Aphex Compellor, 2-chnl, mint cond in box, w/manuals, \$975/BO. B Mitchell, KMXX-FM, 4745 N 7th St, Phoenix AZ 85014. 602-545-8181.

Audimax 4450A, gd cond w/manual; Volumax 4110, gd cond w/manual; both BO by 6/91. B Spitzer, KKLK/KMKM, Box 460, Rapid City SD 57701. 605-343-6161.

UREI LA-4 (2), trade for MAP II AM processor. J Randolph, WHIR/WMMGE, Box 1230, Danville KY 40422. 606-236-2711.

Gates Solid Statesman AGC (2), \$250/pair. H Widsten, KGNB/KNBT, 1540 Loop 337 N, New Braunfels TX 78130. 512-625-7311.

CBS Audimax 4450; CRL APP 300; CBS Volumax 411; all BO. NW Ariz Brdcast Eng, 602-753-1995.

Optimid 8000A
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CRL SEP-400A, mono, \$100; CRL SEP-400B, mono, \$100; (2) Valley Ppl Dynamite, 2-chnl, \$175 ea/\$300 pair; CBS Labs Volumax 4000, mono, \$75. P Walkowiak, WWWWM, POB 167561, Oregon OH 43616. 419-255-1470.

CRL FM stereo units: SPP800 preparation processor, SMP800 mod processor, (2) SEP400B spectral energy processors, right/left chnl, SG800 gen, \$1900/all. M Golub, WMJS, POB 547, Prince Frederick MD 20678. 301-535-2201.

Valley Ppl VP-440 limiter/comp/DSP, used 6 months, \$300. B Lord, Lord Brdcast, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Optimid 8000, recently factory rebuilt, \$1600. E Moody, KESE/KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Optimid 8000A, gd cond, used for back up, \$1700. B Watson, KSAK, 1551 E Amhr, W Covina CA 91792. 714-946-6249.

CBS Volumax 4110, w/manual, excel cond, \$150+shipping/trade for Ashley SC-50 compressor. S Mahaffey, Mahaf Prod, 3592 N Delsea Dr #12, Vineland NJ 08360. 609-692-3439.

Harris Solid Statesman FM limiter, working, as is, no manual, \$100. C Hendrix, WMNF, 1210 E Milking Blvd, Tampa FL 33603. 813-238-8001.

CBS Volumax 400 peak controller, \$150. L Wagner, ARN, POB 1788, Orlando FL 32802. 407-299-1299.

RCA BA 43/46 & 45 audio processor, working when removed, w/rack mount chassis frame, \$65. J Cunningham, KEOR/KHKC, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

CRL SMP-900 AM stereo matrix processor, \$1000. M Young, WJON/WJQ, POB 220, St Cloud MN 56302. 612-251-4422.

Mod Sciences CP-803 composite clipper incl rack mount, excel cond, w/documentation; Orban Optimid 8100A/XT2 6-band limiter chassis, excel cond, w/manual; CBS Audimax 4450A stereo AGC, gd cond; WMMEE/WQHK, 2915 Maples Rd, Ft Wayne IN 46816. 219-447-5511.

Valley 400 mic processor (3), never used, \$300 ea. W Bergman, WIZD-FM, POB 850, Plover WI 54467. 715-344-6050.

Want to Buy

Optimid AM 9000 audio limiter/compressor, prefer converted w/NRSC. A Crain, WAWN, Rt 6 Box 250, Byahlia MS 38611. 601-895-6483.

Fairchild 660/670, Teletrex LA2A and LA3A, other tube compressors and limiters, other tube signal processing equip. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Symetrix CL150B basic compressor. M Smith, WNYR, POB 98, Waterloo NY 13165. 315-539-5671.

Ashley SC-50 in gd cond, need badly. S Mahaffey, Mahaf Prod, 3592 N Delsea Dr #12, Vineland NJ 08360. 609-692-3439.

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

MICROPHONES

Want to Sell

Shure Beta 58, super cardioid pattern w/ neodmium magnet for grtr output, stand clamp and case, \$125. B Fisher, KPOK, 122 S Main St, Bowman ND 58623. 701-523-3883.

Electro-Voice RE 16, variable-D super cardioid pattern, rejects P popping well, w/clip and pouch, like new, \$125. B Fisher, KPOK, POB 477, Bowman ND 58623. 701-523-3883.

HME System 82 diversity wireless mic, w/body-pack xmttr w/Audio Technica mic, rcvr w/3-antenna syst, battery pack, road case, \$1000/BO; AKG VR-2 long exten tube for C-451 mics, never used, \$115. R Streicher, 818-359-8012.

Altec 639 (2), sound gd, \$500 and \$550. L Beigel, On-Cue Rcrding, POB 85042, Los Angeles CA 90072. 800-726-9813.

Crown PCC-160 cardioid condenser boundary mic, orig box, used few weeks, \$175. S Swanson, KBNL, Box 440029, Laredo TX 78044. 512-724-9211.

Sennheiser 404, batt pwr condenser w/pwr supply, \$50. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

Shure SM89 shotgun mic, w/foam wind-screen, hard carrying case & AB9SM shock-mount, like new, \$400. D Ross, DAF Prod, 408 S Seymour Ave, Mundelein IL 60060. 708-949-8360.

Audio Ltd RMS 14 wireless syst, (2) xmttrs, 182.2/183.0, (2) Tram 50 lavs, clip to Betacam back, w/rcvr for both mics, \$1500; Audio Ltd RMS 1000 dual chnl rcvr w/(2) xmttrs, 171.9/171.1, various audio connectors, \$1500. K Heinemann, Breken Entrprs, 7938 Jefferson, Munster IN 46321. 219-836-8325.

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

AKG C460B preamp w/CK-61ULS cardioid capsule, \$350+shipping. D Glasser, Airshow, 7021 Woodland Dr, Springfield VA 22151. 703-642-9035.

Shure SM82 line level condenser mic, new, \$150; (2) SM63L long handle interview mics, new, \$85 ea. E Davison, 125 N Illinois, Springfield IL 62702. 217-787-0800.

Shure SM-61 (4), vgc, \$235 all/\$60 ea. W Dougherty, WLD Rcrding, Music Valley Rt 1, Mill Spring MO 63952. 314-998-2377.

Neumann U-87 (2), w/wind screen & shock mounts, \$1250 ea; Sennheiser MD 441U, w/case, \$200; all excel cond, like new. S Kowalski, WXXL, 337 S Northlake Blvd #1067, Altamonte Springs FL 32710. 407-339-1067.

Telefunken/Schoeps CM-61 tube mic, very rare, uses std 6AU6 plug-in tube, w/o cables/pwr supply, mint cond, \$975/BO. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

Crown P2M 30GPG (2), w/PX-188 pwr supplies, like new, \$400 both. B Weiss, KLSI, 3101 Broadway #460, Kansas City MO 64111. 816-753-0933.

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).

Want to Buy

RCA 44-BX, and other ribbon/velocity mics by RCA, WE, etc. D deForrest, 7441 Wayne Ave 10-D, Miami Beach FL 33141. 305-866-5401.

RCA BK-10 TV boom mic, any cond. J Steele, WKVX-FM, Box 2525, Kingsland GA 31548. 912-729-6106.

RCA 44-BX mounting yoke for RCA 44-BX w/desk stand. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

RCA, WE, Neumann, AKG, etc, older mics, parts, stands, any cond, literature. R Van Dyke, Caffrey House, 2 Squires Ave, E Quogue NY 11942. 516-728-9835.

RCA 77A, any cond; RCA 88A, BK-10; WE 639; pre-U47 Neumanns; mic flags. B Kuhar, 1543 Eaton Ave, Bethlehem PA 18018. 717-645-8814.

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

AKG-414 & EV RE20, Irg condenser & Irg voice mic for studio work. W Dougherty, WLD Rcrding, Music Valley Rt 1, Mill Spring MO 63952. 314-998-2377.

RCA 44BX, any cond. R Howell, Boogie Man Studio, HCIB 1203, Cabazon CA 92230. 714-849-4030.

RCA 44s & 77s, WE 639, other ribbon mics. B Davies Virgo Prods, 5548 Elmer Ave, N Hollywood CA 91601. 818-761-9831.

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

Telefunken/Schoeps CM-61 tube mic pwr supply & cable. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 213-859-5543.

EV or other dynamic shotgun mics in working order, no condenser mics. D Neiburg, POB 194, Laurel MD 20725. 301-490-3015.

Altec, Normann, RCA, Sony, WE vintage mics. W Kreamer, Kreamer Kraft, 301 SW 16th St, Ft Lauderdale FL 33315. 305/524-5652.

MISCELLANEOUS

Want to Sell

KOSS ESP-10 electrostatic headphones, compl syst w/pwrng module and (2) headphones, \$100; AKG K-240 headphones, passive radiator design, dynamic, circumaural phones, cable repaired, gd cond, \$40. R Streicher, 818-359-8012.

Stancil-Hoffman mag film/video degausser; music library of (95) 15 ips tapes, (46) 12" dbl-side records; (2) kg matching audio spkrs; aluminum pole-cat set; much more, send for list. B Howard, Academy Film Prod, 3918 W Estes, Lincolnwood IL 60645. 708-674-2122.

Rotron Blowers for Eloom, CCA, CSI, McMartin, Harris, rebuilt & new.
Goodrich Enterprises Inc.
11435 Manderson St., Omaha, NE 68164
402 493 1886 FAX 402 493 6821

NBC NM-50 passive telephone (nemo) EQ, '50 vintage, \$75. B Kuhar, 1543 Eaton Ave, Bethlehem PA 18018. 717-645-8814.

Peerless xformer line, Altec octal plug-in, red #15095, green #4722, black # 15356A, \$20 ea. J Newman, Box 1211, Newport RI 02840. 401-847-0455.

Catel FMS 2000 FM stereo modulator, used 3 months, \$560. D Dennon, TPMD, 448 La Paloma, El Sobrante CA 94803. 415-222-5078.

Audio xfmrs, Peerless, Ampex, Triad, VTC, input, matching, isolation, \$15 ea. S Lawson, KAK Prod, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Patch bays, many audio and video avail, \$20 ea. W Tinsley, Public TV, 1123 Holcomb St, Watertown NY 13601. 315-788-3549.

ADC PJ341 sngl and dbl jack strips w/rack mount mats and 10' numbered pigtails; (5) Xmas tree terminals; (12) Switchcraft 17QF17 3' patch cords, some new; (2) Weatherbank 20-key keyboards, terminated in 5 pin 180° DIN plug; all BO by 6/91. B Spitzer, KKLK/KMKM, Box 460, Rapid City SD 57701. 605-343-6161.

ADC PJ341 sngl and dbl jack strips w/rack mount mats and 10' numbered pigtails; (5) Xmas tree terminals; (12) Switchcraft 17QF17 3' patch cords, some new; (2) Weatherbank 20-key keyboards, terminated in 5 pin 180° DIN plug; all BO by 6/91. B Spitzer, KKLK/KMKM, Box 460, Rapid City SD 57701. 605-343-6161.

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Sony RMM501 type-5 rack mount kits (6), never used, \$800. D Jordan, WDTM Inc, POB 3417, Jackson TN 38503. 901-668-1153.

Wilkinson mod xformer & high voltage xformer for 2.5 kW AM Wilkinson xmttr, BO; Collins xformers, (4) 115 V primary & (2) 900V CT secondaries, BO. A Terry, WOXY, Box 545, Bassett VA 24055. 703-629-5900.

Reach Elec VIP II pagers (25); Liaison Reach dial access paging terminal; Texas Instrument data terminal; BTC SCA gen; Belar SCM SCA mon, manuals & cables; \$7995/BO. B McMa-kus, KZJH-FM, Box 2620, Jackson WY 83001. 307-733-1770.

Music on hold interface to 1A2 phone syst, up to 5 lines, \$25 ea; 10 for \$100; Bogen Sam phone page interface, new, \$50/BO; Plantronics miniature operators headsets (2), w/289B DBL plug, new, \$25; WE 52 headsets w/289B plugs, jacks, gd cond, \$25; (2) Magneto field phones in Stell case, w/handsets, \$75/BO; sngl numb dealer red wall phone, new, \$35/BO. E Davison, 135 N Illinois, Springfield IL 62702. 217-787-0880.

RCA AVQ-21 WX radar system, \$400. D Fant, OK Two-Way, 413 NE 38 Ter, Oklahoma City OK 73105. 405-528-6467.

Gentner FBTRB prewire bay (10), \$225 ea; Gentner GEC-10A stereo prog switcher, \$400; Gentner GEC-FB-100 Flexiblock, SIE-MF2250, \$24 ea; Jim Long digital Dyaxis 320 MEG, w/Apple IICX, for digital editing, used 6 mnths, \$8000. B Lord, Lord Brdcastg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

ADC 1/4" patch bay, 52 pt, normalled, \$30. D Bailey, Fock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

ABC network decoder, BO. J Curtis, KLSQ/KFRO, 481 Loop 281 E, Longview TX 75606. 214-663-3700.

ADC 1/4" patch bay, 52 pt, normalled, \$30. D Bailey, Fock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

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Radio vet, 23 yrs exper, seeks On-Air C & W or AC in S GA, gd refs. B Rachels, 516 Colton, Thomasville GA 31792.

Rock jock looking for FFT slot, if you're sick of liner card stiffs & dead air, call me. S Dunaway, 5 Evergreen Dr, Conway AR 72032. 501-327-7587.

Tech school degree, interest sound eng, seeking compensated training AV prod work, studio recording/mixing, university radio, film prod or electro-mechanical servicing in CT. J Addison, 8 Thorne Rd, W Hartford CT 06110. 203-561-4534.

Main eng seeks FFT, P/T, contract work, CET, FCC licensed, radar endorsement, NABRE, NARTE certified, experienced. M Rakoff, 114-41 Queens Blvd #148, Forest Hills NY 11375. 718-591-3859.

Design eng/proj mgr, 8 yrs exper in network & local radio, articulate & committed, will travel anywhere. Engineer, POB 303, Avenel NJ 07001.

MSEE eng, SBE AM/FM cert, exper incl: teaching, troubleshooting, budgeting, mngmnt, construct, computers, rcrding & live brdcast. W Freeman, POB 125, Castleton VT 05735.

Annrc w/15 yrs exper seeks position in TX, AR, MO or KY, news prod & sales exper also. T Horan, 501-337-7218.

ATTN Syracuse area stations, looking to come back to area, 15 yrs exper in announcing, talk, news. W Byers, 321 16th Ave NE, Jamestown ND 58401. 701-251-2336.

Engineer w/8 yrs exper seeks position as chief/assistant in AZ, CA or UT, exper in AM stereo & directional & FM. Allen, 1854 Granada Dr, Riviera AZ 86442. 602-758-7829.

AM/FM/Combo turnaround wanted for consulting, no equity desired, small unrated mkt only. B Simonson, 208 Blake, Galesburg MI 49053. 616-665-7140.

P-B-P w/7 yrs exper, relocating to NH/MA 9/91, prev positions in SD, PD, MD, GM & OPS, salary not biggest factor, last 6 yrs at same smkt AM. A Ward, 602-855-9672.

CE, 4 yrs exper, studio construct, hi-pwr FM, directionals, programming, jock, seeking eng or combo position anywhere E of Mississippi. Paul, 904-654-1697.

Smart Eng, detail oriented, exper w/remotes, audio, prod, equip repair, seeking position at NYC-CT area broadcaster. D Schwartz, 5 Peveril Rd #3, Stamford CT 06902. 203-965-8340.

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

Data Signal MTI-700 modular telephone; (3) RCA Tactec programmable trunking mobile; 3M FAX machine; all BO. NW Ariz Brdcast Eng, 602-753-1995.

Sparta Elec misc audio & RF tech manuals, request list. D Peluso, KJUL-FM, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

Inflatable logo, over 20' tall, can be modified for your station, w/fan & transportation crate, like new cond, call for details. B Weiss, KLSI, 816-753-0933.

ABC network decoder, BO. J Curtis, KLSQ/KFRO, 481 Loop 281 E, Longview TX 75606. 214-663-3700.

ADC 1/4" patch bay, 52 pt, normalled, \$30. D Bailey, Fock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

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MISC . . . WTS

Harris 994-8524-001 motor-driven RF contactor, DPDT, 30A at 1 MHz, new; Harris 994-4703-003 motor-driven rheostat, 300 W, new. G Jablonski, WHMI, POB 887, Howell MI 48844. 517-546-0860.

Electrovoice Baronette spkr cabinet, w/ or w/out spkr, BO. D Geis, Geises, POB 991, Gualala CA 95445. 707-884-4833.

Moseley Assoc CSA-3 DC amp modules (2); Moseley Assoc MMA-1 mod mon adapter. H Ginsberg, WMEE/WQHK, 2915 Maples Rd, Ft Wayne IN 46816. 219-447-5511.

Lead screw for Presto 6N cutter, 120 lines; Edital 1" block for splicing tape; Audiohead alignment tape 7.5-15 ips 1/4" tape; Dynakit PAS II pre-amp. Mr. Oliver, 212-874-7660 in afternoons.

Gramplan cutter head, 1D feedback (tandberg); patch bays (4) 24 inputs single, also patch cords; Edital block for recorders 1". Mr. Oliver, 212-874-7660 in afternoons.

Cannon plugs, 3 prong, male & female, new tubes & resistors cheap; Lafayette TE22 audio gen; Sencore transistor & diode tester; manuals for Ampex, Pultec, others. Mr. Oliver, 212-874-7660 in afternoons.

Want to Buy

Military J-38 hand key and/or Vibroplex bug key, HS-30 head set. N Allebaugh, WICE, 100 John St, Cumberland RI 02864. 401-725-9000.

Leitch CLK analog impulse clocks; McCurdy SA137 timer displays; McCurdy SA138 clock displays; RCA Broadcast News. B Kuhar, 1543 Eaton Ave, Bethlehem PA 18018. 717-645-8814.

Heathkit weather station and accessories, latest model, computer interfaced, other models considered. Mike, MRG Assoc, 95 Colony Dr, Holbrook NY 11741. 516-447-1041.

Harrison Labs 8140A schematic/manual. O Diaz, KRON-TV, 1001 Van Ness Ave, San Francisco CA 94109. 415-661-8817.

Early radar equip for collection. A Weiner, WREM, 14 Prospect Dr, Yonkers NY 10705. 914-423-6638.

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

MONITORS

Want to Sell

TFT 724 AM mod mon w/preselector, \$750. S King, KATP, 7701 I-40 W Ste 660, Amarillo TX 79160. 806-359-5999.

TFT 760 EBS system w/tone gen and decoder cards, no rcvr, \$250/BO. L Fuss, WDTL, POB 159, Fayetteville GA 30214. 404-460-6159.

General Radio 1931-B AM mod mon, gd cond when removed, BO. A Terry, WODY, Box 545, Bassett VA 24055. 703-629-5900.

Belar FMM-2 FMS stereo, SCM-2 SCA, RF amp. J Phillips, WZOM, 408 1/2 Clinton, Defiance OH 43512. 419-782-8591.

UREI 813B & Bryston 4B studio monitors & amp. R Tieggen, Plum Sound, 335 Merrimac St, Newbury MA 01950. 508-415-5653.

Want to Buy

Felar FMM-1 & FMS or comparable. L Maierhofer, WTGC/WUNS, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

FM mon in gd cond. D Van Zandt, WJLU, 2596 State Rd 44, New Smyrna FL 32168. 904-427-9000.

CCA AMM1D service info, will pay postage & copy charges. P Hess, WPPJ, 134 Denwent Dr, Pittsburgh PA 15237. 412-366-1249.

Any older McMartin mod monitors. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

MOVIE PROD EQUIP

Want to Sell

B & H 16mm 202 opt/mag proj, w/sync motor for interlock, M-H 816 hot splicer, Beaulieu R16E camera w/ang 12-120 zoom lens, Hollywood rewinds, sound readers, split and solid reels, send for more info. B Howard, Academy Film Prod, 3918 W Estes, Lincolnwood IL 60645. 708-674-2122.

Magnasync Moviola Sx-B, 2-gang super 8 sync w/footage counter, like new, \$50. C Easlick, 2233 Cumberland Rd, Lansing MI 48906. 517-321-1900.

Want to Buy

Mitchell 16/35mm, other pro 16/35mm incl Arri, Aaton, CP; optical prnts esp Research Products 1000, 1001, Acme, Oxberry; cine lab equip incl sensometer; sm/med 16 or 16/35mm processing machine; optical rcdrs; Stenbacks; gd cine optics, Zeiss, Ultra-T, Angenieux, Cooke; Zeiss 95mm Distagon, reasonable, fair cond; will consider any film equip. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Javelin small 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.

RECEIVERS & TRANSCEIVERS

Want to Sell

Johnson ST-4A SCA rcvr, (18) at 67 and (20) at 92, all new and near-new, \$40 ea. R Evans, Cable Music Network, 156 Prospect St, Wilkes-Barre PA 18702. 800-743-1221.

Motorola Mocom 35, (1) on 2 meters, (1) 160-174 MHz, (1) Moxly VHG w/PL, \$100/all. P Russell, Bowdoin College, Sillis Hall, Brunswick ME 04011. 207-725-3066.

AM STEREO RECEIVERS Portable, Home/Studio, Auto RRADCO GROUP 708-513-1386

Panasonic RF-4800 digital shortwave rcvr, \$195. D Fant, OK Two-Way, 413 NE 38 Ter, Oklahoma City OK 73105. 405-528-6467.

Magnum/Dynalab FT-101 pro FM tuner for rack mounting, excel cond, modified w/Murata 150 kHz selectivity filters, FM/SCA circuit w/67 & 92 kHz outputs, \$461, incl shipping. B Elving, 241 Anderson Rd, Esko MN 55722. 218-879-7676.

Mart RR30/150 dual freq receiver, \$500. M Young, WJON/WJJC, POB 220, St Cloud MN 56302. 612-251-4422.

Realistic PRO-34 hand-held scanner, 200 chnl, receives to 960 MHz, nicads & chrg, like new, \$200; Bearcat BC 220 scanner, 20 chnl, VHF hi, low, UHF, aircraft, gd cond, \$100. M Martin, KWNO, POB 466, Winona MN 55987. 507-454-2918.

GE MPI (2), hand-held 2 W, 2 chnl VHF, w/charger & extra batteries, \$100 both. P Russell, Bowdoin College, Brunswick ME 04011. 207-725-3066.

Scientific Atlanta 9640 video receivers. J O'Neill, 713-621-2800.

High quality micro-miniature 67 kHz SCA decoder, about 1" square, prewired and ready to install, \$15. D Jackway, Background Music Eng, 5742 Fairoak, Springfield MO 65810. 417-881-1846.

Want to Buy

Fisher 90-T, 100-R or 202-R tube FM/AM tuners, gd cond, reasonable. J Douglas, Original Oldies Show, 402 Shirley Rd, Seaford VA 23696.

REMOTE & MICROWAVE EQUIPMENT

Want to Sell

Harris 6550 rcvr terminal, w/PS, down conv and baseband demod, \$750/BO; Control Resource 1055-B digital multiplexer, w/digital demod, clock recovery and Demux, \$700/BO. L Ayer, KRPL/KZFN-FM, POB 8849, Moscow ID 83843. 208-882-2551.

Moseley MRC 1600, Applied Digital Data R/C terminal w/mono video mon, (2) Volksmodem 12 modems, \$2950/all; will consider selling separately. D McIver, KBHL-FM, Box 247, Osakis MN 56360. 612-859-3000.

TFT 770 non-type-accepted composite dual xmt/rcvr STL system, 1 xmt not wrkg, 79 vintage, BO. J Shadle, KRBE-FM/AM, 9801 Westheimer #700, Houston TX 77042. 713-266-1000.

HME, prof brdcast quality VHF wireless mic system, System 85 mic, R-722 rcvr, Excalibur aluminum case, \$395. W Clark, Clark and Assoc, 318 E Calhoun, Macomb IL 61455. 309-837-2244.

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Trillium Panter II telephone key system, (20) 10-button phones, 2 speakers, KSU, KSS, 1 yr old, \$3500/BO. B Downs, KTSR, Box 3248, Bryan TX 77805. 409-846-1150.

Moseley PBR-15 remote control, studio and xmt units, BO. L Fuss, WDTL, POB 159, Fayetteville GA 30214. 404-460-6159.

TFT 7601-C remote cntrl syst w/xmt and (2) studio units, configured for 2 wire telco use, all manuals, spare parts, \$2000/BO. L Lindstrom, WCCO, 1520 N Rock Run Dr, Joliet IL 60435. 815-729-4400.

Harris 6100/6550 satellite receive station & rcvr, foreclosure sale, \$1500. G Milstein, WTYN-AM, 1241 E Lakeshore Dr, Landrum SC 29356. 803-457-3568.

Moseley STL-606/C composite xmt/rcvr updated by Moseley 10/89, \$4800. J Mauk, KMJ Radio, POB 70002, Fresno CA 93744. 209-266-5800.

TFT 7900/7901 remote cntrl syst, chnl interface, direct cntrl unit, (2) model 43 loggers, CRT opt w/Beghine, xmt not wrkg, \$3000. L Mueller, WSTF, 2500 Maitland Ctr Pkwy, Maitland FL 32701. 407-660-1011.

Moseley SCG-4T subcarrier gen, BO. NW Ariz Brdcast Eng, 602-753-1995.

Telos 10 10-line phone syst, used 6 mnths, \$1300. B Lord, Lord Brdcast, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

Moseley PCL303 STL on 950.00, w/kg when removed, as is, \$500; TIE 6-station phone syst & RPU, w/kg when removed, as is, \$125. E Stanley, KBTO, Box 12, Bottineau ND 58318. 701-228-2483.

Moseley SCG-8 FM subcarrier gen & SDC-8 FM subcarrier demodulator, 110 kHz, like new. P Baillon, Miles City Brdcasting, 1218 Pioneer Bldg 336, St Paul, MN 55101. 612-222-5555.

Burke TC-8 remote control system w/computer interface, \$2150. G O'Rear, WZEW, POB 2608, Mobile AL 36652. 205-432-0102.

Potomac Inst RMP-19D-210 digital remote meter panel for use w/AM-19, AM-19D, PM-19 & PM-112 antenna monitors, excel cond w/manual; Potomac Inst DAP-11 digital antenna monitor processing system for auto logging of antenna monitor directional parameters, w/PTR-11 printer & manuals. H Ginsberg, WMEE/WQHK, 2915 Maples Rd, Ft Wayne IN 46816. 219-447-5511.

COMREX RENTALS 1, 2 and 3-Line Systems Call Steve for details Silver Lake Audio (516) 623-6114

Moseley MRC-1600 remote control system, CRT terminal, (2) modems, set up for subcarrier but incl telephone link interface cards, \$2850 complete/BO. G Gaskay, KWNO, 261 Main St, Weed CA 96094. 916-838-3828.

TFT 7771 composite STL rcvr (2), separate mainframes, config'd for auto switch-over, work OK; Mod Sciences CLD-2501 composite line drivers (2), separate rack mounts; all excel cond, w/documentation. H Ginsberg, WMEE/WQHK, 2915 Maples Rd, Ft Wayne IN 46816. 219-447-5511.

Hnat-Hindes telephone interfaces (2), vgc, \$150 ea. G Arroyo, WONO, 2483 John Young Pkwy, Orlando FL 32804. 407-687-9345.

Harris/Ferranor Microstar 23 GHz digital STL, 2-hop system w/repeater, (3) 15 kHz analog & (2) 20 kHz digital audio chnl or video & (3) analog chnl, w/Sony PCM audio processor, factory aligned in May, \$15,000/BO. J Bisset, Multiphase, Falls Church VA. 703-379-1665.

Wegner satellite rcvr for SMN or Drake Chenaull satellite services. G Kneisley, WEOL-WNWW, POB 4006, Elyria OH 44036. 216-322-3761.

Scale 8000/450 RF preamp. J Steele, WKVX-FM, Box 2525, Kingsland GA 31548. 912-729-6106.

Gates/Harris RCG-10AC equip to operate xmtm from remote/studio location via phone pairs, older equip OK; Gates RDC-10AC or similar xmtm control and metering unit, both ends or parts, buy/trade. Chip, KCPS-AM, 408 N Main, Burlington IA 52601. 319-754-6698.

Moseley PCL 606/C rcvr in gd cond, any chnl. T McGinley, Cook Inlet, 630 Ivy Ln, Greenbelt MD 20778. 301-441-3332.

Composite STL syst, xmtm and rcvr, must be in gd wrkg order and meet FCC bandwidth requirements. B Harris, KXLT FM, 5350 S Roslyn St, Englewood CO 80111. 303-741-5654.

Wegner Panda II SPSC rcvr for Transtar format, main frame and card #s 1689, 2046, 1610 (2), 1644 and 1630. R Paskvan, WBJJ, 3516 Mill St, Bemidji MN 56601. 218-751-3077.

SATELLITE EQUIPMENT

Want to Sell

Scientific Atlanta 7300/7325 digital satellite receiving equip w/15 kHz cards and manuals, \$5000. B Shannon, WKZA, 5158 Countryside Dr, McKean PA 16426. 814-476-7426.

Scientific Atlanta 67300/7325 digital audio rcvr, w/(2) 15 kHz dual audio cards and voice cue card, like new, \$5500. J Jeizer, Sheboygan Brdcastg, 6400 Hawthorn Rd, Sheboygan WI 53083. 414-457-3366.

Microdyne 1100-FCCX1ROCL SCPC satellite downlink rcvr, 70 MHz down converter, excel cond, \$1200. T Hutchinson, KKL-AM, POB 639, Lowell AR 72745. 750-1440.

Moseley PCL-505 STL; Moseley RPL-3A remote pickup, 166.250 MHz; Moseley MRC remote control; Mark 4' STL dishes. J Phillips, WZOM, 408 1/2 Clinton, Defiance OH 43512. 419-782-8591.

Class A FM CP in Quincy CA, excel studio facilities built to lease or buy, BO. R Trumbo, KNLF, POB 117, Quincy CA 95971. 916-283-4144.

Class A FM w/CP to upgrade to 50,000 W, located half way between Jackson and Nashville TN, near Loretta Lynn Dude Ranch, \$150,000 w/\$25,000 down, shown only by appt, ref req'd, serious inquiries only. B Coleman, WIST FM, PBO 460, Lobelville TN 37097. 615-593-2294.

FM SCAs avail in 6 SE markets, 5 Class C, all grt tech facilities, BO. C Davis, Voyager Co, 3201 Glenwood Ave, Raleigh NC 27612. 919-781-7333.

1 kW daytimer; 3 kW FM, can get to 6 kW; LPTV chnl 6; cable chnl 8; BO. D Jordan, WDTM Inc, POB 3417, Jackson TN 38503. 901-668-1153.

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Scientific Atlanta 7550 satellite rcvr used 18 months on Transtar ACII format, like new, BO. J Curtis, KLSQ/KFRO, 481 Loop 281 E, Longview TX 75606. 214-663-3700.

Fairchild 384 digital satellite rcvrs (2), (1) w/15 kHz card, (1) w/7 kHz card, 10 months old, call for price. Jonathon, KNLT, 405-789-1140.

IGM EC, compl for satellite, half price. J Phillips, WZOM, 408 1/2 Clinton, Defiance OH 43512. 419-782-8591.

Fairchild Dart 384 digital audio satellite receiver w/downconverter & 100 degree LNA, \$4000. R Cowell, KNTR, Box 308, Ferndale WA 98248. 206-384-5117.

3"-4" 950 MHz dish or PARA reflector; also, Mari RPT-2 VHF and UHF. R Paskvan, WBJJ, 3516 Mill St, Bemidji MN 56601. 218-751-3077.

STL dish, 6' Mark, Scala or similar. D Donovan, KCGR-FM, 1620 American Bank, Corpus Christi TX 78775. 512-888-8555.

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1 kW AM station, E SC town of 7,000, w/5 kW upgrade, \$90,000 w/small downpayment, owner terms. John, POB 649, Alma GA 31510. 803-661-6000.

APPRAISALS, radio, \$600 + expenses, 404-928-7906.

Western PA, 1 kW AM on 960, dark since March, \$65,000, easy terms. B Shannon, WKZA, 5158 Countryside Dr, McKean PA 16426. 814-476-7426.

Low pwr TV-CP, chnl 26, buy all or joint venture, CA LPTV, ready to construct; radio station, 1290 AM, Santa Barbara CA, currently dark, \$250,000/as is, \$400,000/back on air. G Erway, Gol LPTV, 46 Freedom Place, Buellton CA 93427. 805-688-9231.

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1 kW daytimer; 3 kW FM, can get to 6 kW

TAX DEDUCTIBLE . . .

5 kW FM xmtr, 2 element antenna, RF wattmeter, 200' coax, satellite receive equip. T Hunt, Faith Comm Corp, 2201 S 6th St, Las Vegas NV 89104. 702-731-5452.

World for Christ Radio needs 50 kW xmtr, non-profit foundation. C Riddle, WFCR, 6046 Greenway Ct, Manassas VA 22111. 708-878-4441.

FM radios, boom boxes, table models, lrg portables, wrkg order, for modification for blind ppl to get subchnl radio reading service, donate/sell lwr price. B Elving, 241 Anderson Rd, Esko MN 55722. 218-879-7676.

Religious group needs board & TTs, tax deductible. G Pettyjohn, Hour of Truth Ministries, POB 12379, Knoxville TN 37912. 615-688-7044.

Educ FM station for Port-au-Prince, Haiti, needs easy listening tapes for auto syst, tax receipts avail. R Weir, Radio Lumiere, POB 15665, W Palm Beach FL 33416.

Emanuel Methodist Church needs donations of any audio & video equip, will pay shipping. M Williams, Emanuel Church, POB 163, Baraboo WI 53913. 608-356-8518.

Handicap radio station needs donations of all brdcstg equip. G Pinckard, 4930 Franklin Ave, Los Angeles CA 90027. 213-661-6528.

Harris/Gates FM exciter; also, 19" rack, 5-6' enclosed; will pay shipping. A Hagler, KMUD, POB 135, Redway CA 95560. 707-923-2513.

LP community Amer would appreciate brdcst equip donations incl xmtrs, will pay freight. R Schoedel, WMCB, c/o 4305 Eber Rd, Monclova OH 43542. 419-893-7966.

Educ station needs all types FM brdcst & studio equip for start-up, will pick up. M Casey, West End Radio, 303 Main St, Hampden MA 01036. 413-566-2445.

Eng student desiring donation of old brdcst 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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AVCOM PSA-65A, 1-1000 MHz spectrum analyzer, w/10 kHz res BW option, \$2650/BO. C Springer, KLMP, POB 890, Lamar CO 81052. 719-336-2206.

Ferroglyph RTS-2 rcrdr test set, compact for analog tape rcrdr calibration and alignment, measures freq response, SNR, distortion, wow and flutter, \$750. R Streicher, 818-359-8012.

HP/Harrison 6200B, DC pwr supply, like new, \$150. M Norman, KCCU-FM, 2800 W Gore, Lawton OK 73505. 405-581-2425.

Sencore DVM32 multimeter, like new, \$50. E Davison, 125 N Illinois, Springfield IL 62702. 217-787-0800.

B&B AM2B phascope, used 6 mnths, \$1000. B Lord, Lord Brdcstg, 13313 SE 208th St, Kent WA 98042. 206-631-2374.

B&K E-200D RF signal generator, like new, \$195; B&K 520B transistor tester, \$149. A Bernard, WA2JTN, POB 690098, Orlando FL 32819.

HP 1741A 100 MHz dual trace storage scope, \$888; Paratronics 5000 logic analyzer w/pods, \$475; HP 8444A tracking generator, \$1250; HP 5341A counter, \$1200; HP 8445B preselector, \$1100; HP 717A variable klystron pwr supply, \$67. G Wachter, KFYI, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Technical Material 18K-A 18 kW dummy load, \$895. R Smith, KFGSA, 1122 Via La Cuesia, Escondido CA 92029. 619-739-1835.

★encor SC61 wave analyzer, \$1550; LC75 Z meter, \$400; FC71 freq counter, \$650; HP 239A oscillator, \$385; HP 331A noise & distortion, \$500; HP 400E voltmeter, \$200. B Adene, McKenney Brdcst Rg, Rt 3 Box 205, Russellville AR 72801. 501-967-5451.

General Radio 1606-A RF bridge, late prod serial #1700, grey panel, excel cond, \$475. A Smith, Adams & Smith, 25 Stonehedge Rd, Lincoln MA 01773. 508-841-2209.

Heath IG-5218 sine-square wave audio gen, gd cond, w/manual, \$40; Heath SM5218 VTVM w/manual & leads, gd cond, \$25. D Bailey, Rock Shoppe Prod, 3422 Beech St, Rowlett TX 75088. 214-475-9796.

Want to Buy

RCA/Nems-Clarke field intensity meter. A Crain, WAVN, Rt 6 Box 250, Byahlia MS 38611. 601-895-6483.

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Thompson CSF 334583 chnl 2 TV xmtr w/synthesized offset, 10 W, excel wrkg cond. R Paskvan, 3516 Mill St, Bemidji MN 56601. 218-751-3077.



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RCA BTA10 10 kW xmtr, \$8000; RCA 50H 50 kW xmtr, \$12,000. V Stone, WWMO, POB 81, Cascade VA 24069. 804-685-3128.

Collins 21-E 5 kW AM xmtr tuned to 1380 kHz, Hays spare crystals for 1260 kHz, needs finals, 1 kW cut back on skids, gd cond, \$4500. T Edmison, WDKN-FM, 106 E College St, Dickson TN 37055. 615-446-0752.

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RCA 10 kW FM, recently removed, \$5000. C Strozler, 205-928-9406.

1982 Harris 20 K with MS-15 exciter. Good condition. Recently taken off the air. Contact Mr. David Dovich, Celebrities Productions, POB 11543, St Louis MO 63105. 314-721-1247.

Harris BC1H AM MW xmtr, 250/500/1000 W, in use, c/n, gd cond, well maint, BO; Collins 550A-1 AM xmtr, 500 W, gd cond, \$2500/BO. A Terry, WODY, Box 545, Bassett VA 24055. 703-629-5900.

Harris TE3 exciter, \$600/BO. E Moody, KESE/KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

CSI 25,000 25 kW AM xmtr, tuned to 1200 kHz, like new, \$30,000, you ship; CSI T-1000A 1 kW AM xmtr, tuned to 1480 kHz, vgc, \$7000, you ship. G Arroyo, WONQ, 2483 John Young Pkwy, Orlando FL 32804. 407-687-9345.

Kahn STR-77 AM stereo exciter, grt cond, tuned to 900 kHz, BO. J Bisset, Multiphase, Falls Church VA. 703-379-1665.

Continental 816R-3B 25 kW FM xmtr w/802A exciter, all manuals & compl spare parts kit, has less than 200 hrs, can easily be tuned, \$47,500 FOB St Paul. D Thompson, Minnesota Public Radio, 612-290-1599.

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Versacount V-322 manual, copies fine. E Mitchell, Star 105, 12201 Merit #930, Dallas TX 75251. 214-716-7800.

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Collins 831-G 40kW FM dual (2) 20kW xmt's w/combiner	25,000	Gentner Audio Prism stereo pair	1,795	Nautel Ampfet 1 1kW AM solid state	12,000	Tektronix 2236 scope, 2 years old	1,200
Collins 20V3 1kW AM transmitter	3,000	Go-Cart 24 multiple cart player, stereo, several available	ea. 2,000	Nautel Ampfet 5 5kW AM solid state	18,000	TFT 7700B composite STL system	4,175
Collins 831G 10kW FM transmitter	11,000	Harris AM-90 AM modulation monitor	1,000	Nautel Ampfet 10 10kW AM solid state	25,000	TFT 8300 composite STL system, 1 rcvr, 1 xmt	6,000
Continental 3148 4.3 kW FM, 5 years old	12,000	Harris BC-1H 1kW AM transmitter	4,000	Neumann U87A microphone w/WS/87 windscreen, several avail	ea. 1,000	TFT 844 FM stereo mod monitor, complete freq. synthesised	3,000
Continental 315R1 5kW AM, PDM modulation	18,000	Harris FM 25K FM transmitter, 1983, well maintained	17,500	Optimod 8000A	1,000	TFT 8600A 950MHz STL system rcvr/xmt discreet 2/channels	3,000
Continental 814R-1 2.5kW FM w/510R1 exciter	7,000	Harris FM 40K 2-20kW FM w/combiner	35,000	Optimod 8100A	2,000	TFT 8610 remote control system, 10 channel	2,120
Continental 816R w/exciter, 5 years old, 25kW FM	20,000	Harris FM 5H 5kW FM 3 phase with Harris MX 15 exciter	10,000	Optimod 9100B1/U Optimod AM mono	2,000	TFT 8700 voice grade TSL system, 1 rcvr, 1 xmt	1,500
CRL Audio Signature FM/AM stereo processor	3,000			Optimod 9100B2/U stereo Optimod AM	3,250	TFT 8888 RPU transmitter w/8889 receiver	2,750

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boxes, like new, \$3900 ea. B Evans, KBAC-
FM, 740A St Michael, Santa Fe NM. 505471-
7110.

Technics SLP-1200 & SLP-1300 CD players,
in use, no remotes, \$800 ea/\$1500 pair; Tech-
nics SP-10 TT w/SME 3009-R tonearm, Or-
tofon MC-10 Super, Allied shock-absorber
pedestal, spare pedestal insert, \$1350 pkg;
(3) Urei 1122 transcription preamps, \$45 ea.
P Walkowiak, WWWW, POB 167581, Oregon
OH 43616. 419-255-1470.

SP 10M2A TT (2), SH-10E pwr supply, SH-
10B3 base, 303 micro trak tone arm, \$400 ea;
(2) McCurdy AT235 preamp modules, \$150;
(2) Ramko Research LC-4 console remote
cntrl modules, \$25 ea. A Williams,
CKCK/CKIT, 306-569-6200.

Russco Studio Pro B (2), w/hw idler wheels,
excel cond, \$100 ea. W Kremer, Kremer Kraft,
301 SW 16th St, Ft Lauderdale FL 33315. 305-
524-5652.

Want to Buy

Disc recording equip accessories, heads,
amps, limiters, needles, blanks, manuals, liter-
ature, etc. K Gutzke, Custom Recording, 7134
15th Ave S, Minneapolis MN 55423. 612-866-
6183.

Gates CB500 or others, prefer wrkg w/amps.
R Osborne, WMOV, Box 667, Ravenswood
WV 26164. 304-273-2544.

Rek-O-Kut M125 lathe lead screw parts. J
Parsons, 10375 Cannas St, N Huntingdon PA
15642. 412-863-9590.

Rek-O-Kut M512S lathe screws or compl
machine. J Parsons, 10375 Cannas St, N Hun-
tingdon PA 15642. 412-863-9590.

RCA Presto disc rcrdrs, blanks, needles; al-
so, prerecorded discs & pressings. B Davies,
Virgo Prods, 5548 Elmer Ave, N Hollywood
CA 91601. 818-761-9831.

Fairchild disc rcrding equip, #740 & simi-
lar, Presto, Rek-O-Kut, RCA, etc; also, acces-
sories incl amps, limiters, heads, manuals,
needles. K Gutzke, 7134 15th Ave S, Min-
neapolis MN 55423. 612-866-6183.

Fairchild 750, any cond. R Howell, Boogie
Man Studio, HCIB 1203, Cabazon CA 92230.
714-849-4030.

TV FILM EQUIP

Want to Sell

RCA film island, TK29B camera, (2) TP66
16mm proj, TP7 35mm slide proj, lw hrs, new
tubes, like new, \$12,500; Panasonic/JVC
AG1950 edit syst, (2) VCRs, A-95 controller,
excel cond, \$1450; JVC KA-3U Betacam back
for KY series cameras, \$395. D Brennan,
Brennan Entrprs, 3596 Loma Ridge Dr, Bir-
mingham AL 35216. 205-823-0088.

VIDEO PROD EQUIP

Want to Sell

JVC RM820 video editing controller for JVC
3/4" editors, excel cond, \$175. G Ormrod,
GFO Prod, 432 X St E. Tumwater WA 98501.
206-352-8028.

Sony LDP-1000A industrial laser video disk
player for CAV & CLV disks, external sync,
subcarrier inputs for use on line, R5232C seri-
al port for computer interface, remote, case,
\$500. J Krepol, 7 Dustin Dr, Wilmington DE
19703. 302-798-4076.

Video time base corrector, gd price, call for
details. J Schramm, 205-826-0390.

Sony VO-3800: portable VO-3800 video
recorder, needs REP, color video camera
DXC-1600 w/Canon TV zoom lens-200,
V6x18, 18-108 mm, 1:1.6, camera control unit
DXC-1600, color adaptor AC-3000, camera
adaptor AC-1600, cart w/camera mount &
swivel cords, (4) batt packs, (11) used cas-
settes, \$300+shipping. W Steinfeldt, AT&T,
320 Holloway Rd, Ballwin MO 63011. 314-227-
7545.

Strand Century CCR600 studio/stage light
dimmer system, 8 chnl, 4 kW/chnl, 120 V,
semi-portable, compact, full documentation,
\$1100. D Boggs, Covenant Prod, Anderson U,
Anderson IN 46012. 641-4344.

Orban 536A dynamic sibilance controller,
\$350/BO. F Baker, Sound Post, 7250 Thornap-
ple River Dr, Caledonia MI 49316. 616-698-
0866.

Grass Valley 950 sync gen, 908 color black
gen, 955 358 MHz oscillator, 900 pwr supply,
rack & extender, \$95 ea/\$275 whole system;
Barco GD-33 color RGB pro monitor, \$95. G
Wachter, KFYI, 831 N 1st Ave, Phoenix AZ
85003. 602-258-6161.

Want to Buy

Edutron CCD 2H-2 tech manual, will pay for
Xerox and related costs. R Carlsen, Univ of
Wash, M/S SB 54, Seattle WA 98195. 206-543-
8455.

Sony 1630 or 1610 digital audio processor &
late mdl 3/4" VTRs, must be complete & in
top cond; also need read-after-write boards
& other access for above. T Krikorian, RPM,
4198 Orchard Lake Rd, Orchard Lake MI
48323. 1-800-521-2537. In MI: 313-681-2660.

**VIDEO TAPE
RECORDERS**

Want to Sell

Panasonic NV-9400 portable 3/4" w/AC adap-
tor, excel cond, \$425. G Ormrod, GFO Prod,
432 X St E, Tumwater WA 98501. 206-352-
8028.

Sony VO2600 U-matic VCR (2), \$425
ea+shipping; Panasonic NV9100A U-matic
player, \$350+shipping. N Mishan, POB 335,
Lynbrook NY 11563. 516-582-1338.

Ampex VPR-2B w/TBC-2B, AST slow-mo,
\$11,500; same w/stereo audio kit, \$12,500;
Ampex ACR-25 (2), spare parts, carts, air
compressor, \$3,500. R Beierle, KFYR-TV, 200
N 4th St, Bismarck ND 58501. 701-255-5757.

IR/Magnavox IT4 VHS VCR will convert PAL
tapes for PB on any NTSC TV w/a vertical
hold control, \$400. D Rappoport, Tape Con-
version, POB 650185, Miami FL 33285. 305-
387-3330.

Ampex AVR-2 (2), vgc, w/Tektronix monitor
bridge, (2) spare video heads, (4) stereo
stacks, (3) mono, BO. B Winans, WMHT-TV,
17 Fern Ave, Schenectady NY 12306. 518-356-
1700.

JVC CP5000U 3/4" U-matic player w/wired re-
mote, grt cond, w/20 KCS20 U-matic tapes,
\$550. B Hines, IPS Inc, RD 1 Box 413A, Ex-
port PA 15632. 412-468-4115.

Sony 2600 3/4" R/P, excel cond, \$400. R Jen-
sen, Telecable Prod, 5812 21st St, Radue WI
53406. 414-632-3131.

Sony BVU-100 VTR, rebuilt by Sony, Por-
taBrace case, excel cond, all manuals, \$2000.
MRG Prod Assoc, 516-447-1041.

Sony VO2610 3/4" U-matic stereo, \$390; So-
ny VP2011 3/4" U-matic stereo, \$290. G
Chapekis, Digital Prod, POB 22122, Denver
CO 80222. 303-689-9114.

Zenith/Sony VR9800 w/VR9850 tuner/timer,
Beta, matches Sony F-1 PCM, vgc, \$200/BO.
J Martin, WHIL, POB 160326, Mobile AL
36606. 205-460-2395.

Sony BVU-50, 3/4", w/ime gen, Kangaroo case,
\$750. K Schmidt, Bristol Prod, 2401 Bristol Ct
SW, Olympia WA 98502. 206-754-4260.

Sony VP-1000, \$100; VP-1200, \$120; VP-2000,
\$200; VO-2630, \$300; VO-2850, \$200; VO-3800,
\$250; BVE-500, \$300; BVE-500A, \$400; AV3600,
\$150; AV3650, \$200; (6) Panasonic NV-9100,
\$200 ea; Ampex VR1200B parts & heads, \$500.
J Krepol, 7 Dustin Dr, Wilmington DE 19703. 302-
798-4076.

Toshiba V-8000T 1/2" Beta 2&3 w/remote, man-
ual, orig box, needs tweaking, \$40; JVC HR-
D725U 1/2" VHS HiFi w/Dolby on linear trks,
w/remote & manual, \$200; JVC CR-4400LU 3/4"
portable rcrdr, needs tweaking, \$600; Sony
SLC340 1/2" Beta I portable, w/pwr supply, cover
& strap, lw hrs, grt cond, \$500. D Bailey, Rock
Shopper Prod, 3422 Beech St, Rowlett TX
75088. 214-475-9796.

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JVC 200 VCR, 1", need parts plus repair manu-
al. J Bahtar, Maine Reel, 67 Green St, Augusta
ME 04330. 207-623-1941.

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