

Seattle RF Proposal Fought

by John Gatski

Seattle WA Local broadcasters in conjunction with the Washington State Broadcasters Association have joined forces with the NAB to oppose a proposed city RF radiation emission standard 10 times more stringent than current FCC guidelines.

Stations that serve Seattle believe the proposed ordinance is unnecessary and not based on scientific research. The NAB fears a "snowball" effect that could have national implications, costing stations millions of dollars if the city council

adopts the recommendation.

The controversy is the result of a Seattle Office for Long Range Planning recommendation to limit human RF exposure to 100 $\mu\text{W}/\text{cm}^2$ (microwatts per square centimeter).

Stricter than ANSI

The proposed 100 $\mu\text{W}/\text{cm}^2$ limit is 10 times more strict than the 1000 $\mu\text{W}/\text{cm}^2$ voluntary American National Standard Institute (ANSI) standard that is recommended but not mandated to broadcasters by the FCC.

"If the city of Seattle is successful, it (a

strict standard) could be implemented anywhere else," said KOMO-AM/TV Engineering VP Don Wilkinson, a member of the group spearheading opposition.

According to Seattle officials, city council could approve the ordinance by late July.

The ordinance would require new and existing stations that increase power or change their antennas to obtain a permit from the local health department.

In order to receive a permit, a station would have to make engineering calculations of the antenna's potential RF emission level.

If engineering analysis concluded that RF emissions are 75% (or higher) of 100 $\mu\text{W}/\text{cm}^2$ for new stations or those changing their antenna or transmitter, the station would have to provide actual monitoring results to the health department.

(continued on page 7)

Most Favor AM Plan

by Charles Taylor

Washington DC An FCC proposal aimed at reducing AM interference by allowing stations to adjust coverage areas or go dark was widely supported by most broadcasters, despite the NAB's continuing criticism that it would promote the controversial concept of "negotiated interference."

The item, contained in Docket MM 89-46, would allow AM licensees to agree among themselves to reductions in protected contour areas, which the FCC said would ultimately reduce interference to

neighboring stations.

It also would discontinue the current practice of grandfathering for a year the radiation and protection rights of stations that surrender their licenses.

Comments of opposition

In comments filed in June, the NAB insisted that establishment of a waiver policy under which the Commission would accept certain contingent applications was more appropriate and less radical than a formal rulemaking.

"We advocate a system whereby the

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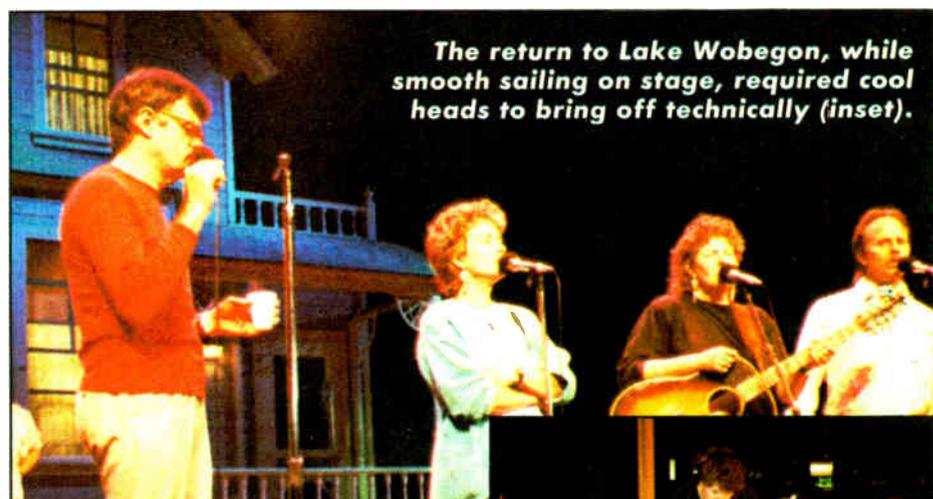
DYNAMAX LEADS COMPETITION BY NEARLY TWO TO ONE

The New Professional Audio Marketplace (PAM) Census and Survey from Sheer and Chaskelson Research, Inc. reports that an estimated 47.6% of all broadcast facilities planning to purchase cartridge machines in the next twelve months have chosen DYNAMAX by a margin of nearly 2 to 1 over any other brand of cartridge machine.

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The return to Lake Wobegon, while smooth sailing on stage, required cool heads to bring off technically (inset).

Wobegon Revisited

by Frank Beacham

Lake Wobegon MN In Garrison Keillor's hometown, where all the women are strong, all the men are good looking and all the children are above average, there's a pretty good radio station.

At Radio Wobegon, as it's known by the locals, the women hold all the top jobs, the men are very good engineers and the offspring—all above average—are some of the most unique live radio programs to come along since the medium's "Golden Age" 40 years ago.

A *Prairie Home Companion*, the legendary live weekly radio show from Minnesota Public Radio that showcased Keillor's small town stories from the mythical Lake Wobegon, ended as a weekly series in the summer of 1987 after a 13-year-run.

But the fiercely loyal listeners who tuned in Saturday evenings on American Public Radio network never let go, and Garrison Keillor has returned for the past two summers with nationally-broadcast PHC "farewell" programs.

Transported cross-country

On 10 June, *The Third Annual Farewell Performance of A Prairie Home Companion* was broadcast throughout America by



more than 200 radio stations to an estimated 3.5 million listeners on the APR network.

This was his first live national broadcast of *A Prairie Home Companion*. Lake Wobegon, for one summer weekend, was transported by tractor trailer truck to the stage of the 6,000-seat Amphitheatre at Universal Studios in Los Angeles.

Some familiar characters were back: Buster the Show Dog; Pastor Ingqvist and his wife Judy, and the Norwegian bachelor farmers who hold court at the Chatterbox Cafe. And some not so familiar characters also were back: those seemingly "shy" people from Radio Wobegon who are rarely seen but whose talents bring this mythical world to life for the radio audience.

To hear a *Prairie Home Companion* is (continued on page 18)

NEWS BRIEFS

No Special Filing Provision

Washington DC The FCC said it will not reinstitute provisions giving minority and noncommercial applicants an exclusive opportunity to use channels in already served areas.

The National Black Media Coalition (NBMC) and its New York affiliate, National Black

Coalition, sought reconsideration of a report and order under a 1985 docket deleting the non-technical AM application acceptance criteria from its rules, including the special provision. National Public Radio supported the call for reconsideration.

The deleted provisions required that proposals for new AM stations or major changes in existing stations could be ac-

cepted for filing only if the proposal was designed to serve unserved areas or communities. The purpose was to funnel AM growth into areas lacking adequate service and to stimulate the growth of FM, which at that time, was a fledgling medium.

But the FCC ruled that changes, including the emergence of FM as the predominant aural broadcast service, have a negative bearing on the continuing need for the non-technical acceptance criteria as a whole.

The Commission pointed out that new rules regarding non-

clear channels are expected to provide expanded opportunities for minority filings. For the first time, the FCC stated, minorities, along with others, can apply for AM stations in multistation communities on the 82 channels from which the former non-technical acceptance criteria had barred all applicants.

More Radio on TV

Raleigh NC Four Raleigh area AM radio stations are simulcasting the 6 PM WPTF-TV news for their commuting listeners.

Signed on are WXKL, Sanford, WBZB, Selma, WCBQ, Oxford, and WLLN, Lillington. The AMs are allowed to sell ad time over the TV station's spots.

The simulcasting with AM makes for a "good combination," said WPTF Operations Manager Bob Wolfe with AM leaning toward a talk format and not as program restrictive as FM. He also noted some AMs are looking for alternatives when budget restraints force them to cutback.

A similar simulcasting effort is ongoing in Charlotte.

SBE Nominations

Indianapolis IN The Society of Broadcast Engineers (SBE) has proposed a slate of officers for 1989 whose election will be announced in October at the annual convention in Kansas City, MO.

Officers proposed are: Brad Dick, Lawrence, KS, president; Richard Farquhar, Columbus, OH, VP; Paul Lentz, Toledo, OH, secretary and William Harris, Denver, treasurer.

Nominated for the board of directors are: Phil Aaland, Tucson, AZ; Frederick Baumgartner, Aurora, CO; Terrence Baun, Milwaukee; Dennis Behr, Madison, WI; Dane Erickson, Burlingame, CA; William Hine-man, Indianapolis; Charles Kelly, Quincy, IL; Joseph Snelson, Lenexa, KS; Tom Weems, Simi Valley, CA, and Larry White, Tulsa, OK.

Under SBE rules, additional nominations may be submitted in writing to the secretary by 28 July. The current secretary is Richard Farquhar, SOS Productions, 753 Harmon Ave., Columbus, OH.

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Duopoly Rules Benefit Stations

by Alan Carter

Schenectady NY Changes in duopoly rules enacted by the FCC last fall are allowing certain station owners to simulcast programming and increase their coverage areas.

Under liberalization of duopoly rules The RadioActive Group recently bought 50 kW WACS-FM and 3 kW WNYJ-FM here, and will simulcast programming on the two stations.

WACS, assigned to Cobleskill, NY, in suburban Albany, and WNYJ, assigned

to Rotterdam in the Albany, Schenectady, Troy market, are about 26 miles apart. The stations fall under new FCC rules adopted last October that set the overlap restriction to the 3.16 mV/m contour for FM, up from 1 mV/m under previous rules.

"... We can go to the Honda dealer and say you can have (coverage) from here to the green mountains of Vermont," said RadioActive President Bruce Lyons.

Coverage area

With a simulcast format—claimed to be the first in a major market for FM—the combined coverage area is from Western Massachusetts and Western Vermont through the capital district of Albany to Utica, Rome and west to Syracuse in upstate New York, Lyons said.

This is among the first of a series of station deals that could be forthcoming under the new duopoly rules. In addition to changing the overlap restrictions for FM, the Commission changed the restrictions for AM from the 1 mV/m contour to 5 mV/m.

NewCity Communications was the first group to take advantage of the duopoly rules in March when the company purchased WKLS-FM in Atlanta to go with its WYAY in nearby Gainesville.

The two stations, however, are not simulcasting.

"Improved" fairness

Lyons said the change in the duopoly rules makes radio broadcasting "more fair," allowing owners to buy smaller stations in suburban areas and join them together to compete with more powerful stations. He noted that under this deal, RadioActive took a Class A, WNYJ, in a major market and combined it with a more powerful Class B for added

... the change in the duopoly rules makes radio broadcasting "more fair"...

coverage area.

The simulcasting was to begin 21 June with a new format RadioActive calls "SHO Radio." A spokeswoman said it will be a registered trademark for RadioActive, like Westwood One did with Pirate Radio.

SHO Radio, for "show radio," will be a "hot AC, personality- and promotion-oriented" format.

For information from RadioActive, contact Jessica Bennett at 518-393-2300.

Bush Taps Nominees

by Charles Taylor

Washington DC The White House in mid-June nominated Washington attorney Sherrie Marshall and Illinois Commerce Commissioner Andrew Barrett for two vacant seats on the FCC.

Announcement has been delayed, however, of a nomination for chairman, a seat expected to go to Alfred Sikes, head of the National Telecommunications and Information Administration (NTIA).

Sikes, if approved by the Senate, would replace Chairman Dennis Patrick, who announced his resignation 4 April pending approval of a successor. Marshall and Barrett would fill vacancies that have existed since April 1987 and October 1987.

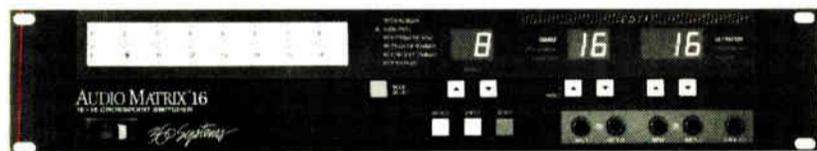
A White House spokesperson did not know when Senate confirmation

hearings would be scheduled.

Marshall, 35, is a former director of the Office of Legislative Affairs at the FCC and currently is a partner with Wiley, Rein and Fielding in DC. She also was an attorney with the White House Counsel's Office in the Office of the President-Elect for President Bush.

Barrett, 47, has been an Illinois commerce commissioner since 1980. Before that he was assistant director of the Illinois Department of Commerce and Community Affairs.

Sikes, 49, has been assistant secretary of Commerce for Communications and Information and head of the NTIA since 1986. He has been involved in management of Missouri radio stations and headed a Missouri broadcast and political consulting firm.



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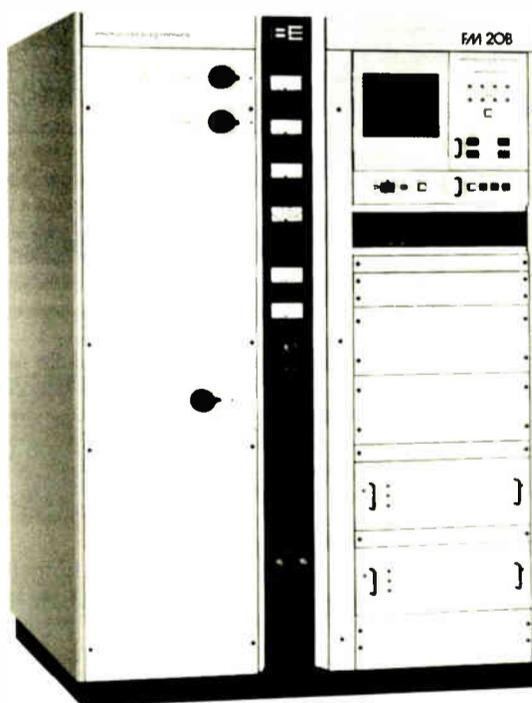
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Bucking For A Fighting Chance

by Judith Gross

Falls Church VA It takes an act of Congress to declare war.

Fitting then, isn't it, that it's no less than Congress itself that is contemplating action now to help **AM's war** for technical parity with FM.

I'm talking about HR 1136, better known as "**The Broadcast Radio Quality Improvements Act of 1989**" introduced by New Jersey Congressman Matthew Rinaldo, whom we have dubbed around here "AM's Knight in Shining Armor."

The bill has a twin over in the Senate, sponsored by Senator Robert Packwood.

What they do, basically, is **amend the Communications Act of 1934**, the one that gave the FCC its current mandates, to make things better for AM with some other good morsels to help FM as well.

First and foremost, the bill requires receiver manufacturers to make radios that pick-up **both AM and FM**—no more "FM only" radios, guys. And if the radio has FM in stereo, it has to get AM in stereo as well. No more excuses.

It strengthens the FCC's requirement for **locally oriented service** and also assures "**interference-free service**."

It also lets daytimers "homestead" on the **expanded AM band** for five years while they continue to broadcast on their original frequencies. After five years the original frequency is phased out and not reassigned. What does that mean?

Well to paraphrase President Bush, "Read my lips. No new AM stations." Translation? **Reduction of interference** through attrition.

The bill also **stops the FCC** from adopting any policy adding interference to either AM or FM. It tells the Commission to do a study of **non-broadcast interference** to AM and report back to Congress with some answers within 90 days.

And finally, it restricts the **use of trans-**

lators to a station's local service area except in cases where the area being rebroadcast to is underserved.

Whew! Sock it to the Commission. As **Congressman Ed Markey**, chairman of the House Telecommunications Subcommittee, told the NAB Board at its June meeting, there may be a lack of Congressional consensus (that's how they talk across the river in DC) on regulatory issues.



But he says there's "more unanimity to address the technical issues." So go to it.

But hey, we're taxpaying citizens. Don't just sit back and let Congress do all the thinking. How about a **letter or postcard** telling your esteemed reps that you support passage of this bill? They're hearing it from the NAB, but after all, you pay their salaries, too. So let 'em know.

If an **act of Congress** is what it takes, then let's have it. And muchas gracias to the honorable representative from the great state of Joisey. (I'll never say anything bad about youse again.)

☆☆☆

The NAB Board got caught up in the **AM improvement momentum** the week they held their summer meeting.

Got to hand it to them, they may flee the **January cold** for the warmth of golf resorts for their winter meetings, but darn if they don't have the stamina to hold their summer meeting each June in the sultry, **sizzling nation's capital**. So we kept the humidity to a minimum. But it rained a lot.

Anyway, the NAB Board approved a **Task Force** on AM improvement, to get the manufacturers to make better radios and get stations to go stereo via a letter-writing campaign.

And word is that if the **NTIA's Al Sikes** is tapped for FCC chairman (as rumor strongly has it he will be) the NAB is going to try to get the FCC to reconsider the issue of an **AM stereo standard** and this time—make a decision!

And even though it's about that other medium, you know, the one with the pictures, I couldn't resist telling you that NAB's **Advanced Television Task Force** is seeking to investigate "ghost canceling systems."

That's right. Guess that makes them "**Ghostbusters**." Who you gonna call?

☆☆☆

Equipment companies really get themselves in the thick of things these days. First it was **Comrex** whose frequency ex-

man trailers. Haven't seen the flick yet but as soon as those lines subside . . .

And what you gonna do when you're looking forward to getting out of town on that **summer weekend**, zipping along at just slightly over the speed limit and making good time to the mountains, the lake or the beach and then wham(!) you run smack dab into that jam-up caused by road construction.

It happens every summer.

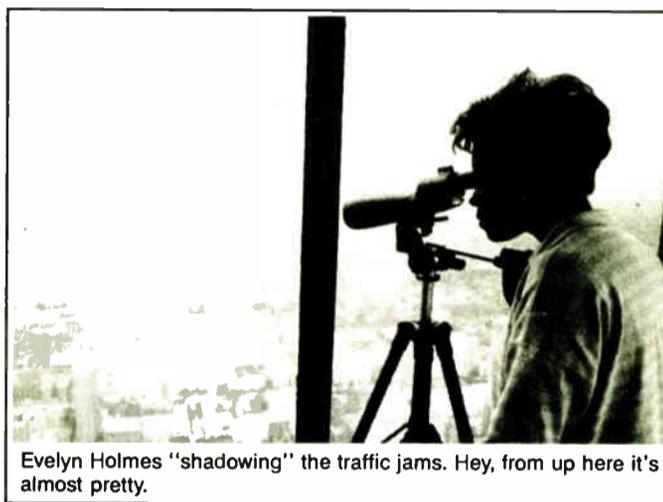
Well lots of local areas have **special traffic watches** during the heavy traveling months.

But in **Chicago**, where there are only two seasons in the year—winter and road construction—radio's **Shadow Traffic** is waging its own war by scoping things out from the 96-story John Hancock building where the view is magnificent and the traffic patterns obvious.

These guys—and their counterparts in other congested cities—have whole SWAT teams out there with helicopters and all,

so the only thing to do is tune in.

Then when you're stuck anyway and the only way home is the **Dan Ryan Expressway** (or the BQE or the Santa Monica Freeway or the Capitol Beltway), you can sit back, take that white-knuckled grip off the steering wheel and sing along with the oldies, or the country or the rock.



Evelyn Holmes "shadowing" the traffic jams. Hey, from up here it's almost pretty.

tenders helped get those reports out of Beijing when the Chinese government pulled the plug on satellite and dial-up.

Then **Tascam** was the recording gear of choice for Warner Brothers' in-house trailer production for those terrific **Bat-**

That's it. **Stress-busters.**

Heard something interesting? Spill your guts to **Earwaves**. Write PO Box 1214, Falls Church VA 22041, or call me at 703-998-7600. Best tidbit of the month wins a coveted 1989 edition **Radio World** mug.

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No worry if unbalanced

Dear RW:

After I submitted my review of the Aural Exciter Type III (RW *Buyers Guide*, 28 June), Marvin Ceasar, Aphex' President, called my attention to a statement in the review which could be interpreted incorrectly.

My previous exposure to electronically balanced circuitry led me to advise extra care in hook-up if unbalanced operation is needed.

The Type III input and output stages are servo-balanced. This design eliminates all problems associated with traditional transformerless I/O. Therefore, hook-up is no more complex than any conventional transformer coupled I/O.

I refer the reader to the manual which clearly describes the circuitry and all the various hook-up possibilities.

John Miller, CE
KLON-FM
Long Beach, CA

Hot smashing triggers blending

Dear RW:

The recent article in the 10 May issue of RW about the loudness wars in LA explained why I recently had a problem with one of the New York (City) rock stations on my car radio.

I am an independent consultant specializing in the design of radios, especially consumer type receivers used in the home and car. (Yes, there are still a few of us left in this country.)

Part of my work involves helping in the design and application of ICs for Sprague Semiconductor Products, so I usually have some of the new ICs in my car radio for testing.

Two of the most recent products are the ULN3827A FM stereo decoder and the ULN3800A FMX™ decoder. These two ICs have some unique features which make them perform better than most other FM stereo decoders under adverse signal conditions.

The first feature is the use of so-called Walsh functions in the demodulator which eliminates interference to the 38 kHz (L-R) signal up to the fifth harmonic or 190 kHz. This reduces interference from adjacent channel signals at least 20 dB over most of the demodulators used today.

The result is that the swishing sound you often hear in the background from the adjacent channel sidebands is gone.

The second feature, which is affected by signal processing, is an automatic blend feature. Most FM receivers made today have some form of blending of the L and R signals which depends on signal strength.

This just reduces the stereo separation and resulting noise as the received signal becomes weaker. Below a minimum signal strength the receiver is in mono.

The problem with this type of blending is that it is easily fooled by multipath conditions and they will often not blend enough to eliminate multipath-produced

distortion and noise. Or they will often blend to mono when it is not necessary and some stereo would be satisfactory. The ULN3827A and the ULN3800A use the noise around the 19 kHz pilot to control blending. This is done by detecting a quadrature demodulated pilot signal and passing it through a low-pass filter. This detects the noise sidebands around the pilot signal.

The IC is set up internally to produce a constant SNR until it reaches mono. I have found in testing at home and on the road that this form of blending is much more consistent than that using the signal strength and will also reduce severe multipath-produced distortion to a level where it sounds normal.

I should mention, also, that the low-pass filter following the 19 kHz quadrature demodulator is, of course, not perfect even though it is a 4-pole active filter. Therefore, some of its response extends down into the upper audio region around 15 kHz.

100% stereo modulation at 10 kHz will not affect the blending circuit.

However, during a recent trip past New York, I noticed that a very loud rock station (you can guess which one) was causing the stereo decoder to blend almost to mono.

When the blend circuit is turned off the station sounded very bright and distorted. With it on, it sounded tolerable, although with very little separation.

The effect of the excessive signal processing of the station was to cause the stereo decoder to blend. The equivalent sine wave modulation was about 100% at 15 kHz!

Because they offer such a great improvement in stereo performance under adverse conditions, we expect these stereo decoder ICs to gain significant acceptance.

However, if many stations start using too much processing in a loudness war, the listeners using these decoders will hear the station in mono or the radio designers will be forced to modify the blending circuit so that it does not respond very much to signals which cause audio distortion or noise.

The result will be poorer quality audio on stations which do not use so much processing.

Thus, I would caution station managers to consider carefully any processing schemes they may be planning.

Jon Grosjean
Woodstock Engineering
S. Woodstock, CT

A "dynamite idea?"

Dear RW:

The article in your 10 May 1989 issue concerning the petition to license 10 W to 1000 W FMs to daytime AMs sends chills up my spine.

I was at the NAFMB Convention in Chicago in 1967 when Mrs. Edwin Howard Armstrong was honored for her husband's pioneering work in frequency modulation. FM, still in its infancy, was considered AM's poorer "stepsister."

Upcoming action by city lawmakers in Seattle on an RF radiation standard raises issues that all broadcasters should be watching closely.

The failure of the EPA to complete its standards work in this area has left a vacuum that many local towns and counties are only too eager to rush in to fill.

Many of them, feeling that current ANSI standards do not offer adequate protection, are contemplating more stringent RF radiation standards.

Overzealousness and a lack of understanding of the dangers could result in a situation where existing stations are slapped with fines or forced to defend themselves in court.

It may also make it harder for new stations to build towers and locate transmitters close to populated areas where they can best serve their listenership.

Some localities are even using residents' fears as a way to rid the area of what they perceive as "ugly" structures.

The truth is that most stations already fall well within RF radiation standards set forth by ANSI which are sufficient protection even in densely populated regions.

The areas of highest radiation concentration—adjacent to antennas—are usually adequately fenced off and far removed from residential areas.

In addition, studies of the health hazards posed by RF radiation emitted from most radio facilities are far from conclusive. More research needs to be done to avoid leaving broadcasters at the mercy of a panic-stricken minority.

The EPA, at the urging of the broadcast community, should find the resources to continue its research and set realistic standards.

And broadcasters themselves need to start a campaign to educate the public so that a sense of moderation prevails. Radio towers have healthily and peacefully co-existed with populated areas for more than six decades—to the benefit of both.

As for those "ugly" towers, lawmakers and listeners who rely on quality radio reception for the latest traffic, weather, news and their favorite music would be wise to remember that it is a small price to pay for the service.

—RW

Let Sanity Prevail

Some proposals considered by the FMers included obtaining a Congressional mandate that all car radios be equipped with an FM receiver; utilizing low power AM "carrier current" transmitters in the business district to let store owners at least hear your programs; using FM translators (not yet legal) to expand into a second market; and implementation of mandatory Quad Stereo transmission to attract new listeners.

One FM owner even bragged that he bought two hours daily from the local AM during the dead of the afternoon Monday through Friday, in exchange for letting the AM air high school ball games live in the evening!

The desperate measures used by program directors were equally laughable: One sponsor per hour (who received an "open-and-close") and one spot at the half hour. Therefore, you could sell twelve sponsors "prime time" from 6:00 PM until midnight (at the time, FM's market was the affluent, who could afford console stereos and shied away from the drivel on TV), and give your dozen sponsors 6:00 AM until 6:00 PM.

Why, at a hundred bucks a month each, you could gross \$1200 a month—more than enough to pay the power bill and sub-minimum wage help!

Many FMs were stacking albums on a changer to fill up the programming. There were calls to expand hours (about half those present at one seminar did not sign on until noon) and advice to play only soft instrumentals since FM couldn't afford to program hits. How on earth could we afford to buy four or five records every week?

The point is that FM didn't happen

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Radio World

Vol 13, No 13

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Editorial

Editor: Judith Gross

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News Dept.: Alan Carter, Editor
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John Gatski
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RF Plan Spurs Outcry

(continued from page 1)

Existing broadcasters also would have to meet the standard, but would not have to secure a permit unless an antenna or power change is made, the ordinance draft said.

Health director decision

According to the proposed ordinance, if a station exceeds the RF emission level, the health director would have the power to require it to take corrective action. The ordinance, however, does not detail what the corrective action options are.

The health director also could fine a station up to \$500 a day for every day a station is not in compliance with the ordinance.

Several stations that are not located in Seattle, but have listeners in the city, are concerned that if the city adopts the strict standard, King County (where Seattle is located) will follow suit.

King County also is working on a RF standard, but has been leaning toward 200 μ W, a standard suggested by the National Council on Radiation Protection (NCRP).

The 200 μ W standard is a standard many Seattle area stations say they can live with, but engineers are skeptical the county would approve a more liberal standard than the city.

"The 100 μ W standard is just way too restrictive. We can live with 200 μ W. But if the city does adopt its standard, the county is not going to adopt a less restrictive standard," KISW-FM CE Buzz Anderson said.

A double whammy for KISW

According to Anderson, KISW can be affected by both ordinances. Its main transmitter is located on a site proliferated with 10 broadcast towers, known as Cougar Mountain, which is located outside Seattle but within King County.

KISW's 125' back-up tower is located in the city, Anderson added, which

means it would be affected by the city ordinance.

Barry Umansky, deputy general counsel to the NAB, said the proposed Seattle standard is an over-reaction to research that suggests RF radiation can pose health hazards.

"It is overly stringent," Umansky said. "The scientific data does not support this type of standard."

Some research suggests constant exposure to RF can cause body warming and other ill health affects including cancer, but the results have not been conclusive. The scientific community also disagrees on a safe RF exposure level for humans.

Besides the ANSI and NCRP sug-

"... if the city does adopt its standard, the county is not going to adopt a less restrictive standard."

gested standards, other jurisdictions have enacted varying exposure level limits including New York City, which limits RF radiation to 50 μ W and nearby Portland, OR, with its 200 μ W limit.

Blame the EPA

Umansky said the EPA's 1988 decision to suspend work on a mandatory RF radiation standard for broadcasters has prompted local governments to take RF regulation into their own hands.

Seattle station engineers agreed. "You will wind up with a patchwork quilt (of RF regulations) of 10 μ W here, 100 mW there and 1000 mW over there," Wilkinson said. "I think these (varying local standard) are grounds to get the EPA to try and resurrect its standards work," he said.

"For the good of the industry, you can't

let standards go through based on fear and hysteria," he added.

Seattle Senior Environmental Planner Clifford Marks said a 100 μ W limit will not be a problem for Seattle broadcasters.

"We have a situation here where 100 μ W will not impinge on any broadcaster," he said.

The highest level recorded at any antenna site within Seattle is 40 μ W, and that reading was just outside the tower of a station, he said.

On paper, Marks said the city council will have several options to consider for the ordinance, including 100 μ W, recommended by staff, 200 μ W, and 1000 μ W, the ANSI standard. A third option, he noted, is no standard.

Questionable guideline

In addressing the unlikely prospect of the city adopting the ANSI standard, Marks said that standard has come under scrutiny in recent years and even the standards body is considering lowering the limit for RF exposure.

"Everybody agrees, except perhaps broadcasters, that the ANSI standard is too lenient," Marks said.

Marks agreed with broadcasters and the NAB that EPA should not have stopped its RF standard work, which was nearly complete.

"A lot of this (controversy) is because of the EPA dropping the ball on its standard," he said.

If the EPA had adopted 200 μ W for its RF exposure standard, it is unlikely that Seattle would consider anything stricter, he said.

Along with the tighter RF emission limits the ordinance would bring, Seattle stations have questioned whether the health department should be allowed to supercede FCC authority if there is a violation.

Anderson questioned the legality of the Seattle health director who could, perhaps, force a station to lower its power when it is found in violation of the RF emission limit.

"Once this gets passed, any yahoo at the health department can go out to a tower, wave a meter and say, 'hey, we have a problem,'" he said. "He can make us turn it (the power) down."

Anderson said broadcasters believe only the FCC can authorize power changes—not a local government.

"So far, the FCC has turned a deaf ear on it," Anderson added.

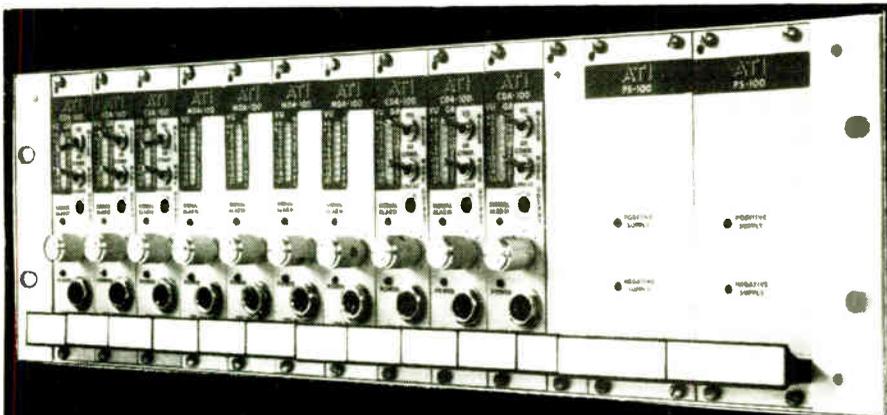
Marks said Seattle is not trying to take over or diminish FCC authority.

The Commission does inform stations they must meet local codes when they go through the licensing process and the RF ordinance will be a local code, Marks added.

Anderson said adoption of RF guidelines may be a thinly-disguised ploy by environmentalists to rid the environment of broadcast towers because they don't like the way a tower looks.

"They can't get rid of them based on ugliness, but maybe they can get rid of them based on radiation," he said.

For more information, contact Don Wilkinson at 206-443-4010, Buzz Anderson 206-285-7625, Barry Umansky at 202-429-5456 or Clifford Marks at 206-684-8056.



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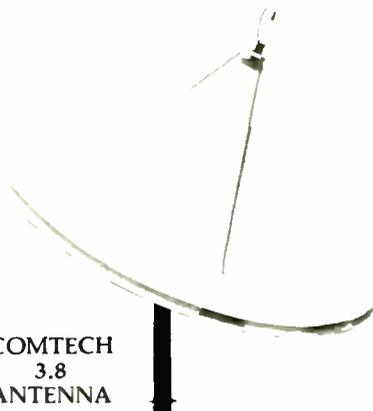
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FCC Suggests Digital Screening

by Charles Taylor

Washington DC An FCC plan to create a new procedure for measuring electromagnetic emissions from digital devices was generally supported in comments, though some advised caution against possible increased interference to broadcast services.

The item, contained in Docket GEN 89-44, proposes in part to adopt new standards to improve measurement techniques based on FCC and industry experience and to include industry suggestions to reduce testing burdens and increase testing repeatability, the docket said.

Products affected by the measure would include electronic devices such as personal computers.

Dramatic technological changes

The NAB agreed that "dramatic change in computer technology warrants revision" of the Commission's current measuring procedure, known as FCC/OET MP-4. A new measurement procedure would be called TP-5.

But it advised the FCC to proceed with care because a new procedure has the potential for changing measured results and could increase interference to radio and TV services.

"Such interference increases should not be tolerated at a time when government and industry are now working to reverse that trend," NAB said.

Adherence to International Special Committee on Radio Interference procedures also was recommended, though the NAB urged that it is equally, if not more important, that test standards meet those of the latest version of the American National Standards Institute (ANSI).

NAB also recommended that new measurement standards hold a maximum transition period for manufacturers of three years.

Avoid lengthy process

Motorola Inc., in its comments, questioned whether minor changes in test procedures could be accomplished without a lengthy rulemaking process.

"In the event the Commission and industry recognize through experience using the newly adopted procedures that such minor changes may be desirable or even necessary, Motorola believes they might be affected by an administrative order (that is) so long," the company said.

Motorola also recommended that equipment originally compliant under the existing MP-4 testing procedure should be grandfathered.

It would be unreasonable to remove a product from service or from the market prematurely because of a change

The Consumer Electronics Group of the Electronic Industries Association (EIA) agreed wholeheartedly with the

Products affected by the measure would include electronic devices such as personal computers.

mid-stream in the measurement procedures, Motorola said. And over time, such equipment will be replaced considering a normal amortization period and availability of newer products.

docket's intentions. The group made only minimal technically oriented suggestions.

For more information on Docket GEN 89-44, contact the FCC at 202-632-5050.

Broadcasters Resist Application Lottery

by Alan Carter

Washington DC While most Americans dream of winning "the lottery," broadcasters are not willing to take a chance on receiving new station applications by the luck of the draw.

The FCC put forth the idea as it seeks to reform the process for authorizing new stations. The current comparative hearing process is plagued with problems, most of them involving allegations of payoff scams by applicants.

Comments filed under Docket MM 89-15 showed broadcasters and interest groups generally want the comparative hearing process revised, but not dropped in favor of a lottery system similar to that used at other levels of the Commission.

Unwanted sacrifice

The Federal Communications Bar Association (FCBA) proposed an extensive reform for the comparative hearing process.

The FCBA said a lottery could "sacrifice" the goal of localism.

Among its recommendations are limiting settlement payments and limiting parties not among original applicants from any settlements. The FCBA also would require new licensees to keep their licenses for at least two years and require the full Commission to consider Review Board decisions, on comparative hearing appeals, within a specific time period.

The NAB agreed with the FCBA that application Form 301 changes, which now requires further disclosures, be applied retroactively to pending applications.

Too chancy

The NAB opposed the lottery commenting, "The selection must be made with a view towards selecting applications who will provide quality service to their local communities . . . the selection

(continued on page 12)

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NRSC Meets at CES

Chicago IL Getting improved radios for AM on the market is still on the minds of NRSC members as the group's focus shifts more and more toward FM technical issues.

Meeting at the summer Consumer Electronics Show in early June, the NRSC tackled pending tests on FM multipath and continued discussions on work done by its technical subgroup on composite clipping.

Members also had a look at a proposal for specifications for a certification trademark for improved AM radios incorporating the NRSC standard.

Multipath testing is to start at WAEB in Allentown, PA by mid July as a joint effort between WAEB, Radiotechniques Engineering Corp. and Delco Electronics.

WAEB CE Harry Simons told the group that strategies for testing multipath were still being worked out and that the first round of tests would likely characterize multipath interference within certain predetermined geographic areas and investigate the effects of synchronous AM modulation.

Simons said, however, that a third objective, investigating the effects on multipath of adding a 67 kHz subcarrier, would take more time and probably have to wait for a second round of tests.

The multipath work is now being undertaken by WAEB for submission to the NRSC, instead of on behalf of the NRSC

as originally thought, Simons said.

He added that the change in terminology would eliminate the need to return to the full committee for approval each step of the way.

The technical subgroup looking at composite clipping still has some work ahead of it as well. After an initial report from Chuck Adams of CRL which proposes a "composite mask," the group intends to hear from other manufacturers of composite clippers, including Eric Small of Modulation Sciences and Frank Foti of Cutting Edge Technologies.

While Adams' report showed that clipping can erode a station's baseband and uses up more spectrum space than a station which overmodulates but does not clip, discussion among NRSC members showed that the debate over the effects of clipping rages on.

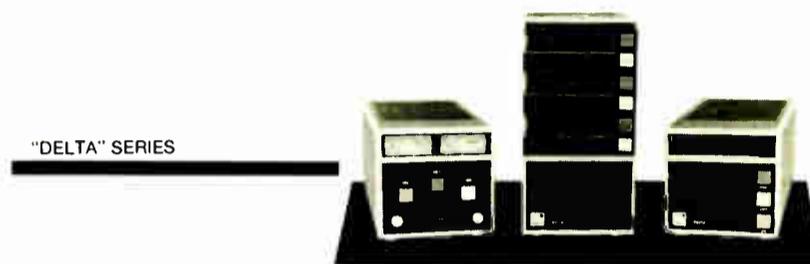
Some broadcasters maintain that any kind of clipping is detrimental to a station's signal while others caution that other types of processing may be the culprits and that clipping alone does not necessarily have to be harmful.

In addition, the composite clipping furor has heated up recently with the programming philosophy of such stations as New York City's Z-100 and Westwood One's Pirate Radio in Los Angeles, where loudness through the use of clipping has improved ratings.

On AM issues, the committee agreed

(continued on page 16)

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Lightning Strike Gear Debated

by John Gatski

Boulder CO Has the fire protection industry unfairly excluded the latest technology in lightning protection through a bias of its own?

A company that claims its lightning protection system is almost 100% effective against damaging strikes believes the National Fire Protection Association (NFPA) has shunned its products because of the influence from lightning rod manufacturers.

The NFPA, which writes up guidelines for fire protection equipment and procedures, denied it has purposely excluded lightning dissipation systems. The organization said such systems have not proven themselves under tests.

Many local governments adopt procedures and codes based on NFPA recommendations. The organization's lightning protection recommendations and guidelines are known as NFPA 78.

No NFPA recommendation

Hans Dettmar, president of Lightning Eliminators and Consultants Inc., (LEC) said his company has manufactured lightning dissipation products for 18 years using state-of-the-art technology, but without the NFPA stamp of approval.

He said the lightning rod industry has influenced NFPA to refuse inclusion of any new lightning protection methods in its guidelines.

LEC believes the lightning rod manufacturers are trying to stymie innovative technology.

"They have tried, successfully, to stop us for 18 years," Dettmar said. "They have done a lot of damage. If everybody had that type of attitude, we would still be driving horse and buggies."

He noted that lightning rod technology dates back 250 years and maintained that it can no longer meet the needs of modern technology.

"There will always be a market for lightning rods, but with the increase in high technology, such as mainframe computers, they don't do the trick anymore," Dettmar said.

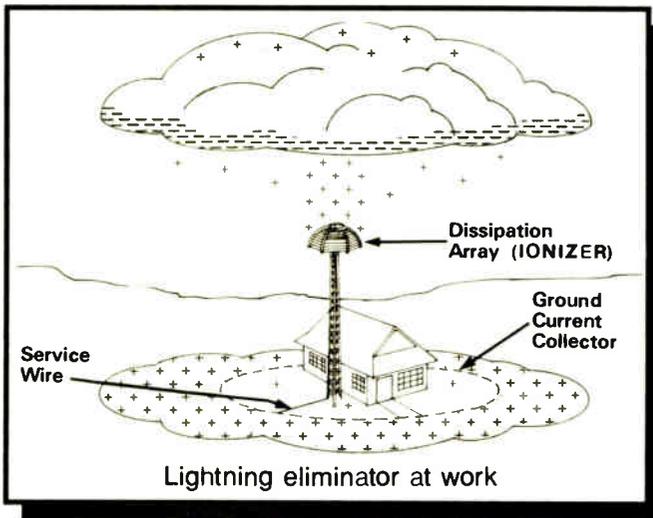
LEC and other companies sell dissipation systems to broadcasters and other customers. They say that these systems dispell lightning strikes by creating a charge opposite the cloud's polarity charge as it passes over a protected tower during a thunderstorm.

Dettmar claims that other dissipation systems are actually hybrids and therefore not as effective as the LEC system.

According to the company, the

patented LEC Dissipation Array System (DAS) uses a large array of metal points, which looks like an umbrella attached to the top of the tower.

The system slowly removes the cloud charge through an ionization process, which eliminates the lightning strike potential before the current becomes a



lightning bolt.

Dettmar said lightning rods are different in that they act as a diversion path for lightning to discharge the energy.

LEC, however, contends that lightning rods encourage strikes and do not guarantee that antenna and broadcasting hardware will not be damaged by a strike.

Custom-made

Each LEC dissipation system is custom-designed. The top-of-the-line system costs about \$15,000 and to be totally effective, requires the LEC Chemrod ground system and AC surge protection, according to Dettmar.

The company introduced a new product called the Spline Ball Ionizer, which although it is not 100% guaranteed against strikes, provides significant protection for under \$2000, Dettmar said.

There are several LEC systems in use at

stations around the country and in Canada. The system also is used by various military, police and business applications including NASA and the Federal Express hub in Memphis, TN.

Several stations that use LEC's products say the technology has eliminated most lightning strikes, which were quite common prior to the system's installation.

"We haven't been hit by lightning in years," Canada station CKLW-FM CE Wally Dowhan said. "It works for us."

Dowhan said the Windsor, Ontario, station used to average 12 outages a year attributed to lightning strikes prior to the system's installation in 1973.

WVUD in Dayton, OH, also suffered through numerous outages prior to installation of a LEC system in 1982.

Dissipation works

"I think the array system has definitely helped this station," WVUD CE Walt Biggs said.

He said there have been a few outages, but they were caused by AC interruptions. His station does not have LEC's ground or surge protection systems.

Despite LEC's claim of a lightning rod bias at NFPA, spokesman Rich Bielen said the dissipation system has not been recommended because it has not proven itself to be reliable.

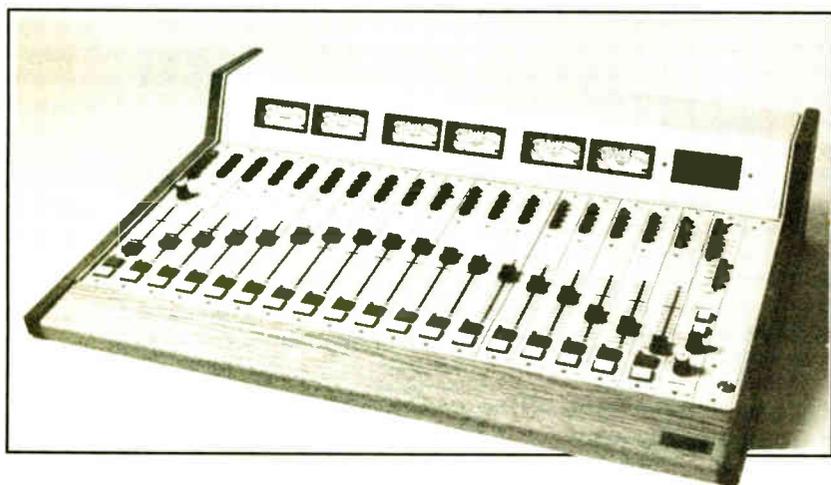
"It's still up in the air as to whether it works or not," Bielen said. "The NFPA Technical Committee has not seen any data that shows lightning won't strike with the system."

With regard to the lightning rod industry's alleged influence at NFPA, he said the technical committee is composed of 18 members, of which only six can be manufacturers of fire protection equipment.

Bielen said there are only three lightning rod manufacturers with representatives on the committee: Thompson Lightning Protection Inc., the Lightning Protection Co., and AC Lightning Security Inc.

For information, contact Hans Dettmar at 303-447-2828, Wally Dowhan at 519-258-8888, Walt Biggs at 513-229-2041 or Rich Bielen at 617-770-3000.

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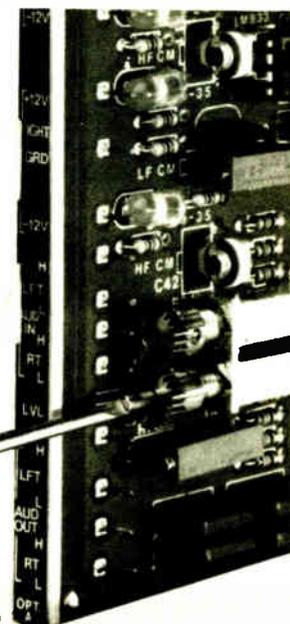
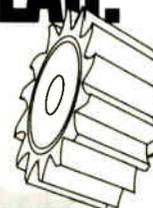
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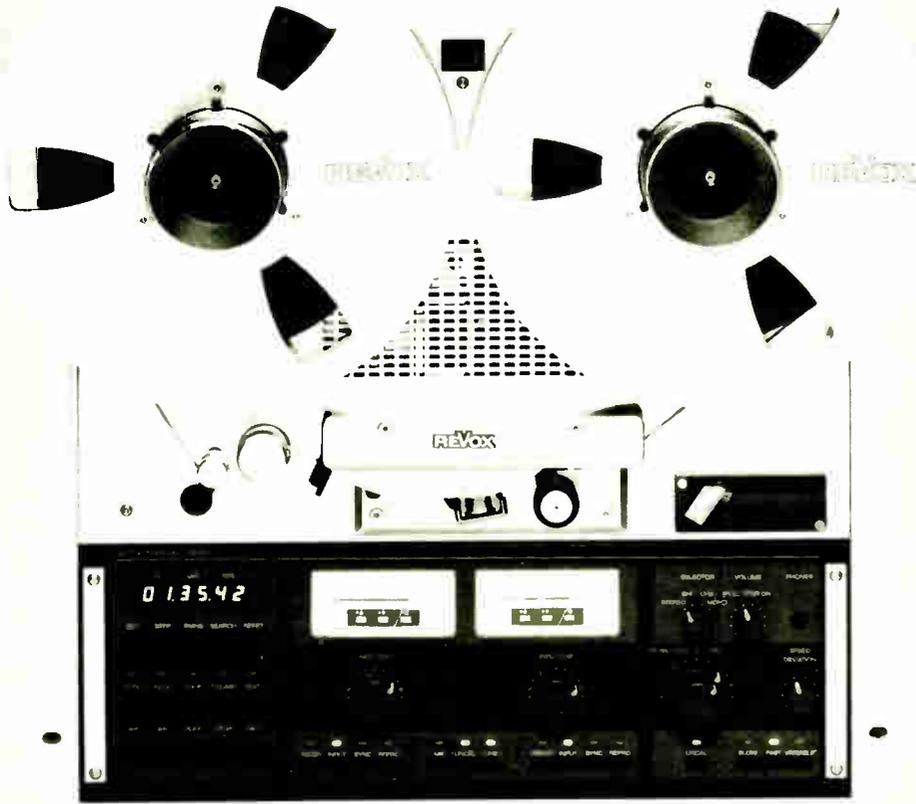
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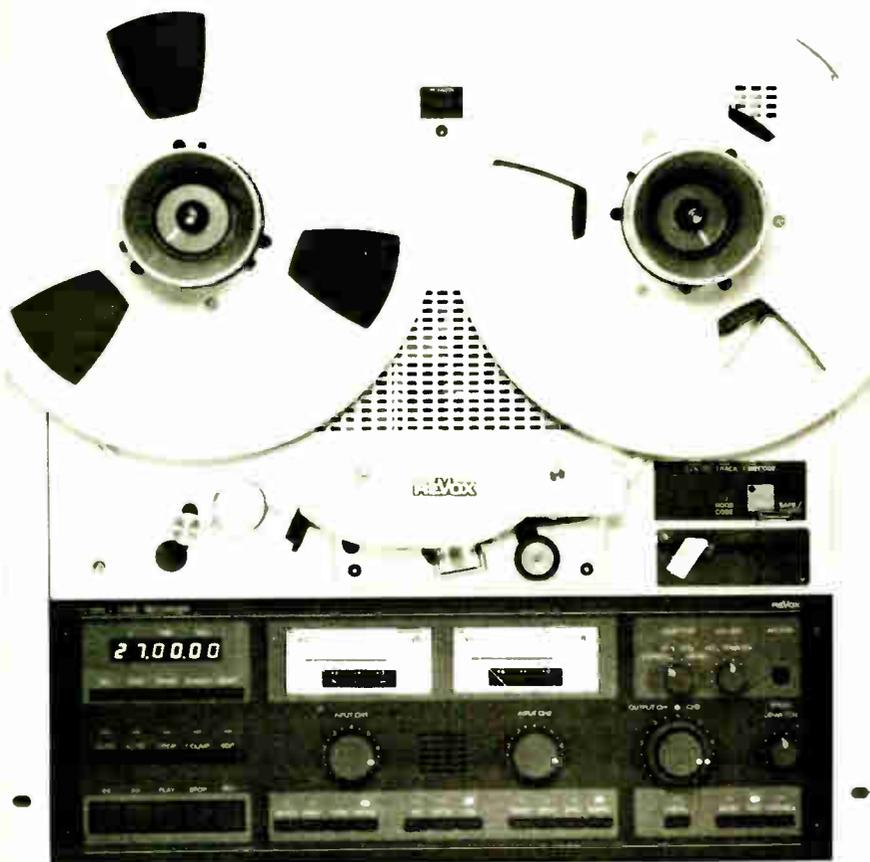
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World Radio History

Readers Respond

(continued from page 5)

overnight. But, the Class A-1 petition could sure hurt radio in a hurry—AM and FM.

The band is already overcrowded. Due to the receiver capture ratio, a Class C adjacent can override a Class A local at a distance of 150 miles. In fact, the Class Cs should have their power reduced. If 50 kW will compete in New York City, you sure don't need it anywhere, especially considering that Class Cs in poorly populated states often have 100 or more translators.

But back to the A-1 proposal. Consider that many AMs could have picked up a Class B license for the asking in 1967, but they were simply short-sighted tightwads.

I heard lots of owners say, "I don't want FM and have to stay on until ten PM." Another constant complaint was, "I don't want to have to go stereo to compete with the other FMs—why, I'd have to replace my board, tone arms . . . and that stereo fad won't last anyway."

Now, let's look at the errors in logic presented by the A-1 proponents in the RW article: The use of Class D "space" would be short lived. The biggest problem is with AMs in metro markets. Many rural AMs are able to serve their au-

dience, where a local daily newspaper isn't even published. But in the city, there isn't even Class D space available.

And what about TV Channel 6? No, there would be immediate requests to move into the commercial band.

How can the proponents expect to serve their area with ten watts FM, when WNRK's 42 watt PSSA signal is inadequate? There would be instant clamor for more power for A-1.

Consultant Richard Arsenault notes that "skywave interference" is a big factor in AM's troubles. Well, FMs don't have any skywave signal. This was a stumbling block for the medium for decades. And skywave interference could be reduced in one fell swoop with implementation of horizontal antennas. How about it, are AMs ready to serve their market, instead of someone else's?

Finally, is this really a "community service" issue? Arsenault was quoted as saying, "AMers cannot serve their listeners, or compete with FMs for advertising revenue." WNRK President Al Campagnone said, "It's like playing the radio sales game with both hands tied."

WCTR AM owner Dave Taylor said, "It would be dynamite if something like this

happened." He is right! If we further clutter up the FM band—crank up the modulation to compete (thus decreasing separation, while increasing distortion)—and further degrade radio in general, we may all be petitioning the Commission for a second cable system in our markets to get our signals to the

public, while print media and TV take advantage of our in-fighting.

Dynamite, huh? It would blow all of us to Hades!

L.K. "Bud" Price, President
Berrey-Price Communications
and GM, WKXQ-FM
Rushville, IL

Lottery Plan Nixed

(continued from page 8)

of licensees must not be left in the hands of a ping-pong ball or the roll of dice."

The NAB also noted that the FCC has "an extremely heavy burden" from Congress to demonstrate that lotteries should be utilized in licensing full-service broadcast stations.

In particular, the organization said a

cost-effective to apply in a lottery and won't apply."

The Community Broadcasters Association, a trade group representing low power television that goes through the allocation process by lottery, did not recommend lotteries for widespread use.

"Even those LPTV applicants who accept lotteries out of economic necessity

...(The NAB) said a lottery system would handicap daytime-only licensees, local residents and female applicants.

lottery system would handicap daytime-only licensees, local residents and female applicants.

The National Black Media Coalition (NBMC) was another vocal commenter opposed to a lottery, in favor of a system which singles out those with true broadcast interests.

No real benefit

"While minorities would have a greater weight in lotteries . . . (they) would likely only increase the number of minority front applications," NBMC said. "Genuinely interested minority applicants, those who apply now in hearings because they do not fear scrutiny of their comparative qualifications, local minorities motivated by a desire to serve their home communities, won't find it

resent the fact that lotteries attract speculators and resent being disappointed by the bounce of a ping-pong ball in a drum and seeing construction permits being awarded to some applicants who never build their stations and either sell or ultimately abandon their permits," the association said.

Two separate filings representing numerous applicants currently before the Commission also opposed the lottery system.

" . . . No drastic overhaul of the comparative hearing process is needed," one group stated, "just some fine-tuning (of comparative renewal)."

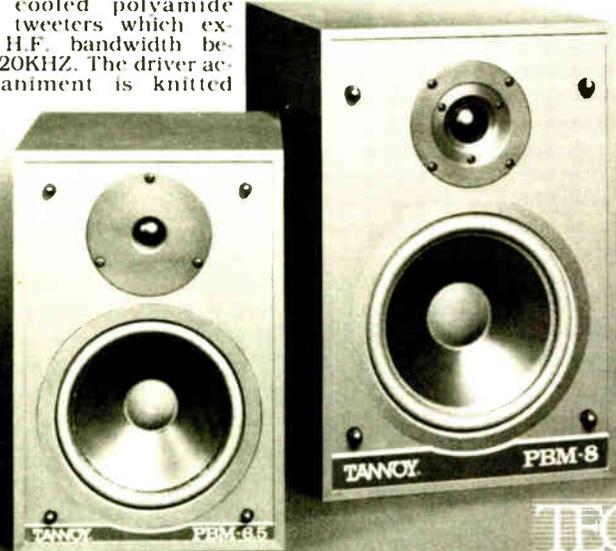
For additional information on the lottery issue under Docket MM 89-15, contact Andrew Rhodes at the FCC, 202-632-7792.

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AM Plan Supported

(continued from page 1)

Commission would make a full public interest evaluation—assessing the amount of AM interference to be reduced as well as the effect on levels of broadcast localism if particular contingent applications were filed," NAB said.

NAB advised that the FCC should accept contingent applications only where one of the applicants proposes to cease operation, which would help bring finality to the process and would avoid the possibility of the same applicants returning time after time to adjust interference patterns.

The organization also said it would be impossible for the Commission to determine whether a particular community maintained adequate local broadcast service following the grant of a particular set of contingent applications. Thus, each proposal should be examined case by case.

NAB added that policies to be adopted in the proceeding should be implemented following resolution of several pending documents regarding AM improvement.

"Once these revised standards are in place, the Commission will be in a more effective position to begin its assessment of the class of contingent applications which we believe the Commission should accept and process on a waiver basis," the NAB said.

Little negative to say

Others filing comments had little negative to say about the proposal. CBS said it represents a significant step toward a less cluttered AM dial.

The suggested changes would "give broadcasters more flexibility to reduce interference and delete inefficient AM operations," the network said. "Accordingly, the Commission will ensure that the public will benefit from a higher quality and more reliable service and that some stations will emerge with improved facilities, better to serve their listeners."

The network disagreed with charges that the changes would promote "negotiated interference," in which broadcasters negotiate between them-

selves the levels of interference they will cause and receive.

"Were CBS to share this view, we could not support the proposals under consideration here," it said.

Unethical not likely

The Association for Broadcast Engineering Standards (ABES) also said it felt assured that such unethical agreements were not likely under the proposal.

"There is all the difference in the world between a system of rules that permits existing instances of destructive interference to be eliminated, under

close and reasonable Commission supervision, and the idea that licensees or mere applicants might be encouraged to enter into agreements that condone

(The proposal) represents a significant step toward a less cluttered AM dial.

the creation of new interference areas," ABES said.

Added the Corporation for Public

Broadcasting, "Up to this point in this rulemaking, the Commission has displayed both thought and creativity in developing the appropriate safeguards and limitations for negotiated interference arrangements between AM stations."

Group W applauded the proposal, commenting that reducing interference is the single most critical method for improving AM quality, even if it means that some AM stations reduce their service areas or go dark.

"Our goal should be to provide the maximum number of persons with a clear interference-free service, while ensuring that all geographic areas of the country receive an appropriate level of service," the company said.

For more information on Docket MM 89-46, contact Diane Hofbauer at the FCC, 202-254-3394.

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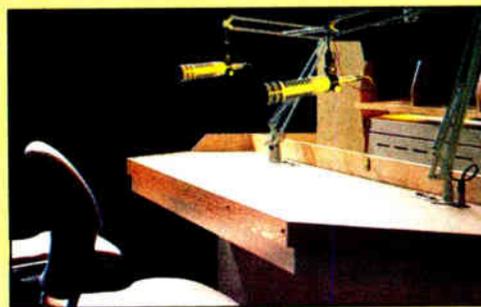


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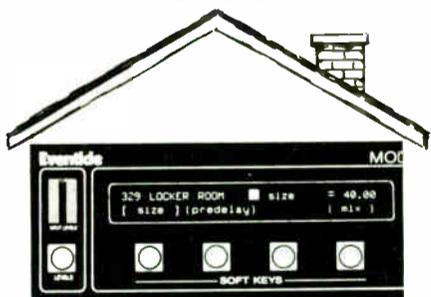


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World Radio History

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PRC Highlights Digital Audio

by Chris Durso

San Francisco CA The theme of the 1989 Public Radio Conference was "Think Radio," but for engineers it was "Think *Digital* Radio."

Digital audio is "out of control," according to Ken Pohlmann, an author on digital audio and director of the music engineering program at the University of Miami. That was the message he brought from a recent AES digital audio conference in Toronto.

Opening the engineering track of the Public Radio Conference held here 17-21 May was a "Digital Audio Crash Course."

Behind the scenes

A main area of research in digital audio is in data compression, according to Pohlmann. This translates to less than real time data dumps and more storage time in less media, meaning less cost.

Since data compression results in reduced bandwidth requirements, there may be some future application to transmission of digital audio direct to consumers in much less spectrum than is currently required.

An exciting revelation concerning digital audio was NPR's commitment to become a leader in using digital technologies in radio broadcasting from NPR President Douglas Bennet.

He maintained that this commitment ensures that NPR will always be on the cutting edge of technology and breathes new life into the "reputation for excellence" that NPR so painstakingly earned in the 1970s.

Points of interest

One area in digital audio the conference examined was direct digital synthesis (DDS), which represents pain to most radio engineers.

In the process, the NCMO (numerically controlled modulated oscillator) utilizes DDS to create and modulate an RF signal. The military has used NCMO in different forms for many years because of the flexibility (ie., security) that it offers for data transmission.

The frequency of the digitally generated signal is controlled by the application of a digital number. The modulation also is applied as a digital number either from an analog-to-digital converter or directly from a digital source.

The type of modulation is determined by user defined parameters. Perfect AM, FM, DSB, SSB, FSK and other modes are obtainable. Even the stereo multiplex signal can easily be created using the NCMO.

Since numbers can be "crunched" in the digital domain by the NCMO, no distortion generating peak limiters are necessary using this modulation scheme.

A prototype system for FM broadcast use is soon to come, according to Bob Zavrel of Digital RF Solutions. Zavrel said Digital RF Solutions is talking with manufacturers of FM broadcast exciters about the research and development necessary to make NCMO a reality in the marketplace.

The digital studio

Looking at digital audio workstations, the tools that allow audio engineers to manipulate sounds in the digital do-

main, a panel of manufacturers discussed their application in public radio.

The message was that to get a feel about what these workstations do, you must ask what they won't do. If the task can be performed in the production room of a facility chances are it can be done faster and easier using a digital workstation.

The workstation is basically a computer that crunches, splices, sweetens and mixes audio.

Workstations offer increased efficiency, repeatable mixing and editing, minimum noise and distortion, and time compression. With a workstation, non-

destructive editing can be performed over and over again.

Prices for workstations vary greatly as do capabilities. One of the largest cost factors involved is in hard disk memory. Some 720Mb of disk space is required to store one hour of stereo audio at a 50 kHz sample rate. Remember that the sample rate must be at least twice the highest audio frequency desired.

Points of evaluation

Another factor to consider in workstations is the type of archival that the system supports. Most of the larger systems can archive data (sound) on optical disk

or RDAT. Although the load/unload time is much shorter with the optical disk, the cost of long-term storage on RDAT is much lower.

One of the evolutionary problems with the current generation of workstations is the complete lack of standardization of format for the digital I/O port. Standardization needs to be addressed as these workstations find their way into everyday use in the broadcast environment over the next decade.

A highlight of the conference was the hands-on demonstration of a number of workstations. Manufacturers ran their gear through its paces and, judging from the "oohs" and "aahs" in the room, digital audio workstations have definite applications in the modern radio broadcast facility.

(continued on page 16)



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Digital Audio Focus of PRC '89

(continued from page 15)

In other areas NPR Assistant General Counsel Karen Christensen said the next three years are critical for translator expansion in public radio.

Freeze on licensing

A freeze exists on new translator licensing under terms the FCC adopted in March. But NCEFM translator applications on reserved NCEFM channels are exempt from this freeze.

In a session on "The Nuts and Bolts of Translator Implementation," public ra-

dio engineers were given a checklist for preparing an application for an FM translator or booster that is unlikely to be challenged on technical grounds.

now is the time to move.

Mike Starling, senior engineer for NPR engineering and operations, said NPR will begin to advise member stations

A lot can be learned from the land mobile business about the careful use of hardline, cavities, circulators and isolators.

The tone of the translator session was clear. If a station is considering the use of an FM translator or booster station,

when translator applications, which may encroach on that station's service area, have been filed. This service is designed

for smaller member stations that cannot afford to hire a consultant on a regular basis to provide that information.

On the practical side, the translator session dealt with case histories of translator implementation from the working engineer's point of view.

The lesson: A lot can be learned from the land mobile business about the careful use of hardline, cavities, circulators and isolators.

FMX . . . continued

Another issue examined is where the FMX™ stereo extension system stands with public stations. In a session on "The FMX Controversy" public radio engineers related their experiences with FMX.

No one reported any real negative effects due to FMX in the baseband and one station felt FMX was a real success in its market.

There was a general consensus that since the addition of FMX to the baseband requires careful attention to transmitter tuning to reduce synchronous AM, this alone has improved the performance of a number of transmitter plants.

Broadcast Technology Partners (BTP), which markets FMX, declined to participate on a panel which would have examined the FMX system in light of a negative study done by Amar Bose of Bose Corp. and MIT.

BTP said it did not want to give Bose a platform. Bose declined to attend citing other commitments.

Dave Evans, CE, KALW, San Francisco, suggested that BTP supply public radio outlets in the top 100 markets with FMX units to facilitate independent evaluation of the system.

While topics for the engineering sessions were timely and meaningful, fewer than 30 stations were represented by engineering personnel.

The 1990 conference will be in Washington, DC.

NRSC Meets

(continued from page 9)

to send out for comments by mail a proposal for specifications of a certification mark for improved AM radios.

The proposal would require only that radios carrying the mark be NRSC deemphasis-compliant, and not necessarily be stereo nor include the expanded band or other features.

The proposal would also define AM receivers carrying the mark to have a bandwidth from 85 Hz to 7.5 kHz which represents a compromise between the full 10 kHz bandwidth allowed by the now-mandatory NRSC standard and the 5 kHz, and in crowded parts of the AM dial, 3 kHz required for acceptable nighttime listening.

Several broadcasters present said 7.5 kHz is acceptable, but at least one receiver manufacturer said that if 7.5 kHz were a requirement of the certification mark, "we're simply not interested."

In addition to defining technical aspects of the trademark, the proposal calls for promoting the new radios through AM stations and calls for implementation of the new trademark as early as the middle of next year.

A meeting on the marketing aspects of the certification mark was slated at the EIA's headquarters in Washington, DC for 7 July and the next full NRSC meeting is set for just prior to Radio '89 in New Orleans in mid-September.

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NRSC (National Radio Systems Committee) has created a voluntary national transmission standard that makes wideband high-fidelity AM radios practical. As broadcasters adopt the NRSC standard, receiver manufacturers can extend and flatten their frequency response without risk of increasing the audibility of interference.

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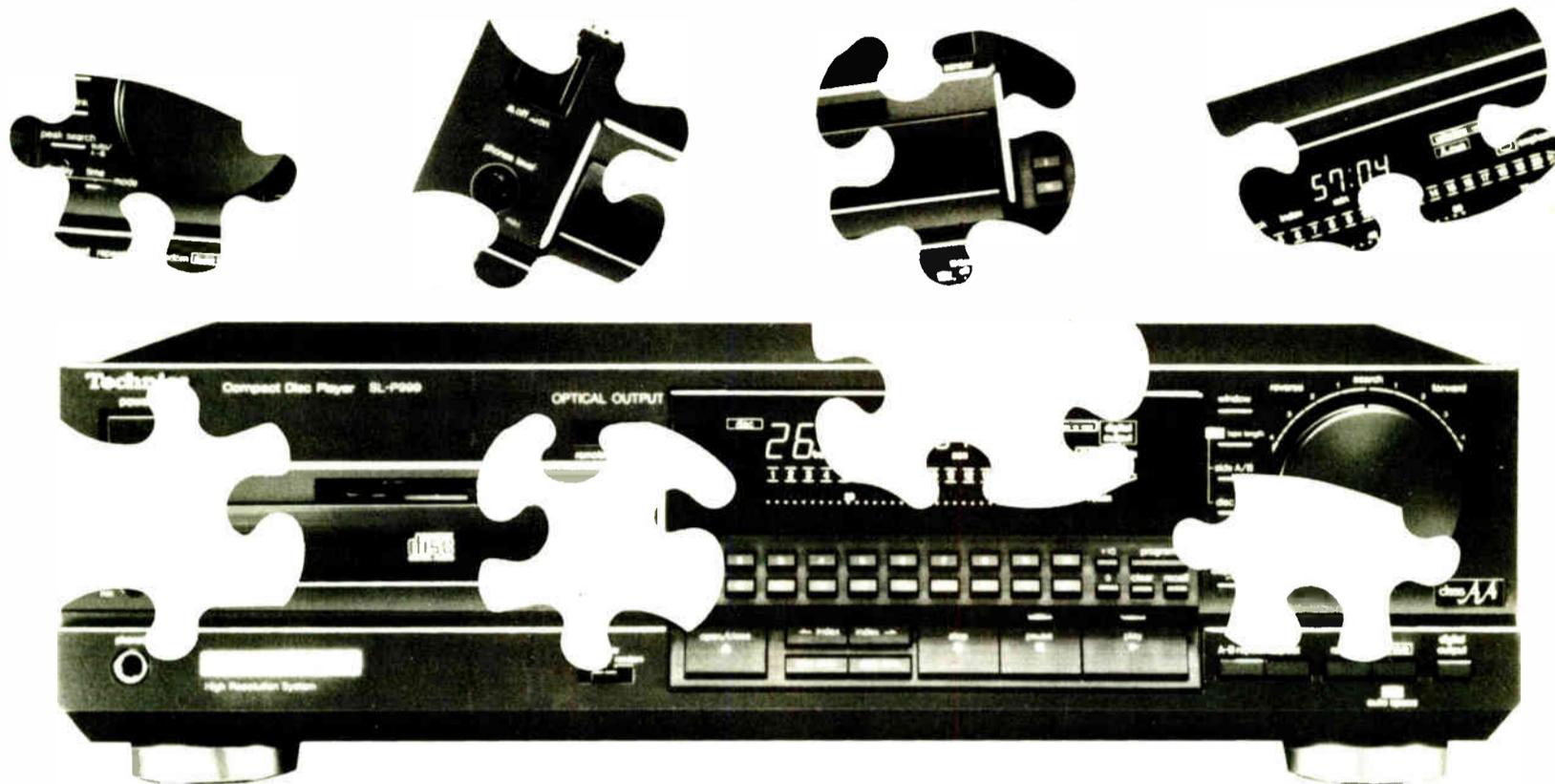
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Return to Wobegon

(continued from page 1)

a soothing experience. There's music, usually jazz, country and gospel, some comedy routines with sound effects and the "News from Lake Wobegon"—storytelling monologue by Keillor. To the audience, it's a simple, back-to-basics kind of show. Must be simple to produce too . . . right? Wrong!

This performance used 37 microphones, four mixing consoles, two 24-track tape machines, two satellite uplinks, several miles of audio cable and enough processing equipment for several radio stations. If the program sounded simple, that may have been a bigger illusion than Lake Wobegon itself.

Lynne Cruise, for many years technical director of the original PHC from St. Paul, MN, and national broadcast coordinator for this farewell performance, oversaw several interconnected "islands" of audio mixing and processing gear.

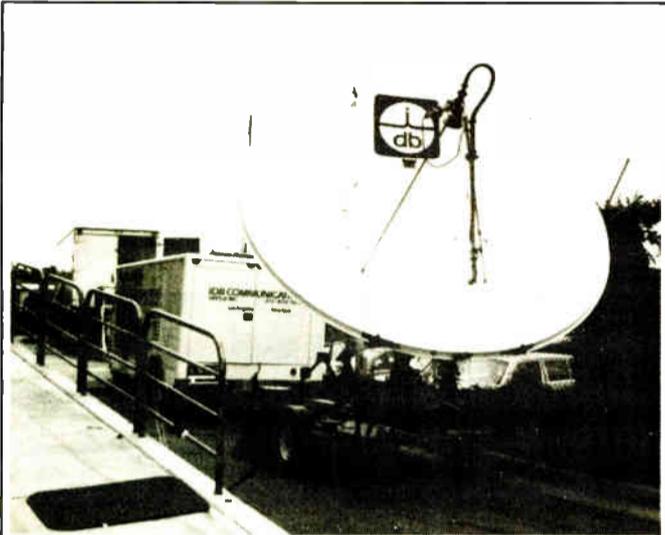
Each of the 37 microphones was split three ways, with individual mic feeds going to the house sound system, the broadcast mixing station and to a mobile recording truck

from LA's Record Plant equipped with a 44-input audio console and two 24-track tape machines.

Assembling the crew

"My job was to get a bunch of people who are really good at what they do together and let them do their jobs," Cruise, now an LA-based audio producer, said.

One of those people was broadcast mix engineer Jim Anderson, a New York City-based audio engineer who has

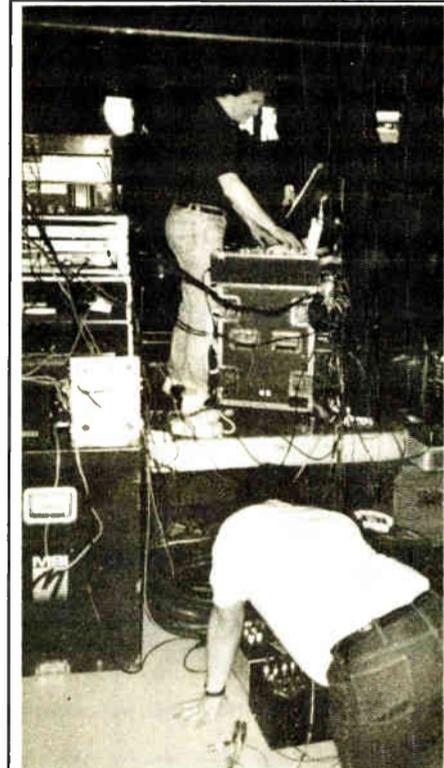


IDB's uplink behind the Universal Amphitheatre beamed the show to the Westar IV satellite.

recorded 19 jazz albums already in 1989. Anderson mixed Keillor's Carnegie Hall appearance last year and handled mixing and recording chores on the 13-city

Keillor tour that preceded this broadcast. Anderson sat on the right of the stage in front of two mixing consoles—a Soundcraft 200B 24-channel board and a Studer 269 12-channel board. He monitored the mix entirely on a "gray market" pair of Sony CD900 consumer headphones.

"Every engineer whose ever heard these headphones goes crazy over them," Anderson said. "You can only get them in Japan, and now Sony's discon-



Jim Anderson (top) and Brian Killian make adjustments to the broadcast mixing island before rehearsal.

tinued them. They're a real prize if you can find a pair."

Most of the microphones on stage were supplied by beyerdynamic. Keillor's primary mic was the MCE 81 handheld condenser. "It has high gain before feedback and good handling," Anderson said. The other prime vocal mics were MC 734 and MCE 80s.

A "big fan" of beyerdynamic ribbon mics, Anderson used the M160 on over-

heads and highhats. The bidirectional M 380 was used as kick drum mic. And MC 737 long shotguns were used as primary audience pickup mics.

Anderson used his personal Neumann SM 69 stereo microphone for X-Y pickup of an on-stage fireworks display, his B & K 4007 for snare and a row of five Shure SM 57 dynamics to supplement pickup of the audience.

Keillor's MCE 81 and three primary MC 734 condenser vocal mics were processed through premium John Hardy Company M-1 mic preamps. "The mics are phantom powered and pre'd to almost line level, running about 30 dB of gain," Anderson said.

Listeners won't know

In the broadcast processing rack, dbx 900 gear was used for gating and limiting and a Lexicon 200 for creating room ambience. "There's an acoustic established by the size of the room," Anderson said. "I try to work with that in the reverb that I add. In a room like this (Universal Amphitheatre) it's unusual because it so dead . . . dry. I'm going to create ambience for it with the Lex 200."

On the stereo broadcast mix, Anderson said he plays it conservative on a live show. "The drums are full spread. Bass is up to center. Piano is 90° X-Y miking. I run Garrison and the primary singers all slightly off center . . . left or right.

"Though Garrison will change mics during the show, the listener will not know it," Anderson said. "We try to keep the setup flexible, not to try to rein in the talent. They need to be able to walk anywhere on stage and do anything they want."

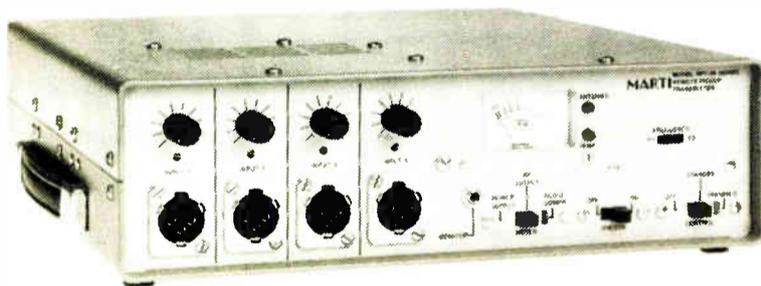
Anderson's feed was routed directly to a mobile satellite uplink behind the theatre that beamed the audio signal to Westar IV.

As a backup, a pair of 15 kHz matched stereo telephone lines from Pacific Bell carried the program feed to local affiliate KUSC's uplink on the other side of the city. An uplink switchover could have been made in less than a minute

(continued on next page)

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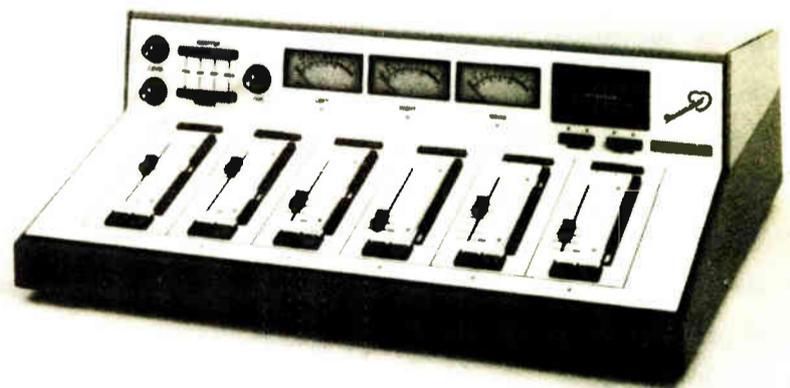
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(continued from previous page)

if the primary dish failed, Cruise predicted.

In case of total system failure, a 24-track recording of a non-broadcast concert performance made the night before in the Universal Amphitheatre was rolling behind the live show and would have been used as an emergency backup if the live feed were lost. During the broadcast, transmission supervisor Bill Kappelman monitored all the outgoing sound feeds for quality.

Broadcast and house mix

Coordination of the radio mix and house sound system mix was essential to the success of the show, Cruise noted. "The house sound is very much part of the broadcast because you hear it come back over the mics," she said. "They are not two separate events. We pay quite a bit of attention to making the house sound intelligible so that people in the audience will respond. It's important to remember that we have one soft talker who is the main event."

Randy Siegmeister of Maryland Sound, Silver Spring, MD, assisted by

"It's important to remember that we have one soft talker who is the main event."

house sound coordinator Patrick Baltzell, mixed house sound from a station in the midst of the sold-out arena.

Mixer Ed Greene, watching the stage action via video camera, manned the board in the Record Plant truck behind the theatre. The tapes will be used for "future product," Cruise said, such as audio cassettes and broadcast syndication in foreign countries.

A fourth engineer moved among the three sound mixing islands, fixing problems. Brian Killian, chief maintenance engineer, spent a good part of the day prior to broadcast chasing down a sticky



Tape operator Tim McCollm tweaks a 24-track machine in the Record Plant truck.

ground loop, and after solving that problem, spent more time zapping buzz and hum in some of the audio snakes.

During the broadcast, all the sound mixing islands and the lighting operators were tied by headset communication with stage manager Steve Koeln.

A nine-year veteran of *A Prairie Home Companion*, Koeln was the point man to fix any problems popping-up during the show. "If a problem is going to appear it tends to happen one minute before broadcast," Koeln said with the expression of a man who has seen it all. Koeln's worst enemy: "hums and buzzes."

"It sounded great"

So with all the potential problems, how did this special broadcast come off?

"The signal was perfect. It sounded great. It really was wonderful," declared

an elated Cruise after the two-hour program. The primary uplink worked flawlessly. No hum or buzzes crept into the show. The 6,000 people in the audience at the Universal Amphitheatre heard every nuance of this latest saga from Lake Wobegon.

As for Anderson, he said only after you have "*Powdermilk Biscuits and Hello Love* swimming past you at the mixing console" do you appreciate the level of complexity and quality demanded by a show like *A Prairie Home Companion*.

Only by recognizing the system complexity and talent necessary to produce a show like *A Prairie Home Companion*, can one begin to understand its story-book appeal to millions of devoted listeners.

And that's the news from Lake Wobegon.



The mic mixer you would have designed yourself—the Shure M267.

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Double-Checking Connections

by John "Q" Shepler

Rockford IL If there's one thing we do around radio stations, it's run wires. We have ceilings and trenches full of shielded pairs.

The underside of the console has bundles more of mic cable, audio patch cords, twisted pairs and multicolored who-knows-what. Many of those wires carry audio from program sources. Are you sure they're hooked up right?

Straight wires are supposed to be transparent to high quality audio. Why is it then that you can hook up two top quality pieces of audio gear and get a crummy sound?

The answer lies more within the equipment than with the type of wire.

Source and termination

When audio travels from one place to another, it has a source and a termination. The source generates the signal and the termination receives it. For instance, the output of a cart player is the audio source and the board channel is the termination.

Now, both the source and termination have their own characteristics and those characteristics better match—or else.

The characteristics we're interested in are levels and impedances. Broadcast equipment has long been standardized on a line level of approximately 0 dBm at 600 ohms. It's a standard handed

down to us by the telephone industry where such things are sacred cows.

The introduction of home-type audio equipment such as cassette decks and CD players, as well as the characteristics of solid state amplifiers have eroded this standard to some extent. However, it is still the best standard operating procedure we have and you have to be careful about what you plug into what.

The match game

What you want to do is match impedances and levels. Sometimes this includes picking the right type of wire and sometimes the wire doesn't matter. More on that in a minute.

Take a look at Figure 1. Here are three typical connections. The first, labeled A, is called a bridging termination. The source is the output amplifiers on the left.



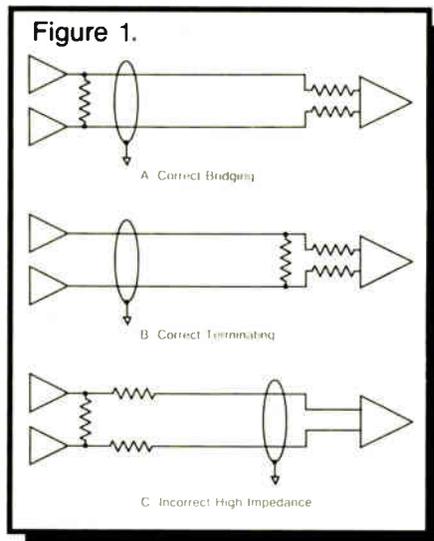
Q-TIPS

A terminating resistor is connected right at the output of the amps. Its value is the one specified by the manufacturer. For broadcast gear, that is 600 ohms. For home equipment it might be 10K or 100K.

The termination on the right is a bridging amplifier. The amplifier's input has resistors that are many times the value

of the terminating resistors, thus, they do not offer any load of their own.

Remember parallel resistors? If a high



resistance and a low resistance are in parallel, the result is a value very close to the lowest resistance.

Significant capacitance

If the termination is 600 ohms or lower and the wire is run within the building, the resistance and capacitance of the cable won't show up. However, if the termination is something like 47K for a phono cartridge, then cable capacitance becomes significant and you better keep that connection short.

The capacitive reactance of the wire is a high impedance in parallel with another high impedance (47K) and can become significant if the line is longer than a few feet.

The diagram labeled B is the same as A except that the terminating resistor has moved from the sending end to the receiving end of the line. The receiving end is terminating the line now.

If the wire is disconnected at the termination there is no load at the source, which is important with tube equipment or transmitters that must have matched loads, or else they'll burn up. Solid state studio equipment like boards, tape decks and preamps, doesn't have that bad habit.

Note that while connected, A and B look identical to the line. The 600 ohm termination resistance swamps out the capacitive reactance of the line and is much greater than the wire resistance. Therefore, the connecting wire is indeed transparent to the audio.

This is not true for case C. This looks like a bridging connection with a long wire to the high impedance amplifier in the terminating equipment. The line sees the two "build-out" resistors in series as the load across the line.

If this impedance is significant, such as 10K or higher, the capacitance of the cable becomes significant and acts to roll off the higher frequencies. This is why you don't hook long wires to phono cartridges, tape heads, or crystal mics. Even the outputs of CD and rack mount cassette players can be high enough in impedance that 25 feet of wire will degrade the sound.

(continued on page 32)

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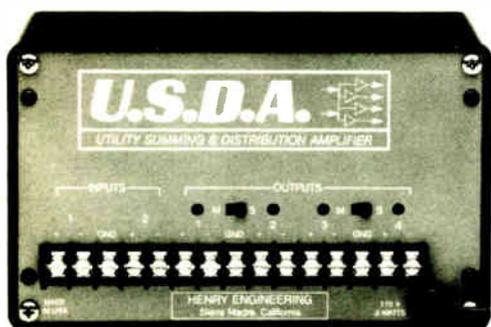
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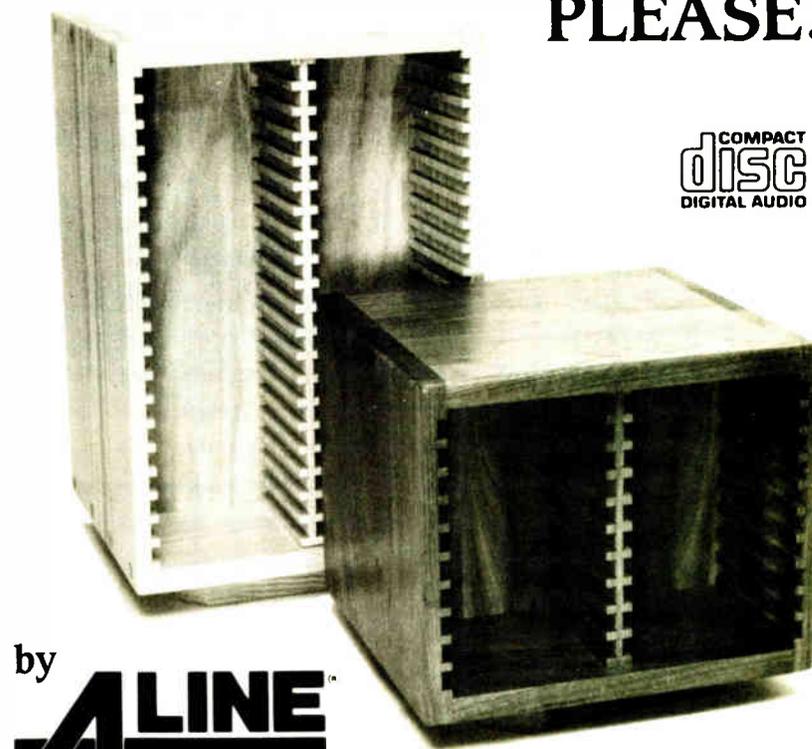
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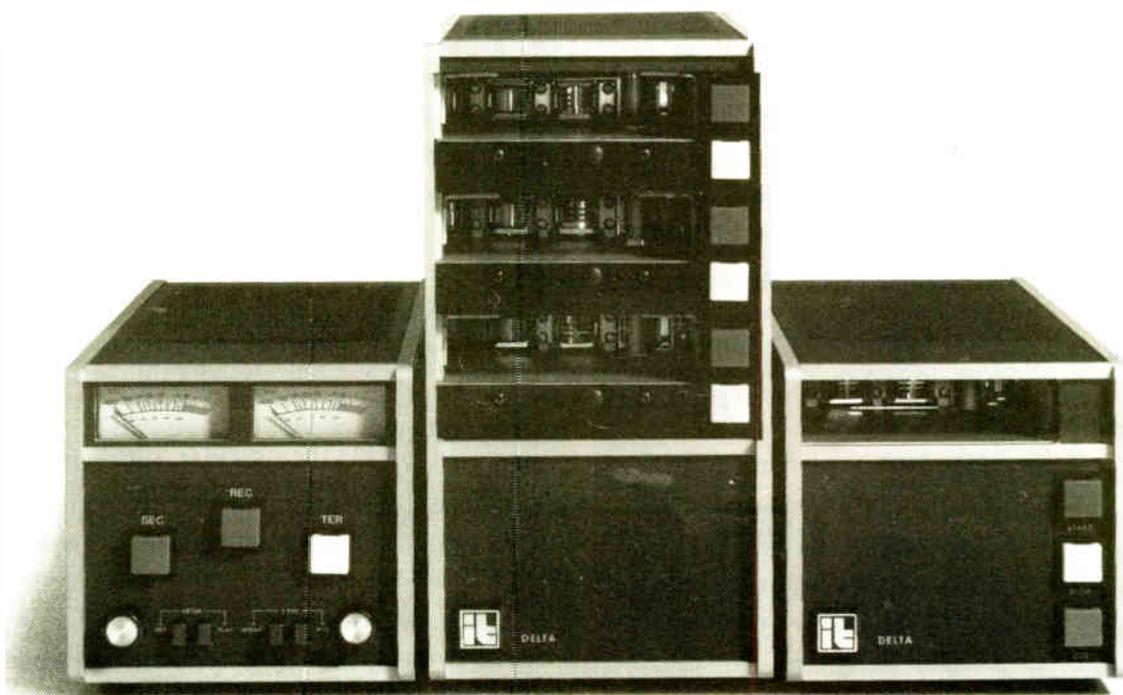
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A Detailed Guide to NRSC-2 Compliance

by Harold Hallikainen

San Luis Obispo CA Now that the Commission has made the NRSC-2 (transmission) standard mandatory, let's see what you need to do to comply.

As mentioned last month, many people thought the annual "proof" (equipment performance measurement) was deleted in the FCC's deregulation attempts.

INSIGHT ON RULES

While the audio measurements (and the audio specifications) were deleted, the RF measurement requirements were actually made more difficult (although the RF specifications did not change until NRSC-2 was adopted).

Looking back in my 1984 copy of the Rules, section 73.1590 required audio and RF measurements to be made at least once each calendar year (with no more than 14 months between measurements). 73.1590(1)(b)(v) required "measurements or evidence showing that spurious radiations, including radio frequency harmonics, are suppressed or

are not present to a degree capable of causing objectionable interference."

The section went on to say that field strength readings are preferred, but observations made with a communications receiver were acceptable.

These required measurements would typically demonstrate that harmonics and intermod were sufficiently suppressed, but did not demonstrate that the occupied bandwidth (specified in 73.44) requirements were being met.

You were required to meet the specifications of 73.44 (which states frequencies more than 15 kHz from carrier must be down at least 25 dB) but were not required to demonstrate compliance.

New requirements sneak in

Several rule changes in 1984, 1985 and 1986 deleted the audio measurement requirement and "simplified" the RF measurement requirement to "merely" demonstrating compliance with 73.44 (we're really just dealing with AM stations here).

As mentioned above, 73.44 includes requirements on harmonics, spurs and "occupied bandwidth." Everything but the occupied bandwidth specification could be measured with a field strength meter.

The occupied bandwidth measurement could, I imagine, be measured with a field strength meter that has a very narrow bandwidth, high tuning resolution and high tuning accuracy. Such a meter would be similar to a "tuned voltmeter." A spectrum analyzer is merely a tuned voltmeter that automatically sweeps.

I don't know how stations have been meeting the requirements of 73.1590

Use of NRSC-1 would have reduced interference to second adjacent channel stations because of the brick wall filter. However, the amount of protection of those stations was not precisely defined, because the transmitter will produce energy more than 10 kHz from carrier even if there is no audio above 10 kHz being fed to it.

The above 10 kHz components can be caused by non-linearities in the modu-

The lack of a standard results in widely varying audio quality between stations and between receivers.

(demonstrating compliance with 73.44), other than perhaps using a spectrum analyzer.

My review of FCC violation notices issued in 1988 shows several stations cited for not having an equipment performance measurement report on file (they all thought the "proof" requirement had been deleted!).

However, I found no mention of incomplete reports, such as demonstrating compliance on harmonics, but not occupied bandwidth. The inspectors may not have been looking for it, but it is required!

NRSC reduces interference

On 20 July 1988, the FCC adopted a Notice of Proposed Rule Making (MM Docket 88-376—call me for a copy), proposing to reduce the allowed 25 dB frequency from 15 kHz to 10 kHz, substantially reducing interference to second adjacent channel stations.

Other than reducing the frequencies at which various reductions were required, the NPRM proposed no other changes in the rules. Although NAB had suggested the Commission adopt the NRSC-1 audio standard (which specifies a standard preemphasis and a "brick wall" audio filter at 10 kHz), the Commission proposed to adopt the NRSC-2 "RF mask."

lator and modulated RF stage (and any following amplifiers). One severe non-linearity that is easily generated in the transmitter is due to overmodulation. The Commission wanted to offer an exact degree of protection, based on radiated RF, not audio.

NRSC-1 also provides a standard preemphasis for audio. If all stations used this standard and all receivers used a complementary deemphasis, we'd get a flat frequency response through the system. The lack of a standard results in widely varying audio quality between stations and between receivers.

This is the "interoperability" question I often bring up (will people be able to receive what you're transmitting?). The FCC currently leaves this question to the marketplace.

Besides the "leave it to the marketplace" argument, the Commission has a very good argument in favor of adoption of NRSC-2 over NRSC-1 in that NRSC-1 would be very difficult to enforce.

Most AM audio processors now use multiband compression, resulting in a "dynamic equalization." The frequency response depends on the program content. So . . . What to do?

The concept of the NRSC-1 standard seems very good. Stations should probably install an NRSC-1 box. They should

(continued on page 31)

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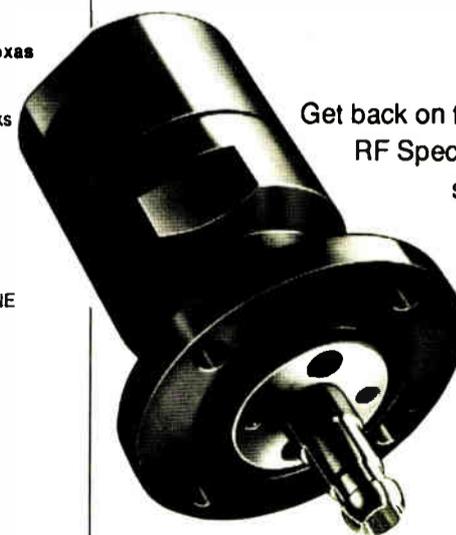
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Studying AES/EBU Interface

by Mel Lambert

Studio City CA Picking up the theme of digital interfaces, which I covered in detail during my April column, I understand that not everything is exactly rosy in the current state-of-the-technical-nation.

I refer to a meeting organized during the recent NAB Convention to consider various problems broadcasters are encountering with the AES/EBU digital interface. The meeting also addressed what should be done to ensure reliable exchange of digital information using the XLR-style INs and OUTs, which are appearing on a growing number of digital recorders, mixers and editing systems.

Word of these same problems seems to have reached the ears of the AES Working Group responsible for "AES3-

The various activities of the sub-working group will now include collecting and examining the specifications for related professional and consumer interfaces (the EBU and EIAJ versions, etc.). The subgroup will examine the specifications to discover areas of present or potential problems and recommend solutions for any conflicts or ambiguities.

Developing examples

Further action by the sub-working group will include the development of a tutorial explanation of the interface's concept, purpose and use, and—most importantly—development of examples of how and why the audio and auxiliary

information is moved through a variety of large and small digital systems.

It is suggested that these "case examples" should cover a variety of applications, and be used to illustrate good sys-

DIGITAL DOMAIN

tem design. In addition, it is proposed that the sub-working group's report should be published as widely as possible—including trade publications—and distributed to users and suppliers of the interface.

The group charged with writing the

interface guidelines is composed of the following individuals, any of whom would welcome calls from any chief engineer or production technician currently encountering problems with AES/EBU interface schemes:

•Steve Lyman, Strategic Engineering Department, Canadian Broadcasting Corporation, Montreal; 514-485-5477; Fax: 514-485-5371.

•David Clementson, Digidesign, Menlo Park, CA; 415-327-8811; Fax: 415-327-0777.

•Ted Jensen, Sterling Sound, New York, NY; 212-757-8519; Fax: 212-757-4607.

•Rob Modeste, Integrated Media Systems, Menlo Park, CA; 415-326-7030; Fax: 415-326-7039.

•Steve Schuster, Lexicon, Inc., Waltham, MA; 617-891-6790; Fax: 617-891-0340.

(continued on page 34)

... extra-long lines and Christmas Tree terminations ... can cause data anomalies.

1985, Serial Transmission for Linearly Represented Digital Audio Data," to quote the standardized document's full (and somewhat terse) title.

Late last year, the working group set up a special subgroup to consider specific input/output interface problems users might encounter in exchanging signals between various pieces of digital hardware.

Having attended the most recent meeting of the Sub Working Group on Implementation of the AES/EBU Audio Interface, I can report that work is well in hand on developing a code of practice, or engineering guidelines to spell out ways in which the interface can provide reliable transmission of data across typical balanced lines found in broadcast and production facilities.

The roots of the problem

I understand several stations around the country have been implementing digital transmission networks using AES/EBU interfaces with mixed results.

A number of broadcasters have found that extra-long lines and Christmas Tree terminations, for example, can cause data anomalies. What's more, badly terminated lines—including the insertion of additional XLR male/female cable extensions—can also cause problems.

During the subgroup's gathering at the recent AES Digital Conference held in Toronto during early May, I learned that problems currently being encountered fall into one of several categories.

In some cases, a lack of understanding regarding the AES-EBU interface specification and its intended use can result in improper or incomplete implementation.

Attempting to set up a digital interconnect with transmitters and receivers that conform to different specifications can also cause problems.

Finally, some difficulties may arise because of equipment behavior at either the interface's transmitter or receiver site that may be interpreted in different ways for certain equipment states.

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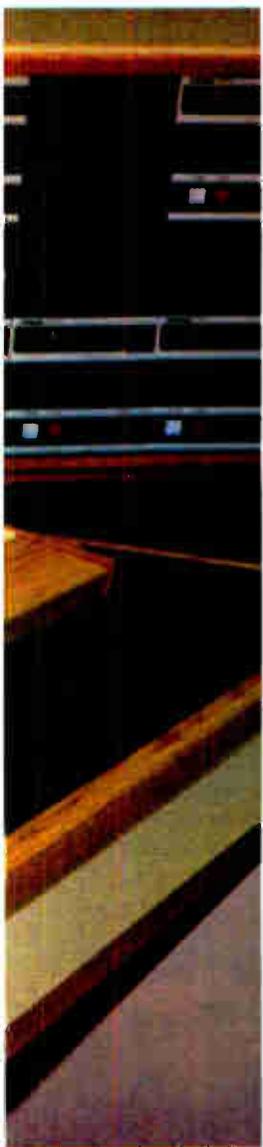
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Classic Calls and the Legend of Brinkley

by George Riggins

Long Beach CA Department of Incidental Corrections and Miscellaneous Information . . . I have compounded an error regarding WLW and the tubes used in the final RF stage.

As reported by others and picked up by myself, the finals were listed as 866s. The correct tube type is 862. A few of these tubes are reportedly still in existence, with one or two possibly in operating condition.

Also, it seems I misquoted the original meaning of the call letters of WEEL. From a chance comment by Bob, N6JUK, at the Chapter 144 QCWA (Long Beach, CA) luncheon, I learned the call stood for "Edison Electric Illuminating," rather than "Institute."

Bob said he listened to WEEL on the Atwater Kent receiver his dad owned in the early '30s. The receiver, a three band affair, was capable of receiving police calls and some of the Amateur bands.

Another "Old Timer," Ray, W6QIL, said the first broadcast DX he heard was KEX, Portland, OR, right after the 1933 earthquake (10 March 1933) in the Long Beach/Compton area of Southern California.

Ray was trying to change stations when he heard a strange call sign, and then discovered what station he had and where the station was located. That small discovery led to a lifelong fascination with radio, including over 20 years as a Navy electronics technician.

An OWL in the "DAY" time

KDAY and KOWL were reported to have been on the same frequency. Not so! KDAY operates on 1580 kc and KOWL operates on 1490. The rest of the story here is: KDAY, a daytimer when first on the air, was originally assigned

the call KOWL. As reported to me, one of the owners started wondering what a daytimer was doing with an "OWL" call.

To denote that the station was on only during the hours that the sun was supposed to shine, the call was changed to the present KDAY. This correction was brought to my attention by Andy Laird of KDAY and Bill Kingman of KOWL. I believe Bill said he was working at KDAY at the time of the call sign change.

Another interesting comment from the QCWA luncheon concerned the original "Peanut" tube from WW1. The filament voltage was 1.1 V, and the tube was used after the war by telephone companies as an amplifier on the "Long Lines."

Delco lighting

The successor to the "Wind Charger" in the Midwest must have been the "Delco Lighting Plant." The Delco plants



put out 32 V to charge a battery bank, would run a milking machine, and made the lights much brighter than the original 6 V wind-driven generators.

There was automatic starting when the voltage dropped below a given point and the plants were powered by a Fairbanks Morse gasoline engine. Tommie, W6PCI, reported that stations he could hear in the southwestern portion of MO—using a Delco Lighting Plant for power—in the early to mid 1930s, were KWTO in Springfield, WMBH in Joplin, and WHB in Kansas City.

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KWTO is credited with going on the air 25 December 1933. In 1941 the station was listed as having 5000 W of power and at the present dial location of 560 kc. There was no movement of frequency in 1941.

The engineer in 1941 at KWTO was listed as Fritz Bauer. Anyone still using a "Brown Bomber" transmitter that Fritz sold as a complete unit or as a kit?

WMBH went on the air in 1927 (month not given). WMBH is listed in the 1929 *All American Official Radio Log* with an assigned frequency of 1420 kc, 211.1 meters, 100 W (higher power daytime), in Joplin, MO; it was owned by Edwin Dudley Aber.

In 1941 the station moved to 1450, and was authorized 250 W of power. Baxter Burris was the chief engineer.

No comments can be made regarding radio along the US and Mexican border

without giving credit—or discredit—to Dr. John R. (Romulus/Richard) Brinkley.

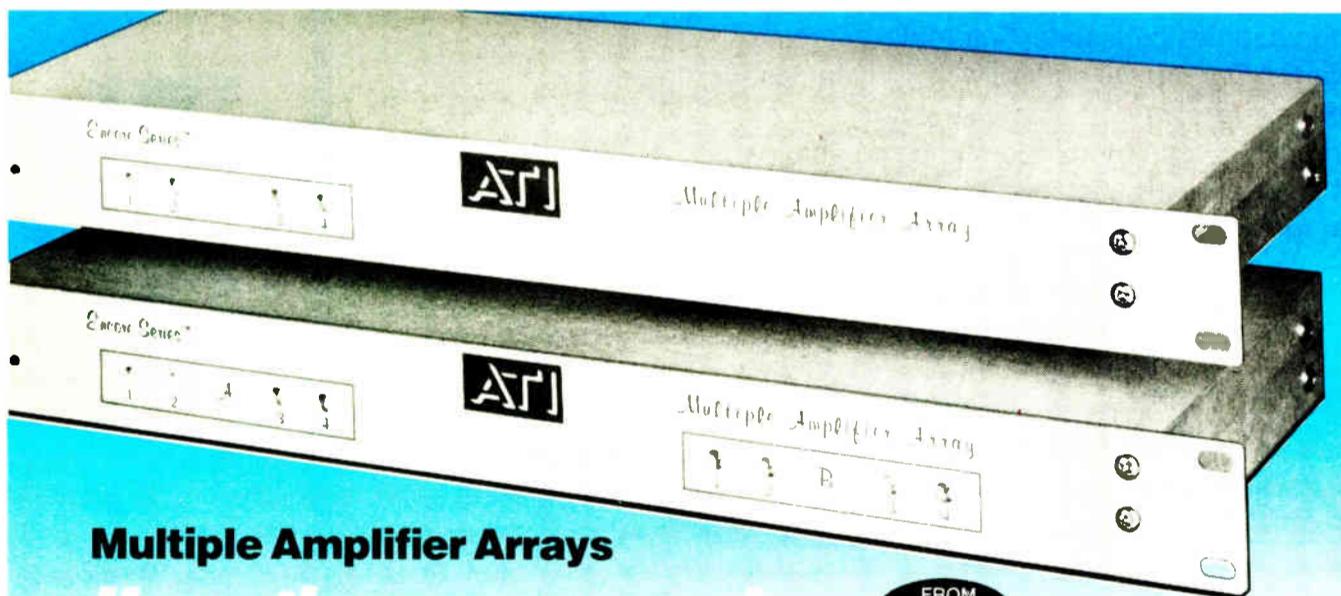
Doctor, as he was referred to in several writings, was of somewhat cloudy origins. A bibliography of the man was included in the book *Superpowers and Borderblasters* by John D. Price.

In this book, the Doctor was listed as having been born 8 July 1885 in Tennessee (based on his Connecticut medical license application), Kentucky (based on his Arkansas application), North Carolina (based on his California and Texas applications), or all the above.

His mother, by various accounts, was not remembered, dead by his sixth birthday, fondly remembered, or bade goodby at her deathbed.

According to *The Roguish World of Doctor Brinkley*, by Gerald Carson, Doctor was born in a log cabin in or near Beta, in Jackson County, NC. However, almost the only "facts" to be found on the early life of Doctor come from *The Life of a Man* by Clement Wood. This work was ordered and paid for by Dr. Brinkley and

(continued on page 34)



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by Bruce Bartlett

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You can change the tempo (without changing the pitch) to make the music fit the timing of the spot. Or you can change the key or the instrument timbre after recording. And if your keyboard skills are less than impressive, you can enter the notes one at a time.

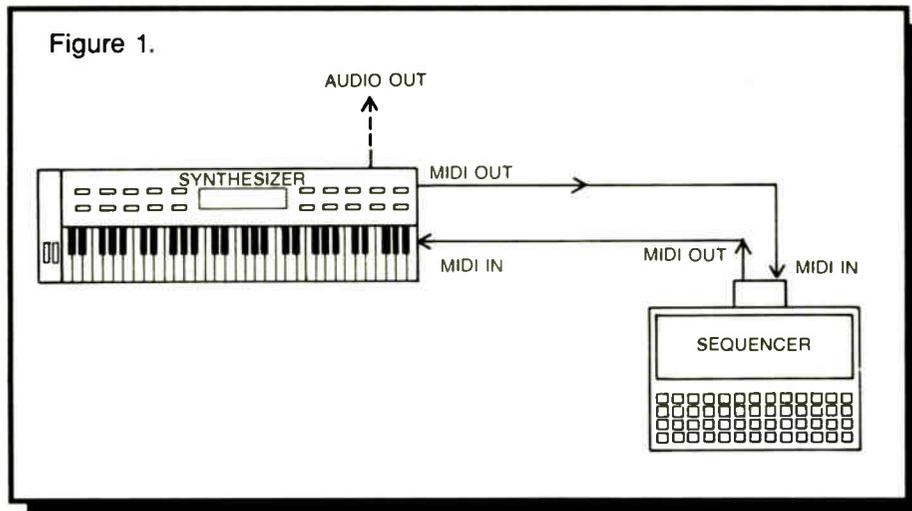
As we explained last time, a sequencer is a device (or a computer program) that lets you record musical performance data into digital memory. The sequencer does not record audio; rather, it records copies of gestures you make on a piano-style keyboard or drum-machine pads.

LINE OUT

In this article, I'll describe how to record a polyphonic synthesizer (one that plays chords) on one track of a sequencer. Most musical spots have more than one instrument playing, but sometimes you can get by with just one—such as angel-voice chords for a New Age spot.

Like a multitrack tape recorder, a sequencer has eight or more tracks on which you can record performances for

2. Play a tune on your keyboard.
3. Play back the sequencer recording to hear it. Your performance will be



up to eight different instruments. You can record even more tracks by bouncing or merging tracks, thus freeing tracks for new overdubs.

Sequencer setup

Figure 1 shows a synthesizer connected to a MIDI interface that is plugged into a computer running a sequencer program. You'll play chords and melody, record them with the sequencer and play back the sequence through your synthesizer. The basic steps follow.

1. Set your sequencer in record mode.

4. Correct mistakes by punching in.

5. Arrange the song by combining various sequences.
6. When the sequenced performance is correct and complete, start the sequencer and record the synth output. That recording is the final musical product, to which you can add voice-over. Let's look at each step in more detail.

Set your sequencer in record mode. Choose a tempo in your sequencer and choose the track on which you want to record. On your computer keyboard,

push the record key (designated in the sequencer instructions). You'll hear a metronome ticking at the tempo you set.

Play music on your keyboard. Listen to the sequencer's metronome and play along with its beat. The sequencer will keep track of the measures, beats and pulses. When you press the stop key on your computer keyboard, the sequencer will stop recording and will go to the beginning of the sequence (the top of the tune).

Another way to record your performance is in step-time—one note at a time. If the part is difficult to play rapidly, you can also set a very slow tempo on the sequencer, record while playing the synth at that tempo, then play back the sequence at a faster tempo.

Play back the sequencer recording. On your computer keyboard, hit the play key (designated in the sequencer-program instructions). You'll hear the sequence playing through your synthesizer.

Quantize the track. If you wish, press the keys to quantize the performance by the desired amount. With quantization or autocorrection, the sequencer corrects rhythmically sloppy playing; it places each note at the proper point in time relative to the beat.

Altering quantization

Some sequencers don't let you alter quantization after recording, but there's a way around this.

First record all tracks without quantization. Next, mute all the tracks except the one you want to quantize.

(continued on page 32)

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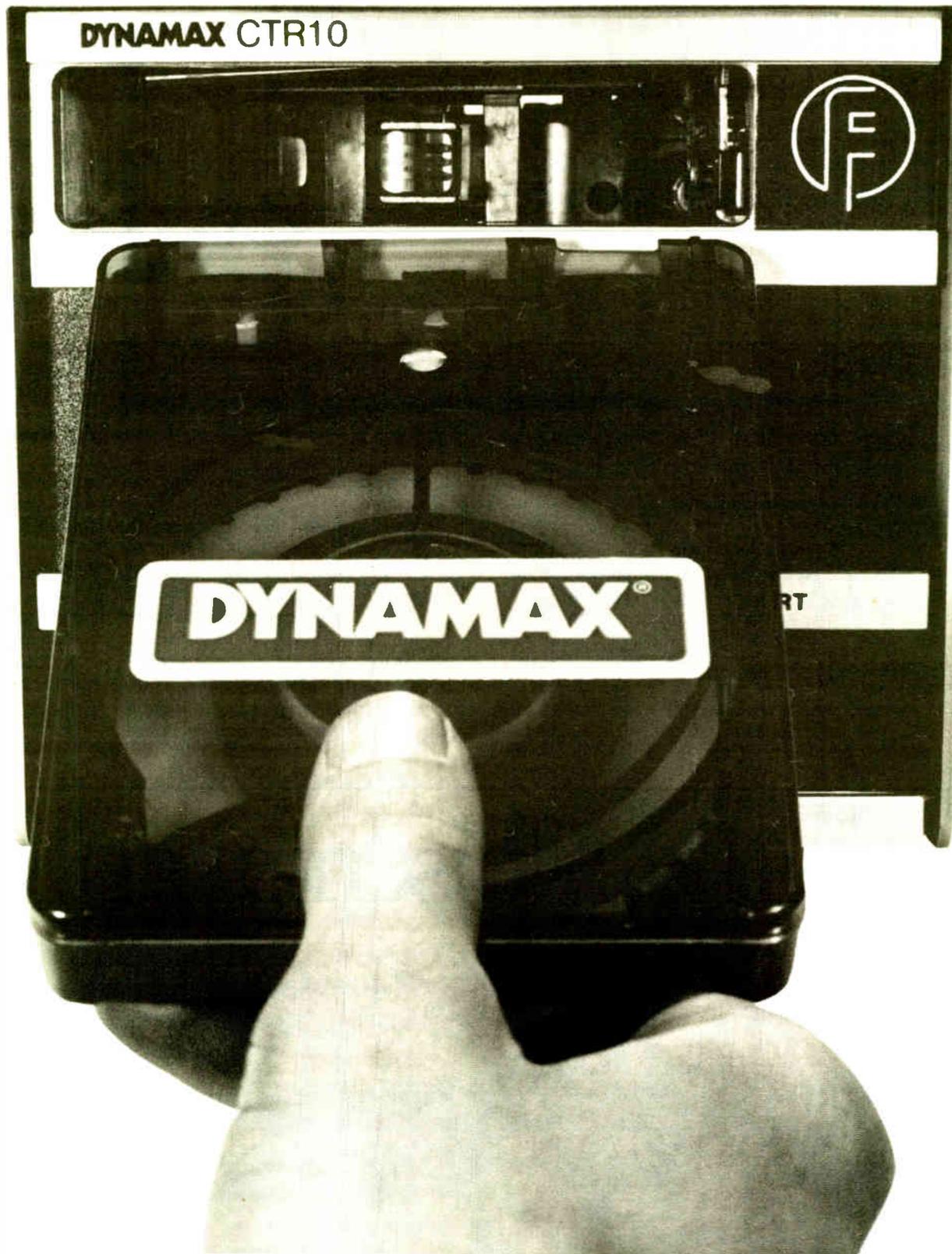


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World Radio History

Getting the Bugs Out of KLDD

by Dee McVicker

Tempe AZ Rumor has it that KLDD-AM's antenna site has the largest bug blower west of the Mississippi. That's right. Bug blower.

Why a bug blower? Only old-timer Earl Cullum knows for sure and since he died in the early '80s, he's not talking. Current CE Hue Beavers, although as curious as the next guy, can only speculate because he would rather not shut down the bug blower to find out for sure.

OFFBEAT RADIO

What's left are a few theories, some more believable than others. It is possible that Cullum just simply had an aversion for gnats, a thriving populace at the Dallas/Fort Worth antenna site. Or, maybe there is some truth to the theory that too much RF is not altogether that healthy.

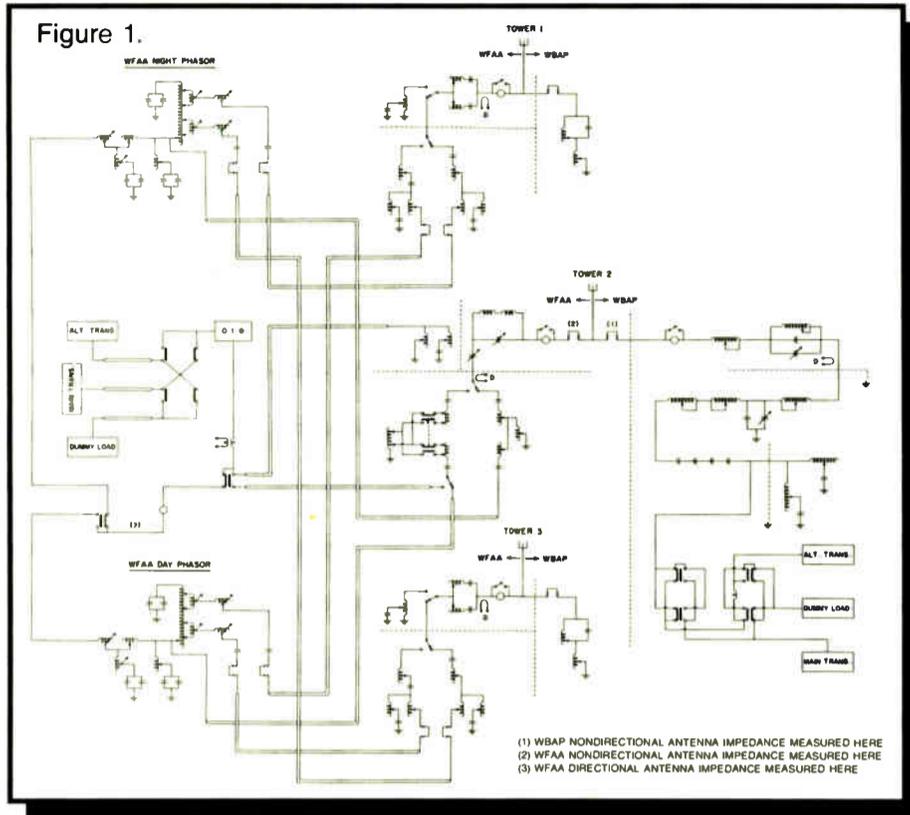
Of course, the answer might be found with simple engineering logic, a much more appealing approach for those who might be concerned that poor Cullum had a bit too much RF.

The bug-a-boo

To enlighten us, Beavers takes us back to the days when KLDD and WBAP were antenna mates. Admittedly this does not explain the bug blower. But it does explain the enormous power these stations shared and why a few pesky gnats might be a problem.

KLDD-AM's antenna site is a three tower directional. From the early '70s to early '80s, the station's center tower radiated KLDD's directional signal as well as WBAP's non-directional signal.

KLDD, 570 on the dial, contributed 5 kW directional; WBAP, at 820 on the dial,



contributed 50 kW non-directional. Top loaded at 490 feet, the antenna-to-ground voltage potential was somewhere in the vicinity of "horrendous," according to most calculators.

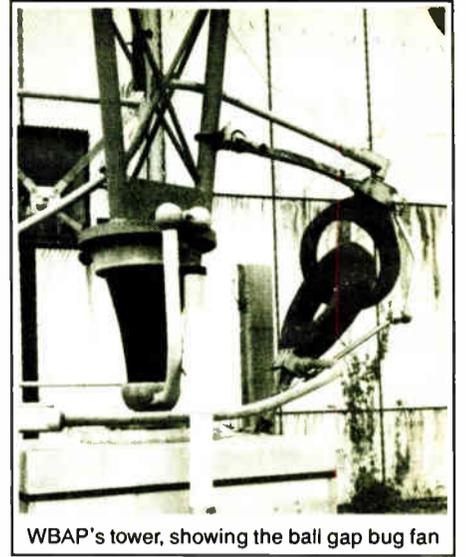
Suffice it to say, the center tower had more than enough spark power to throw off an unsuspecting transmitter. That disconcerting reality must have left Cullum uneasy every time he caught wind of a storm brewing. Perhaps it was on one of those brow-sweating nights that Cullum dreamed up the bug blower idea.

Keeping the spark gap clear

TFT's Perry Kirk was on a visit recently to KLDD and came back with this observation of the site: "To keep the transmitter from going off the air, they have what

they call a spark gap. There was such a large amount of energy being developed that bugs going through that gap would be enough to make it arc. So they have a blower, a bug blower. Craziest thing I ever heard!"

The spark gap is actually a small space



WBAP's tower, showing the ball gap bug fan

between what Kirk describes as cannon balls, which are attached to steel rods. One steel rod is attached to the tower and another is spiked into the ground near the base of the tower. The spark gap is a little over an inch wide, according to Kirk's estimation. Enough for a lightning strike to jump the gap and become grounded.

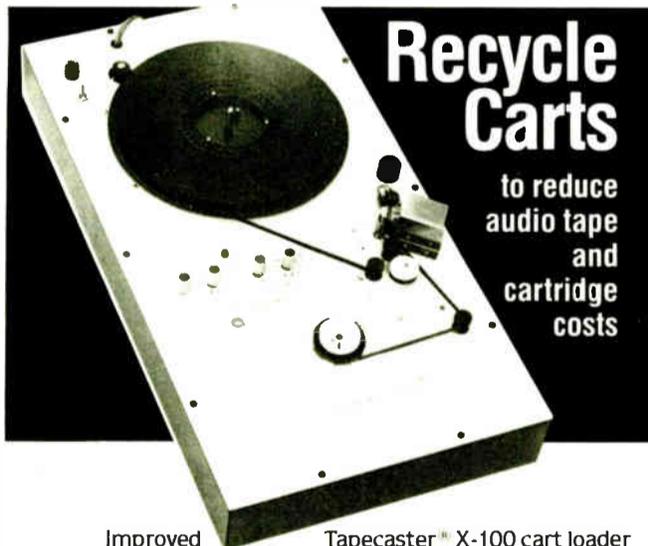
"They're placed close enough together where lightning will arc across, but not so close where modulation will spit and arc over," pointed out Beavers. Unless, of course, a few stray gnats decided to mingle in and around the spark gap, making conditions favorable for radio modulation to jump the gap and become grounded.

Beavers suspects that during a calm Texas night—or rather, during normal ra-

(continued on page 37)

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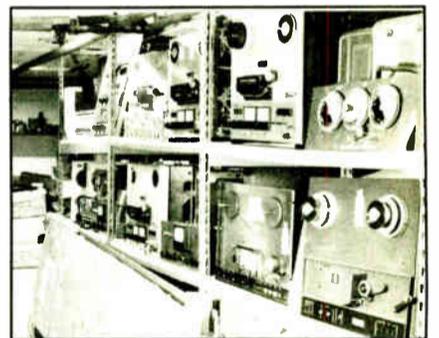
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An Examination of Field Effect Devices

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by Ed Montgomery

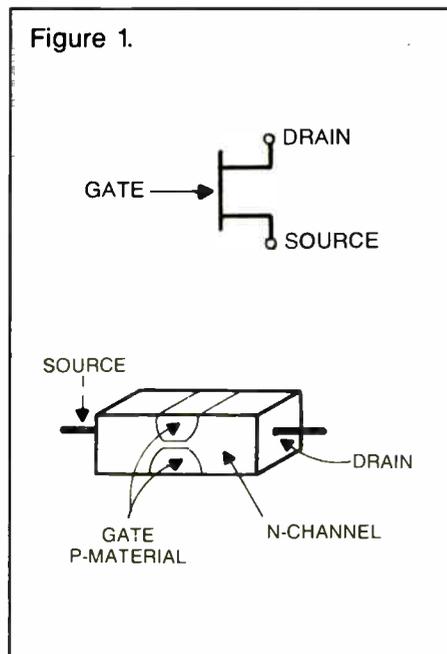
Part VII of XII

Annandale VA To date, our discussion of transistors and how they operate has related to the point contact and bi-polar transistor. Another type of transistor that has gained a high popularity is the unipolar or Field Effect Transistor (FET). This type of transistor is voltage-controlled and has several advantages over its bi-polar and point contact relatives.

Field effect transistors get their name from the varying electric field that is de-

veloped from a voltage applied to a part of the device known as the gate. This is in contrast to bi-polar and point contact transistors, which employ current flow through the junction to facilitate transistor operation.

Two types of FETs currently are manufactured: junction FETs (JFETs) and MOSFETs. Junction FETs are similar to



than bi-polar transistors. FETs are constructed with a drain, source and gate as illustrated in Figure 1. The devices can be made to be either P-channel or N-channel.

Employing bias voltages

Two bias voltages are required for proper operation. One (V_{DS}) is connected between the source and the drain, permitting a current to flow through the channel. The second voltage (V_{GS}) is applied between the gate and the source as illustrated in Figure 2.

The voltage between the drain and source is connected to make the source negative with respect to the drain. In the N-channel device illustrated, electrons

will be permitted to flow. (A P-channel device would permit holes of positive carriers to flow.)

This flow is known as the drain current and is identified as I_D . The voltage applied between the gate and the source, identified as V_{GS} , causes the P-material to become negative, reverse-biasing the PN junction between the gate and the source.

As V_{GS} is increased, the area for electrons to travel through in the N-channel decreases. V_{GS} is used to control I_D (drain current); the output current from the FET. This is in contrast with bi-polar transistors that require currents, not voltage to function.

Input signal

The input signal to the FET is the gate. Since this is reverse biased, no current is flowing and an extremely high input resistance is present. This permits circuits employing FETs to operate without loading down previous stages.

As V_{GS} increases, the area for current carriers to flow between the source and drain decreases. The V_{GS} voltage creates what is called a "depletion region" within the channel.

If V_{GS} is continually increased, the depletion region can ultimately stop I_D . This is known as gate-to-source cutoff

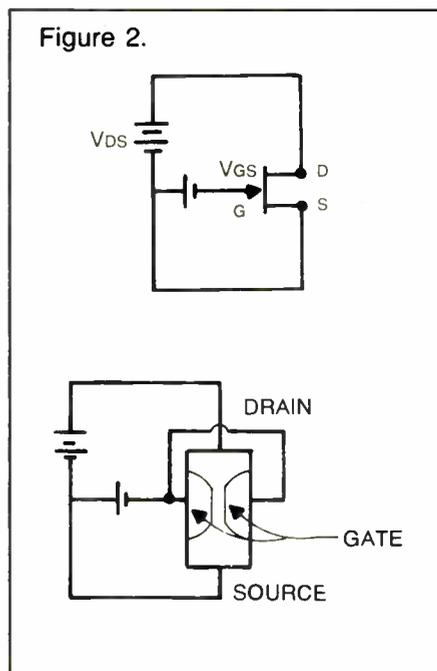
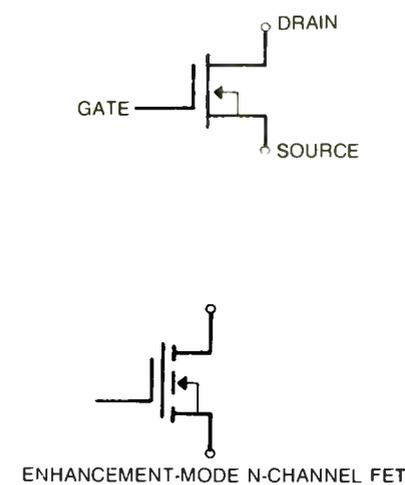


Figure 3.



voltage, or V_{GS} (OFF). Manufacturers of FETs specify cutoff voltages for the devices they manufacture.

FETs have several advantages over bi-polar transistors in the radio frequency spectrum. FETs can operate at much higher frequencies, extending into the microwave region. MOSFETs have become the heart of the computer industry.

Microcomputer memory integrated circuits are arrays of thousands of MOSFETs. They are easy to manufacture and operate on a very low power requirement. MOSFETs have a very high switching speed and their input resistance is nearly infinite. (Figure 3 is an illustration of a MOSFET.)

FETs are classified into two major groups: enhancement mode and depletion mode. Enhancement mode FETs have no channel. The channel is formed when a gate voltage is applied. A depletion mode device has a channel present regardless of whether V_{GS} is present or not. Thus a current will flow if there is no gate voltage, whereas enhancement mode FETs will not operate without V_{GS} .

Ed Montgomery currently is an electronics teacher at Thomas A. Edison High School in Fairfax County, VA. He has taught broadcast engineering at Northern Virginia Community College and worked as a broadcast engineer for several radio stations.

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Using the NRSC-2 Standard

(continued from page 22)

also install an NRSC-1 deemphasis filter on the modulation monitor audio output. Adjust the audio processing for optimum audio on this NRSC receiver, instead of adjusting for the program director's car radio. As NRSC receivers are introduced, people will hear that it really does sound better.

One final comment on NRSC-1. It would appear that the limit on preemphasis along with the frequency spectrum of programming sets a loose limit on radiation between carrier and 10 kHz from carrier. If the high frequency audio content is low and is boosted a limited amount by preemphasis, the energy falling on the first adjacent channel is loosely limited.

Use of NRSC-1 may result in a reduction of interference to stations on first adjacent channels, depending upon what preemphasis was previously used. It would be interesting to see a spectrum analysis from carrier on out under various programming conditions.

NRSC-2 adopted

On 12 April 1989, the Commission adopted the NRSC-2 RF mask (MM Docket 88-376—again, call me for a copy). As described above, this rule change mainly reduces the 25 dB down frequency from 15 kHz to 10 kHz from carrier.

The FCC's Report and Order points out that a major argument in favor of adopting NRSC-1 rather than NRSC-2 was cost. It was reasoned that an NRSC-1 box (less than \$1000) costs less than a spectrum analyzer or splatter monitor.

The Commission points out (in paragraph 32) that 73.1590 *already* requires measurements to demonstrate compliance with 73.44, so no new regulatory re-

quirements are being imposed.

The Commission did, however, partially accept this argument and actually reduced the requirements of 73.1590 by waiving the required measurements until 30 June 1994 if the station complies with NRSC-1 when initially going on the air, or by 30 June 1990.

If the Commission finds (through spectrum analyzer measurements) that the station is not complying with 73.44, the station will need to make the measurements of 73.1590 to demonstrate compliance with 73.44 (after the problem is fixed).

This waiver of measurements, dubbed "presumptive compliance," should encourage many stations to install NRSC-1 equipment (because of the cost benefit due to reduced measurements).

This will help substantially in getting

the NRSC-1 preemphasis standard installed in a large number of stations, making NRSC receivers sound good.

Since the measurements required by 73.1590 are only required once a year, many stations will probably not buy the equipment required to make the measurements (while still complying with the limits of 73.44).

It would appear that consulting engineers or contract engineers could purchase the equipment and offer the service to stations, spreading the cost among many stations.

You may find that a local television station, cable company, two-way radio shop or consumer TVRO supplier has a spectrum analyzer you can use. You may also be able to rent the required equipment.

If you install NRSC-1 equipment by 30 June 1990, the measurements required

by 73.1590 will generally be waived until 30 June 1994.

After that date, you must make measurements once each calendar year (as you've been doing all along, right?) to demonstrate compliance with the new tighter occupied bandwidth specifications (NRSC-2).

These measurements are to be made with a swept frequency RF spectrum analyzer (with various specifications). Specialized receivers may be used (such as the Delta Splatter Monitor), but in case of dispute as to what is actually being radiated, the spectrum analyzer is assumed to be correct.

■ ■ ■

Harold Hallikainen is president of Hallikainen & Friends, a broadcast equipment design, manufacture, sales and installation firm. He can be reached at 805-541-0200.

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Computerized Music

(continued from page 27)

Plug a MIDI cord from MIDI Out to MIDI In on your sequencer or computer interface.

Set the desired amount of quantization, and record on an open track. To change the amount of quantization, erase the quantized track. Now, back to the remainder of the process.

Correcting mistakes

Punch In/Out to correct mistakes. You can correct mistakes by punching into record mode before the mistake, recording a new performance, and then punching out of record mode.

Go to a point in the song a few bars before the mistake. Then, just before you get to the mistake, punch into record mode and play a new, correct performance.

As soon as you finish the correction, punch out of record mode.

Alternatively, you can use autopunch.



Bruce Bartlett is a microphone project engineer and technical writer with Crown International. He can be reached at 219-294-8000.

With this feature, the computer automatically punches in and out at preset times; all you have to do is play the corrected musical part.

Here's how you perform an autopunch. Using the computer keyboard, set the punch-out point (the measure, beat, and pulse where you want to go out of record mode).

Set the punch-in point (just before the part you want to correct). Set the cue point (where you want the track to start playing before the punch).

Hit the play key on your computer. When the screen indicates punch-in mode, play the corrected part. The sequencer will automatically punch out at the specified point in the song.

Using step time

The above punch-in routines were done in real time. You can also punch-in/out in step time. To do this, go to a point in the song just before the mistake.

Set the sequencer to step-time mode. Step through the sequence pulse-by-pulse, and punch into record mode at the proper point.

Record the proper note in step time. Punch out of record mode. Now you can return to the task at hand.

Arrange the song by combining various sequences. Now your sequenced performance is perfect, so you can put together your composition.

Many songs have repeated sections;

the verse and chorus are each repeated, often several times. If you wish, you can play the verse and chorus once each and save each as a separate sequence, which you can copy for all the places each occurs in the song.

You can rearrange song sections, and append one section to another, by pressing a few keys on the computer. You also can have any section replayed wherever desired in the song. Thus, you might build a song by having the computer play sections A, A, B, A, C, B, A.

Spicing it up

To add variety to the song, you might want to have the synth play different patches at different parts of the song. For example, play a piano on the first verse, organ on the second, and marimba on the chorus.

You record these program changes by putting your sequencer in record mode on another track and entering the appropriate program numbers at the right time on your synthesizer. Putting the program changes on a separate track makes it easy to edit them. You can punch in new program changes just as you can punch in new performances.

Plug your synthesizer's audio output (mono or stereo) into the line inputs of your two-track recorder. Or, if you wish to add overall reverberation, plug the synth output into a digital reverb unit and from there plug into the recorder.

Hit the play key on your computer keyboard and set the maximum recording level for your recorder: cassette 0 VU, DAT -3 dB, or open-reel +3 VU.

Once your levels are set, put your

recorder in record mode and start the sequencer. The finished product is a stereo first-generation recording of your song. You're ready to add voice-over and finish the spot.

Connecting Equipment

(continued from page 20)

Here's an interesting case of where a 600 ohm system looked like a high impedance. A station I worked for was located in a shopping mall. The transmitter and tower were at the edge of the property, a couple of thousand feet away.

To get the signal from the studio to the transmitter, the station engineer used high quality microphone cable run underneath the parking lot.

Now, with that wire length, there was enough cable capacitance to roll off the frequency response about 6 dB at 15 kHz. The station tried to counteract the drop by using a graphic equalizer with a high impedance input to boost the highs at the transmitter end.

Worse, the board output of +8 dBm was over-driving the equalizer so the air signal was distorted.

The simple solution turned out to be removing the equalizer, terminating the audio in 300 ohms at the audio processor instead of a bridging connection and adding 300 ohms in series with the board output so it would think it was driving a 600 ohm load.

The line was happy and the response returned to within a dB at 15 kHz. Yes, this arrangement did drop the levels by 6 dB, but there was still plenty of drive.

So, if you think you're having equipment problems because something doesn't sound right on the air, step back and have a look at how the equipment is connected. You may have excellent equipment, working at factory specs. But, the audio may be degraded by a mismatch between source, termination and line.



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

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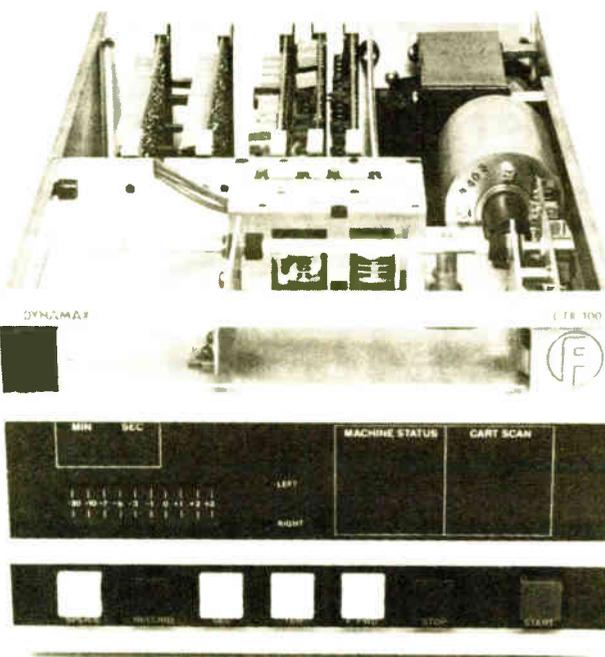
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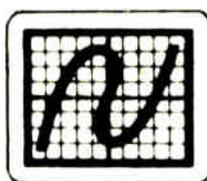
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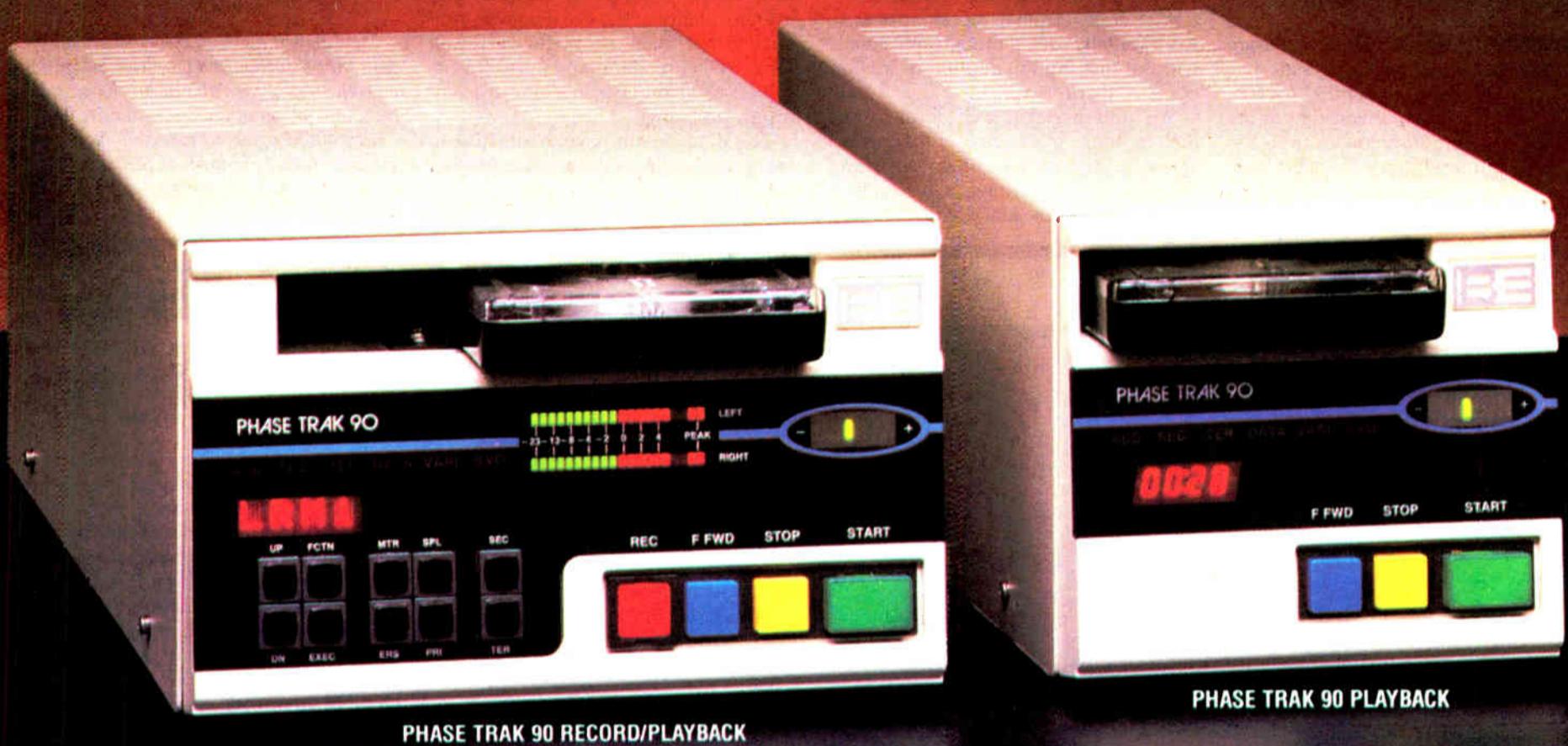
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Digital Interfacing

(continued from page 23)

Preliminary tests have been made of different lengths of shielded, twisted-pair cable, and conventional tip, ring and sleeve jackfields.

Matching instead of bridging

Following discussions with various sub-working group members, the design of digital audio distribution systems may have to revert to the "matching" (or 600-ohm source and load) philosophy, rather than the contemporary low-output-impedance/high-input-impedance bridging schemes that have come into common application.

CBC's Steve Lyman has also provided the results of preliminary experiments, which indicate that "the traditional, telephone-style 'Christmas Tree' blocks used to terminate connections to jackfields may cause reflections that are sufficiently serious to preclude their use."

Wirewrap terminal blocks appear to work well, he says, although splits made without distribution amplifiers are particularly disruptive.

"An unterminated cable even a few meters long inadvertently connected across a feed to a receiver—as would happen when splitting a feed using 'mult' jacks—can make the data un-

recoverable, or only partially so, causing what sounds like ignition noise on an AM radio.

"Maximum cable lengths vary with specific types, but vary from 75 to 160 meters, without equalization. This length tends to decrease if multiple loads are connected to a single transmitter."

Lyman also considers that "the small transformers suggested by the existing appendix to AES3-1985 seem to increase the maximum allowable cable length, and the quality of the eye diagram, suggesting that their use might very well need to be made mandatory. Transformers also simplify some other system-design problems.

"The data stream is very sensitive to disruptions, such as those caused by hot patches, and switches between non-synchronous sources. This suggests that

some method of detecting invalid data may have to be developed, if only to protect monitor speakers."

It should be stressed, however, that this information is very preliminary, and has been included here simply to provide an idea of the types of dialogue currently being established between members of the broadcast community. Your active involvement is encouraged.

Next: Channel Status Information.

■ ■ ■

Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for the past decade, and for seven years served as editor of "Recording Engineer/Producer" magazine. He is currently president of Media & Marketing, a consulting service for the professional audio industry.



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World Radio History

Old-Time Call Signs

(continued from page 26)

was used for publicity purposes.

The Dictionary of American Biography cites Dr. Brinkley as having ministered to Harry Chandler, owner of the Los Angeles Times in 1922. It seems that The Times was in the process of installing KHJ (Kindness-Happiness-Joy), reportedly the first radio station put up in the City of Angels.

License granted

Doctor was very interested and upon returning to Milford, KS, applied for a station license. The license was issued in September 1923 and KFKB was on the air a few days later. The power was 1000 W on 1050 kc.

Although on 13 June 1931 the FRC refused to renew his license, Doctor operated the station until he finally ran out of appeals; he went off the air on 20 February 1932.

Other stations that lost licenses at about the same time were KVEP, Portland, OR; KTNT, Muscatine, IA; and—as reported by Gerald Carson—Reverend Bob Shuler's (KGEF ?) "hate" station in Los Angeles.

Dr. Brinkley is credited with testing the provisions of the Radio Act of 1927 and contributed to the establishment of the principle that United States radio programming must be in the public interest.

KFKB became KFBI, and these two sets of call signs are apparently the progenitors of the present KFDI, Wichita, KS, which is credited as going on the air in September 1923.

KTNT, Muscatine, IA must be mentioned along with KFKB and the Doctor. KTNT was owned by N. Baker Enterprises, 1170 kc and 5000 W. The station advertised Baker cancer remedies.

It is said that there was no real love lost between Baker and Brinkley. However, both eventually wound up in Arkansas extolling their own brand of magic cure or elixir.

More on Brinkley in my next installment.

■ ■ ■

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

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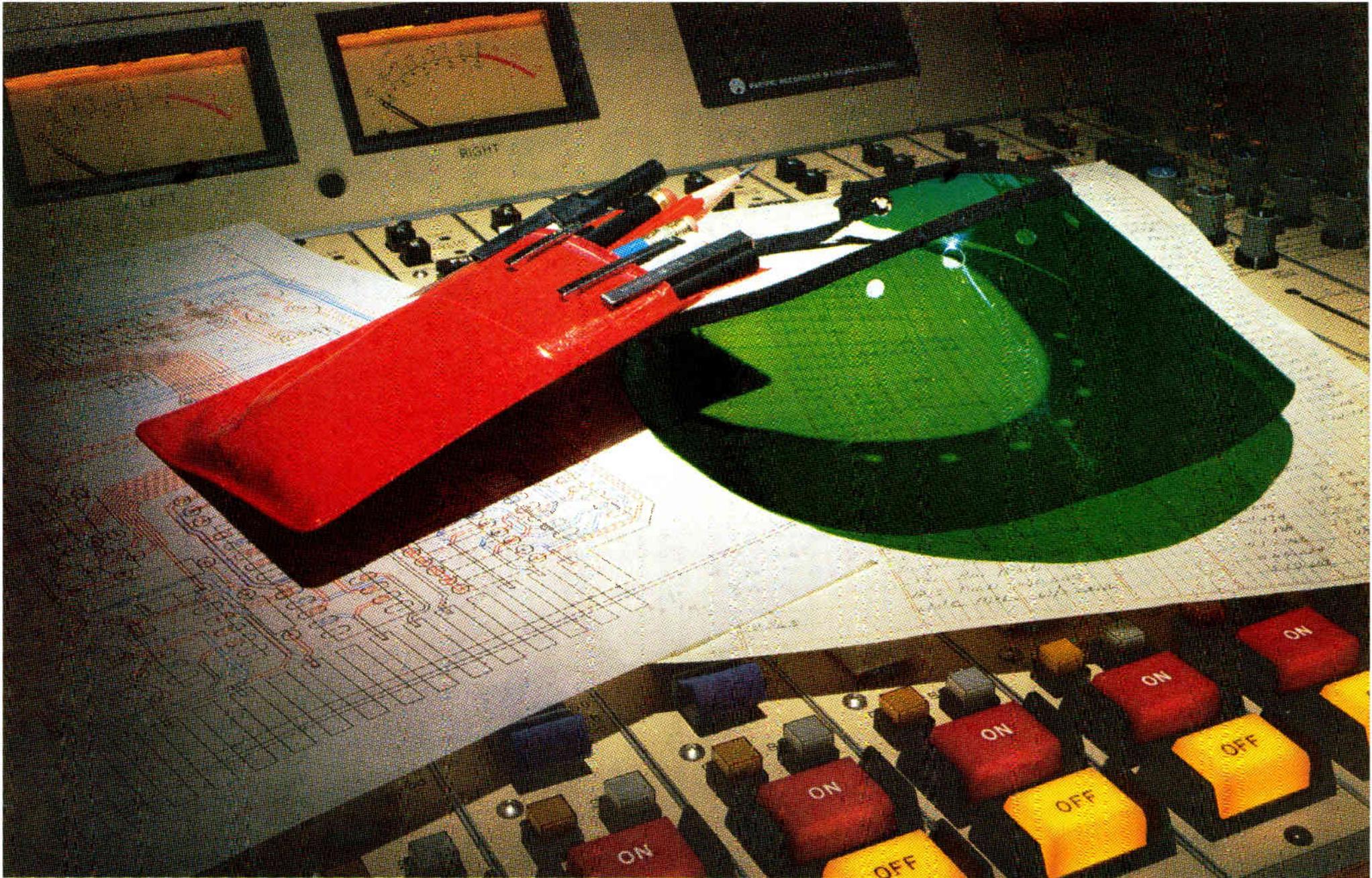
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Bug Fan In Use at KLDD-AM

(continued from page 29)

radio operations—Cullum discovered a gnat gap at the center tower instead of a spark gap. "Apparently what happened is every once in a while a bunch of gnats would gather around (the spark gap). They'd conduct, cause a path—and zap!" Beavers explained.

The first charcoaled mess of kamikaze gnats must have been enough to turn Cullum on his heels, sending him back to the bench to fashion the craziest apparatus known to AM.

Pursuing the idea

Given Cullum's choices, one of which was to attempt annihilation of a persistent gnat population with Raid™ or some equally lethal chemical, the bug blower idea had merit.

One can only imagine Cullum leafing through his favorite vendor's catalog, looking for a device that would rid his transmitter site of gnats once and for all. But Beavers suspects that this picture is unlikely. Cullum was an engineer's engineer—a do-it-yourself kind of guy who would rather build his own transmitter than ship one in.

Cullum, who built the location like "a brick outhouse" according to Beavers, specified the bug blower much like he specified everything else that went into the site: right down to a gnat's, uh, toe.

"It looks like Earl spent many months coming up with the specifications," said Beavers, as he thumbed through the lengthy documentation that Cullum left behind. "(Cullum left) a book the size of a tech manual on a transmitter," clarified Beavers.

In Cullum's manual are "a couple-three" pages outlining what turns out to be a rectangular box mounted on the side of the center tower pier. "It has this snout-like thing coming out of the top," explained Beavers of the 24"x30"x20" bug blower. Air exhaust specs are not shown in Cullum's station manual, but Beavers confirms that it's a big enough

“. . . when it's real buggy, we do stand the chance of having problems."

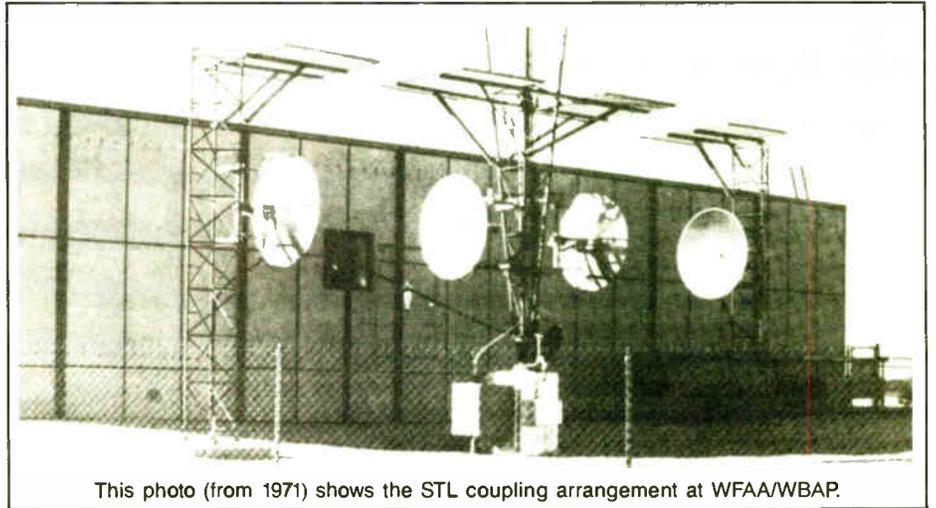
blast to cause quite a rumble at the site.

Cullum's station manual does indicate that Collins, the transmitter manufacturing company, more than likely custom designed and installed the bug blower.

Turning a few more pages in the station's "manual," Beavers encountered another oddity left over from combined station operations. "There was no

isocoupler, because nothing was made to couple across a tower with that much power," he revealed.

Does the station still need Cullum's bug blower? Beavers answers, "As a 5000 watt station, we probably don't have as



This photo (from 1971) shows the STL coupling arrangement at WFAA/WBAP.

Enter Cullum's STL isocoupler. Explained Beavers, "The (STL-) coax goes down the tower to almost the base of the tower, stops and then hooks up to another dish. That dish is looking out toward yet another dish on a small little tower that is not fed with RF." The small tower is what Cullum used to isolate antennas from the two stations' STL feeds.

Keeping a spare

Today, with only KLDD's 5 kW load, Beavers uses an isocoupler to isolate the antennas. But he keeps Cullum's STL isocoupler system around, "just in case." He also keeps a spare bug blower motor around, and recently it looks like he'll need it. "Lately, it's been rumbling more than it should," he explained.

much chance of arcing over. Although at certain times, like right now with all the rain, when it's real buggy, we do stand the chance of having problems."

Before engineers start clamoring for bug blowers and manufacturers start appropriating precious R&D funds to flood the market with these devices, one caveat is in order. It is possible that what we deem to be a bug blower is in reality a pneumatic grass blade lifter. Or could it be some mysterious device meant to baffle future curious "tekkies?"

So much for the argument that a little RF never hurt anyone.

■ ■ ■

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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AMPLIFIERS

Want to Sell

Altec & Eastern Electric 1570B & AM-34 8 tube amps, gd to poor cond, \$75-\$200. C Elmasian, Tri-Core Rec., 27503 Five Mile Rd, Livonia MI 48154. 313-427-8784.

Altec 1568, 1569A tube audio pwr amps, need help, \$150 ea. J Vengrouskis, Soundscapes, 11700 Old Columbia Pk Ste L-3, Silver Spring MD 20904. 301-622-9318.

Bozak CMA-150-2 rack mt pwr amps (4), 150/150 into 8, rebuilt, new PS condensers, excel cond, \$450 ea; Marantz 240 power amp, \$200. Pat Appleson Stds, 305-625-4435.

Preston 92B record amp w/161A EQ diameter w/slider & mount, output 4-807 in PP parallel, \$100; Presto record feedscrews, 112 IO, 120 IO, 224 IO for 6N recorder or 66G, \$20. ER Arn, Film Assoc., 7240 Paragon Rd, Dayton OH 45459.

Russco Fidelity Pro mono & stereo phono preamps, excel cond, balanced outputs, \$50/mono, \$75/stereo. T Devine, WVLC, Box 1559, Lexington KY 40592. 606-253-5900.

Carver 1.0t, will sell for \$550 or trade for Peavey CS800 or CS1200. E Nichols, KMCR, POB 189, Montgomery City MO 63361. 314-564-2275.

Crown D-60 low hrs, excel cond. G Fippinger, Rainbow Program, 150 Crossways Pk Dr, Woodbury NY 11797. 516-364-2222.

Straight Wire Audio UA-2 amp DA cards, \$125 ea. G Wachter, KKRF, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Bogen CHB-35A, \$50; Bogen CHB-10A, \$25. B Clark, WFAS, Secor Rd, Hartsdale NY 10530. 914-693-2400.

Dynaco Stereo 70 tube power amp, clean, original owner, \$100/BO; Dynaco PAT-4 stereo hi-fi preamp, excel cond, \$100/BO. P Keogh, 2511 Memorial, Green Bay WI 54303. 414-499-1336.

Sparta 1020 program amp for A-15, AS-30, etc. w/Sparta documentation, \$45. M Ferguson, N AZ Bdcg, POB 1990, Prescott AZ 86302. 602-776-2810.

Ampro TPS-S stereo turntable preamp w/rack mounts, gd cond, \$50/BO. M Black, WEOS, Geneva NY 14456. 315-789-8970.

Dynaco mono preamp (2) tube type volume treble bass, 6 position sound switch, will sell or swap for other equip. J Roper, Imperial Snd Std, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

Dynaco 70 tube type, 35 w/chan stereo, vgc, \$85/firm. M Kuehl, 1418 N Stevens, Rhinelander WI 54501. 369-4007.

Gates M5700 pwr amps (2), MS702 pwr supply, w/chassis, gd cond, (4) Gates M4176 pwr amps, (3) MO-3964 preamps, MO-3977 pwr amp, M5000 pwr supply, Altec 9550A pwr supply, BO. T Weeden, WMTV, 6802 Putnam, Madison WI 53711. 608-274-1515.

LPB DA-2-16 dist amp, 2 chnl operation, separate audio gain controls, works OK, \$100; Robins Fairchild DA 1520 dist amp, one chnl w/VU meter & adjustable gain control, as is, \$75. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

McIntosh MC240 stereo power amp, w/custom road case, excel cond, \$180; McIntosh MC30 mono power amp, w/custom road case, excel cond, \$60. M Ashley, SwingStreet Studios, 620 Bercut, Sacramento CA 95614. 916-446-3088.

Ramko DA-6BR/E 1 in 6 out dist amp, mono, working cond, rack mount, \$75/firm. M Patton, WXOK, 6819 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

Sigma VDA-100A video dist amp (3), \$145 ea; Sigma ADA-106 audio dist amps (3), \$140 ea. T Zingale, TZ Comm, 213-477-5803.

Straight Wire Audio UA-2 amp DA cards, \$125 ea. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Symetrix A-220 stereo pwr amp, new, \$200; Teac MH-40B headphone amp, new, \$200. J Pappas, The Pappas Group, 209-523-5248.

Want to Buy

Crown D-75 wanted in gd cond for fair price. M Bejarano, Falcon Comm., 6923 Forbes, Seabrook MD 20706. 301-794-5754.

RCA MI-11658B type BA-71C. (2) preamps for RCA type BC-8A dual chnl studio console. R Paolangel, RP Prod, 324 S Geneva, Ithaca NY 14850. 607-273-5773.

ANTENNAS & TOWERS

Want to Sell

ERI FMHH G5-4 4-bay, high power horizontal only 4 bay antenna tuned to 94.5 MHz +/- 3 MHz. Available in Eugene, OR. Contact Chris Reid Murray, CE, KMGE. 503-484-9400.

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RCA MI-19089-2C 3-1/8" flanged, 50 ohms, never used (8). B Matta, 6052 Bunker Hill, Pittsburgh PA 15206. 412-661-2020.

RCA BFB-2A 2 bay panel antenna, needs work, 6 panels from 7' tower, BO. Edd Monskie, Hall Comm, 24 S Queen, Lancaster PA 17603. 717-397-0333.

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Phelps Dodge CP-1000-4 FM antenna, 89.7 MHz w/3 radomes, phasing harness & harness for use w/2 bays. M Black, WEOS, Geneva NY 14956. 315-789-8970.

Andrew motorized coax transfer switch, 4 port, 3-1/8", \$1200. M Patton, WXOK, 6819 Cezanne, Baton Rouge LA 70806. 504-292-4189.

Andrew HJ9-50 5' air heliax, 444' w/gas pass connectors attached, 15' w/one gas pass & one gas barrier, (2) 6" miter elbows, hangers included. M Gideon, KIX 104, 111 W Port Plaza Ste 1000, St Louis MO 63146. 314-878-1040.

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Cablewave FCC 78-50 J Series, 78" heliax foam type, approx 1300' in (3) 375' runs & a 350' run, all w/N female connectors attached, \$250/ft. J Kosobucki, KLDA, 5161 Maple, Des Moines IA 50317. 515-266-6060.

ERI FMH Series 10 bay centered, Rototiller at 92.3 MHz, 8 yrs old, vgc, \$9950. G Wachter, KKFR, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Harris (ERI) FM antenna, 10 bay FM HA series, excel cond, \$13,000; Phelps Dodge 3-1/8" rigid transmission line, 21 sections, 20' long, w/spring hangers hardware, excel cond. B Umberger, WNLT, 51 S Main, Clearwater FL 34625. 813-446-0957.

Lightning Elimination MB-60 heavy duty power surge eliminator 120/240V, 60 Amp single phase, in water proof cabinet, like new, \$450; Square D 82254 double throw nonfuseable 200 Amp, 250V, single phase switch used w/standby power, almost new, \$175. A Fuchs, POB 311, Hobart OK 73651. 405-726-5656.

Mark P-9A72GRN (2) 6' grid STL dishes, 3 yrs old & 7/8" line, consider trade; Myal, various unused x-mission line elbows, flanges, adapters, both 4" & 3" rigid, consider trade. P Kessler, KHUM, 1237 SE 37th, Topeka KS 66605. 913-267-0960.

Mounting brackets, complete set for 18" tower face, for ERI FML-3E 3-bay CP antennas, \$250. R Miller, WRVI, 815 W Dean, Virden IL 62690. 617-965-3388.

RCA BCF 12B 93.9 FM 100 kW ERP, needs cleaning up, BO. J Miller, KGNO, 908 Frontview, Dodge City KS 67801. 316-227-4444.

Shively 6811-3 FM 2 bay tuned 99.3, \$2000. J Cannaday, 919-473-1993.

Andrew LDF5-50A 7/8" foam dielectric 50 ohm transmission line, 200' long w/2 type N connectors, 1 yr old, \$250. G Wilson, WGTE, POB 30, Toledo OH 43692. 419-243-3091.

Cablewave 3" air dielectric 50 ohm jacketed, cable over 450', only 5 yrs old, w/3" flange connectors, \$2500. J Littlejohn, WBYR, 347 W Berry Ste 700, Ft Wayne IN 46802. 219-420-9890.

Coax switch, 3-1/8", manual, \$900; 3-1/8" coax switch, electric, \$1300. J Mitchell, WJKL-TV, 315-673-9049.

CSP Custom 2 tower 1 kW phasor, excel cond, lots of spares, BO. D Barton, KMTI, POB K, Monti UT 84642. 801-835-7301.

ERI 12 bay 50 kW FM on 106.5, 1 yr old, trade for ERI 4 or more bays on 93.3 or BO. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

ERI FMH Series 10 bay centered Rototiller at 92.3 MHz, vgc, \$9950. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

ERI 106.5 12 bay low power antenna, gd cond, on ground, used 1 yr w/bracket, BO. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

Gates/Harris 5 kW lighting choke, like new (2), \$20 ea/BO. G Wilson, WGTE, POB 30, Toledo OH 43692. 419-243-3091.

Jampro 2H 2V 2 bays horizontal, 2 bays vertical, w/power divider, tuned to 96.7 MHz, needs one interbay cable & deicer elements, you ship, \$200. B Sauter, WSLU, Payson Hall, SLU, Canton NY 13617. 315-379-5356.

Jennings RC21 vacuum coaxial relay, \$1995; also a model RC5, \$245. A Emerald, KGGGA, 8956 Swallow, Fountain Valley CA 92708. 714-962-5940.

LC transfer switch, \$200 ea; (6) 1/8" 50 ohm bullets, \$30 ea; 78" Heliax, \$1500/1000; Jennings vacuum coax switch 3-1/8" 50 ohm SPDT, \$1200 ea. Dave, 209-467-0317 evenings only.

Phelps-Dodge CFM-LP3 3 bay tuned to 92.7, w/Radomes, excel cond, \$1200; 250' 1-5/8" transmission line w/connectors, \$300. G McCoy, KZEN, 1606-1/2 16th, Central City NE 68826. 308-946-3816.

RCA-Dielectric BFB 2A 2 bay antenna on 98.3, \$600. JA Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

Rohn 80 tower & 35 acres in Meramec Springs MO, highest point in the area, 3 yrs old, will sell for replacement value & reinstallation of same tower due to relocating FM. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

Stainless G24/25 200', 20' sections, guyed, new sandblast, primer, paint, on ground, 24" face, 2" tubing, BO. J Blodgett, WGTF, 308 Westgate Pkwy, Dothan AL 36303. 205-794-4770.

US Tower 160' MW 30" face, star mount for 8' dish, 200' elliptical waveguide for 7 GHz, buyer take down & remove, BO. W Ellis, KOZK, MPO Box 21, Spfld MO 65801. 417-865-2100.

Want to Buy

FM tower, 100'-150', must be able to mount other antenna such as Marti Yagi, 2-way, repeater. L Maierhofer, WTGC, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

RF contactor; used 111C repeat coils, D Williams, KLLV, 14780 Hwy 140, Breen CO 81326. 303-259-5558.

Six bay FM for 104.3 MHz. B Bundgaard, KLKS, POB 300, Breezy Point MN 66472. 218-562-4884.

ERI 4 or more bay on 93.3 MHz & 550 of feedline 1-5/8 or larger. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

ERI 93.3 antenna 4 or more bays, low or hi power & 1000' of feedline, 1-5/8" or larger, have ERI 12 bay to power antenna on 106.5 to trade. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

AUDIO PRODUCTION

Want to Sell

Shure M610 (2) feedback controller, 8 band EQ, BO. G Mundkowsky, WDAF, 3030 Summit, Kansas City MO 64108. 816-966-0731.

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AKG BX20E1 smooth, tortial transmission line reverb, 2 chnl w/remote, excel cond, BO. B Matta, 6053 Bunker Hill, Pittsburgh PA 15206. 412-661-2020.

Audio Digital TC-4 digital delay unit, excel cond. B O'Connor, KDES, 821-N Palm Cyn, Palm Springs CA 92262. 619-325-1211.

dbx 900 noise reduction mainframe w/(2) type I cards & (2) Type II cards, BO; Spolmaster CLE-FM stereo audio processor, BO. K Stokes, WKJN, 3029 S Sherwood Forest Blvd, Baton Rouge LA 70816. 504-295-1832.

dbx 900 noise reduction mainframe w/(2) type I cards & (2) Type II cards, BO; Spolmaster CLE-FM stereo audio processor, BO. K Stokes, WKJN, 3029 S Sherwood Forest Blvd, Baton Rouge LA 70816. 504-295-1832.

dbx 140 noise reduction unit, Type II, \$200. F Grundstein, WEGX, 3 Bala Plaza Ste 580E, Bala Cynwyd PA 19004. 215-667-3939.

Orban 11B dual reverb, \$200. M Legner, 7807 Suffolk Ct, Alexandria VA 22310. 703-971-7069.

ATI Disc Patcher DP100 Hi Z to 600 ohms balanced interface, \$100. K Thomas, Rebel Recdg, POB 207, Atlantic Beach FL 32233. 904-388-7711.

dbx 222 Type II, 6 mos old, stereo; dbx 222 NR unit, \$100/BO or will swap for EFX unit, 1/2" tape or mics. B Miller, Grapevine Stds, 2525 Imlay City, Lapeer MI 48446. 313-664-1995.

dbx 157 Pro 4 chnl simultaneous play record, rack-mountable, (2) 8 chnl, \$5004 chnl. H Fenster, Universal Rehearsal Recdg, 17 W 20th St, NY NY 10011. 212-929-3277.

Early Model DAP 310's Dorrrough Electronics serial numbers in 600's. Bill Moennig IV, 2039 Locust St, Philadelphia PA 19103. 215-567-2738.

Eventide H910 Harmonizer, recently factory refurbished, gd cond, w/manual, \$400. D Davis, KMBA, 1217 Valencia Dr NE, Albuquerque NM 87110. 505-255-2431.

Gates M-5136 remote bcdt mixer, unknown cond, \$25/you ship. P Mueller, KUTA, Hwy 191 N, Blansing UT 84511. 801-678-2261.

Micro-Trak Ditty Desk 6454-B w/manual, 4 chnl mono, w/Russco 2-speed tables, Micro-Trak 303 arms, BO plus shpg. S Delahoyde, Box 33063, Phoenix AZ 85067. 602-937-9088.

Orban 111B reverb, like new, \$275. K Thomas, Rebel Recdg, POB 207, Atlantic Beach FL 32233. 904-388-7071.

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BE 3000, 1 R/P & 1 play only; Harris Phase Fixer encod & decod. M Seguin, WVMT, POB 620, Colchester VT 05446. 802-655-1620.

ITC PD-II mono R/P cart deck (2), \$600 ea or \$1000/both; BE 5100 triple deck mono PB, low hrs, clean, \$1500 or trades. D Roden, WAAR, 1701 Monte Sand Blvd, Huntsville AL 35801. 205-533-3676.

Ramko Research cart rewriter, \$150. E Nichols, KMCR, POB 189, Montgomery City MO 63361. 314-564-2275.

RCA RT-27 BA-27 (3) PB, mono w/tones, (2) R/P w/tones, vgc. BO. R Mayhugh, KLOA, Box 938, Ridgecrest CA 93555. 619-375-8888.

Spotmaster Ten Spot 19" rack style w/2 play units, room for 3 more below these, works OK, \$30 pls shpg. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Tepecaster 700RP, \$300; Tepecaster 700P, \$200; BE cartwinder, \$50. J Clarke, WRKU, 4531 Belmont Ave Ste C, Youngstown OH 44505. 216-759-0579.

Tepecaster 700RP mono, gd cond. G Fippinger, Rainbow Program, 150 Crossways Pk Dr, Woodbury NY 11797. 516-364-2222.

Gates Criterion (2), one works, one does not, w/manuals, BO. B Keaton, WGEZ, POB 416, Beloit WI 53511. 608-365-8865.

Tepecaster 700 RP recorders in gd cond (2), in use, w/manual, \$250; Tepecaster 700P players in gd cond (2), in use, w/manual, \$150 ea. D Davis, KMBA, 1217 Valencia Dr, NE, Albuquerque NM 87110. 505-255-2431.

Tepecaster 700P fair cond, need rollers & cleaning, \$50 ea; BE 5301, needs motor & bearings, \$750; BE 2100 R/P, mono, gd cond, \$900; Spotmaster 1070 R/P, needs cleaning, gd cond, \$400. J McMahan, WAMD, POB 970, Aberdeen MD 21001. 301-272-4400.

Tepecaster P-700 mono gd cond, new heads, recently refurbished, in use, \$300/BO; Tepecaster RP-700 mono, new heads, recently refurbished, in use, \$350/BO. T Murray, WROI, 100 W 9th, Ste 306, Rochester IN 46975. 219-223-6059.

BE 5300/3500 (2) triple play & record cart, mono player, have 3 cue tones w/spare part, call for price breakdowns. B Gellhaus, WDVV, POB 73, Cheltenham PA 19012. 215-635-4815.

BE 3300, \$750; BE 5502, \$1200; Harris C90, \$500; RFI filter Sprague F-1135/G JN17-3300B1 250 VAC, 100 A snl or 3 phase, for 208 or 240V, 3 pole 100 A, \$600; (4) pole 100 A, \$700. Dave, 209-487-0317 evenings only.

BE 2000 RPS R/P, (2) 2000 PS PB Spotmasters, vgc. BO. I Baron, IVCUA FM, 200 UCIV Catholic Univ, Wash DC 20064. 202-635-5106.

ITC 3-D (2) triple deck, mono, \$900; Gates Criterion 80 stereo PB, \$450. A Pavao, KY-NO, 2125 N Barton, Fresno CA 90703. 209-255-8383.

ITC 3D mono, gd cond, \$1000. B Mountjoy, WIDD, 610-1/2 Hattie, Elizabethton TN 37643. 615-543-5849.

Sparta portable, AC/battery, runs gd, \$50; ATC 8 kHz cue amp, \$10. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

Tepecaster 700RPS R/P stereo, gd cond, \$400. B Sauter, WSLU, Payson Hall, SLU, Canton NY 13617. 315-379-5356.

Tepecaster 700-RP R/P, fair cond, as is, \$75; Rapid Q MA024A R/P, repairable but in fair cond, \$80. M Rakoff, 114-41 Queens Blvd, # 148, Forest Hills NY 11375. 718-591-0002.

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ITC Series 99 record/play, stereo, plus Delta I and/or Delta III Stereo PB decks. Kidd Communications, 4096 Bridge St, Ste 4, Fair Oaks CA 95628. 916-961-6411.

ITC Delta IV record amp for a Delta III, triple play machine. J Nichols, KZZU, South 5505 Regal, Spokane WA 99223. 509-448-5555.

ITC 99, Omega, Premium line, gd used mono or stereo recorder. T Murray, WROI, 100 W 9th, Ste 306, Rochester IN 46975. 219-223-6059.

RCA RT-126 VU meter; RCA RT-126 60 Hz motor in exchange for 50 Hz motor. M Anderson, 1469 3rd Ave, New Brighton PA 15066. 412-847-0111.

Collins 642E-1 Twintape, need cue tone cards/cart deck/parts to make 3 decks into 4 w/rip start from deck to deck. G Dow, WBKN, POB 711, Brookhaven MS 39601. 601-833-6059.

ITC or other make, triple deck in gd cond. R Larson, 509-453-6296.

ITC 3 deck mono, all tones, working cond. R Yaw, KOJM, Box 7000, Havre MT 59501. 406-265-7841.

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Ampex 602-2 w/manual, portable case, operates but needs some work, looks gd, BO, plus shpg. S Delahoyde, Box 33063, Phoenix AZ 85067. 602-937-9068.

Ampex AG-440B 3.75 & 7.5 ips, needs work. G Fippinger, Rainbow Program, 150 Crossways Pk Dr, Woodbury NY 11797. 516-364-2222.

Ampex AG-440 mono R-R (2), \$500 ea. J Cannaday, 919-473-1993.

Metrotech 543R stereo Rec/repro (2); Metrotech 531R mono rec/repro (2). C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Otari MX 5050-B 8 trk, like new, less than 15 hrs, w/full factory remote control, roll around rack & all manuals, \$4000. J Belik, KIKX, Colorado Springs. 719-632-5800.

Otari MX 5050 excel cond, 1/2 trk stereo R/P & 1/4 trk pl ully, \$2000. T O'Malley, Citynet, POB 29341, Oakland CA 94604. 415-223-6757.

Pioneer RT701 3 motors, 3.75-7.5 ips 1/4 trk stereo, very low hrs, excel cond w/manuals, \$250 ea. D Davis, KMBA, 1217 Valencia Dr NE, Albuquerque NM 87110. 505-255-2431.

Pioneer RT-701 2 trk, has speed problem, BO. B Keaton, WGEZ, POB 416, Beloit WI 53511. 608-365-8865.

Pioneer RT-1050 (2) gd cond w/manuals, \$350 ea. L Vollmar, WOBT, POB 738, Rhinelander WI 54501. 715-362-6140.

Rack mount adaptor for Ampex AG600 stereo. F Konwinski, WSOY, 1100 E Pershing Rd, Decatur IL 62526. 217-877-5371.

Revox A700 rack mount or table, 3 speeds stereo 2 trk, gd cond, \$550. G Ernst, Bayside Snd St, POB 166, Lincoln City OR 97367. 503-996-6020.

Revox A-77 R/P, Crown 800 R/P, Ampex 612 PB, all OK motors, used, repairable cond, BO pls shpg. M Ferguson, N AZ Bdcts, POB 1990, Prescott AZ 86302. 602-776-2810.

Revox B77, 7.5-15 ips, 1/2 trk, excel cond, shipping case, \$1000. JA Theodore, 1175 Brockton, El Cajon CA 92020. 619-448-4444.

Sansui DM-350 cassette player, recorder rack mountable, gd cond, \$200/BO; Lazy Susan type cart rack, holds 96 carts, \$75/BO. R Price, KWIK, 259 E Center St, Pocatello ID 83204. 208-233-1133.

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Studer A80 Mark I 8 trk, 7.5-15 ips, \$7500. Call 212-645-6319.

Teac/Tascam 235 4 trk, excel cond, 6 mos old, \$450. B Brintzer, WDCG, POB 2126, Durham NC 27702. 919-682-0318.

Teac 6010 4 trk w/auto reverse, 4 heads, 2 chnl erase, record, forward PB & reverse PB, accessories include dust cover, remote time control, pause control, etc. FOB Chicago, \$400/BO. 312-444-2066.

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Teac/Tascam 3340 4 trk 1/4", gd cond, \$499. C Swack, Sweetwater Snd, 4821 Bass, Ft Wayne IN 46808. 219-432-8726.

Uher 4000 Report L, in great shape, \$150. P Andrus, POB 261, Chimaquum WA 98325. 206-732-4085.

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Ampex AG-440B 2 trk (3), 10.5" rack mount prof, vgc, \$700 ea plus shpg; Scully 280 4 trk 1/2" in Russliang console, late mdl w/motion sensing, spare cards & capstan motor, low hrs, gd cond, \$1600 plus shpg; Denon DH-510 2 trk 10.5" reels, 7.5-15 ips, excel cond, \$900; Teac 2300X stereo 1/4 trk, 7" reels, excel cond, \$250. K Peckham, 2737 Florann, Madison WI 53711. 608-271-8763.

Ampex 4020150-03 reproduce only electr w/factory rack mount, BO. C Kimbrough, WRXO, POB 1176, Roxboro NC 27573. 919-599-0266 aft 6PM.

Ampex 440 stereo in walnut console & remote w/(2) 375 Inovonics electronics, \$1500; Ampex 354-2 stereo, gd cond, \$495; MCI JH110B stereo w/remote walnut console, \$2500; MCI JH110A stereo remote in walnut console, BO. J Price, 2651 Globe, Dallas TX 75228. 214-321-6576.

Ampex 440C 1" deck, no heads but has guides, includes power supplies & manual, \$450. R York, Jewel Records, 1594 Kinney, Cincinnati OH 45231. 513-522-9336.

Ampex 350-351 or AG440 or MR 70 tape machines w/both record & PB functions, 7.5 & 15 ips, mono. P Hons, Mainline Comm, 100 Poplar St, Portage PA 15946. 814-736-3883.

Ampex AG-440 (2) PB deck w/PB amps, \$7500. M Ferguson, N AZ Bdcts, POB 1990, Prescott AZ 86302. 602-776-2810.

Ampex 440C 1" deck, no heads but has guides, includes power supplies & manual, \$450. R York, Jewel Records, 1594 Kinney, Cincinnati OH 45231. 513-522-9336.

Ampex 350-351 or AG440 or MR 70 tape machines w/both record & PB functions, 7.5 & 15 ips, mono. P Hons, Mainline Comm, 100 Poplar St, Portage PA 15946. 814-736-3883.

Ampex AG-440 (2) PB deck w/PB amps, \$7500. M Ferguson, N AZ Bdcts, POB 1990, Prescott AZ 86302. 602-776-2810.

Ampex 351 tube electr (2) modified for Sel-Sync, \$100; MCI solid state JH5 (4), excel cond, \$400; Ampex 300 deck w/2" capstan & strobe idler, 1" 7 trk head assy, x-lg reel motors for handling 2" tape, 2" reel hubs, locks, rebuilt capstan motor; Inovonics 200 Series cassette duplicator reel master, 10" reels, mono, excel cond (2), \$1200 ea. T Boddie, 12202 Union, Cleveland OH 44106. 216-752-3440.

ITC 750 PB only (5), \$250 ea or \$1000/all. S Cohen, KFNW, 65 E First Ave, Mesa AZ 85210. 602-644-1510.

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Otari ARS-1000 (3) in excel cond. V Clough, WZFX, 225 Green, Fayetteville NC 28302. 919-486-4991.

Otari MX-5050 10" 1/2 trk recorder, 7.5 & 15 ips, gd cond, w/manual, \$900; Revox A-77 10" stereo recorder, excel cond, w/manual, \$400. B Mountjoy, WIDD, 610-1/2 Hattie, Elizabethton TN 37643. 615-543-5849.

Otari MX 5050 (2) in fair cond w/one remote, \$600 ea. J Super, WVAM, Box 1827, Altoona PA 16602. 814-944-9456.

Revox A-77 (3) rack mount 2 portable, 2 gd transports, one needs capstan motor & heads, \$500/for two, \$200/other; Dokorder 1140 4 trk 1/4", gd transport & PB, records poorly, gd heads, you ship, no service info, \$200. B Sauter, WSLU, Payson Hall, SLU, Canton NY 13617. 315-379-5356.

Scully 280B (2) FT unmounted, very clean, \$450 ea or \$850/both. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Scully M100 16 trk, 2" in console (2), 1 has great remot/cntr, both vgc w/gd heads, \$7000 & \$8000. R York, Jewel Records, 1594 Kinney Ave, Cincinnati OH 45231. 513-522-9336.

Scully 280B, brand new cond, w/spare head stack & parts kit, \$1700; Sony PCM F-1 digital processor, portable, used 3x's, \$1300. D Koehler, 1901 Hanover, Allentown PA 18103. 215-432-0520.

Scully 280 (2), excel cond, some extra parts. R Fess, WLBH, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Scully 280B-4, 280B-FT, mint, 4 trk \$3000, the FT \$1500; Ampex AG354-2, prfct cond, \$1000/BO. R Bruce, UAR Stds, 8535 Fairhaven, San Antonio TX 78229. 512-690-8888.

Sony stereo cass deck, needs work but repairable, \$60. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

Soundscribe 24 hr recorder, needs work, \$100; NEC music on hold w/50 pin plug, \$40. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

Tascam 122 (10) cassette decks, excel cond, \$350; Otari 5050B 1/4 trk, excel cond, \$950; Otari 4 trk 5050B, 1/2" & 1/4" decks, the 1/2" has an extra transport, \$1500 ea. M Zook, Masterworks, 4024 Williamsburg Ct, Fairfax VA 22032. 703-385-1780.

Tascam EM-1542 reel motor for Tascam Series 30 tape decks, new, \$90 or swap for a Sony TC-850 or TC-854-4S head block. J Roper, Imperial Snd St, RR31, Box 405, Terre Haute IN 47803. 812-877-2663.

Teac 222 1/2 trk, new, \$800; Teac 224 1/4 trk, new, \$1400. J Pappas, The Pappas Group, 209-523-5248.

Telex Mdl 235 (3), Mdl 300 high-speed mono cassette duplicators, 3.75 & 7.5 ips, includes (2) bias oscillators, (3) record amps, & equip rack, needs work, BO. J Garvey, Video Yesterday, Box C, Sandy Hook CT 06482. 203-744-2476.

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Wollensak 3M 1520AV portable 3.5 & 7 ips, excel cond, no AC cord, \$75. P Salois, KPCR, POB 1, Bowling Green MO 63334. 314-324-2283.

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Gates stereo Executive, excel cond, fully operational, \$1000. B Brintzer, WDCG, POB 2126, Durham NC 27702. 919-682-0318.

Gates/Harris 994-5564-003 Ambassador 5 pot console, spare line/mic cards, gd cond. G Fippinger, Rainbow Program, 150 Crossways Pk Dr, Woodbury NY 11797. 516-364-2222.

Gates/Harris Diplomat mono, 6 pots in gd cond, needs VU meter, \$375. G Arroyo, WDNQ, 2483 John Young Pkwy, Orlando FL 32804. 407-290-2020.

Gates Yard II audio console, \$500. J Cannaday, 16602. 814-944-9456.

Gates Dualux dual chnl mono, 20+ inputs, power supply needs work, BO, you ship. 9-5 EDT. 717-489-0005.

McMartin B801 console. B Umberger, 51 S Main, Clearwater FL 34625. 813-446-0957.

McMartin B-802 8 chnl stereo console presently in service, needs some work, several spare parts, \$500. M Meyer, KLOP, POB 70, Madison MN 56256. 612-598-7301.

McMartin B-801 mono 8 chnl, minor power supply problem, \$250. B Keaton, WGEZ, POB 416, Beloit WI 53511. 608-3

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Shure SR107 10 band EQ, balanced in, out, \$130 ea; Shure room analyzer w/mic, \$75. D Kocher, 1901 Hanover, Allentown PA 18103. 215-432-0520.

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dbx 904 noise gate. R Burton, Audio Rents Inc, 7237 Santa Monica Blvd, Hollywood CA 90046. 213-874-1000.

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Thomson-CSF 4500 Presence EQ, new, \$595; Ramko portable mixer PM-42, \$450; Thomson-CSF ES-214 audio level meter, \$1250. H.M. Dyer Electronics, 2982 Wixom Rd, Milford MI 48042. 313-685-2560.

Gates M-5167 w/manual, working when removed, \$30/you ship. P Mueller, KUTA, Hwy 191 N, Blansing UT 84511. 801-678-2261.

Wilkinson LGC-t AGC/limiter, w/man, perf for exp. gd spare, \$275 pls shpg. L Spivey, WLLS, Hwy 231 South, Hartford KY 42347. 502-298-3268.

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CBS 444 Audimax III, gd cond, \$125. R Sumner, CAVU Comm, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

CBS Labs 4100 Volumax FM, single chnl, no manual, \$100. J Cochran, Gateway Video, 225 Ross, Pittsburgh PA 15219. 412-471-3333.

CRL FM 3 SEP400 (2) SPP800, excel cond, fully operational, will sell separately, \$1250. B Brinitzer, WDCG, POB 2126, Durham NC 27702. 919-682-0318.

ESP WBL-11 worked perfect when removed, \$90/BO; Volumax CBS 400, 4000 & 4400 AM limiters, all worked when removed, BO. M Cooney, KBRK, 227 22nd Ave, Brookling SD 57006. 605-672-1430.

Gates M-6543 Solid Statesman, works gd, \$200. R Hernandez, FAZ Bdctg, 903 E Cortinas, Del Rio TX 78840. 512-775-3544.

Gates M6631 Solid Statesman FM's (2), \$150; Orban 8000A, factory upgrade & realigned, \$1600. M Ripley, KOZE, POB 936, Lewiston ID 83501. 208-743-2502.

Orban FM Optimod 8000A, vgc, \$1500. J Denison, Espri Comm, 4510-A S 14th, Abilene TX 79005. 915-691-9292.

Harris MSP-90 gd cnd, sngl bnd w/man, \$495; Dorrough DAP-310 Discrim Audio Proc, gd cond, w/man, \$395; CBS 4450A Audimax FM stereo, auto level cont w/man, \$295. L Vollmar, WOBT, POB 738, Rhinelander WI 54501. 715-362-6140.



You call the shots with this 3-band stereo-FM processor. A wide range of user controls lets you burn a hole in the dial or back it off to totally mellow. Many unusual features - call for blurp.
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Orban 8000A just overhauled at factory, w/all documentation, \$1500. P Black, KMEI, 55 Francisco St, San Francisco CA 94133. 415-391-1061.

RCA MI-34654 older style neg peak limiter, gd cond, \$25 pls shpg. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Valley People 610 compressor/expander, like new, \$750/BO. M Cooney, KBRK, 227 22nd Ave, Brookling SD 57006. 605-672-1430.

CBS 410 FM peak limiters (2), BO. M Saady, First City Recdg, 141-60 84 Rd 3E, Briarwood NY 11435. 718-846-2062.

CBS Audimax 444 AGC, \$200/BO. M Patton, WXOK, 6819 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

CBS/Thompson CFS 4300 AM peak limiter, new, \$525. G Landau, WSMQ, 3300 Jaybird, Bessemer AL 35020. 205-428-0146.

CRL APP-300 audio preparation processor, \$400; CRL SEP-400 spectral energy processor, \$400; CRL PMC-300 peak mod controller, \$400 or all for \$1000. T DeCapua, WLKK, 18 W 9th, Erie PA 16501. 814-456-7034.

Gregg Labs 2542 2 chnl audio processor, \$300. T DeCapua, WLKK, 18 W 9th, Erie PA 16501. 814-456-7034.

Inovonics 221/MAP II AM proc sys w/mdl 215 AGC limiter, excel cond, \$400/BO; Marti CLA-40H, excel cond, \$150/BO; UREI LA-4, \$400/BO. T Randall, KJQ, Box 790, Brookings SD 57006. 605-692-9102.

Mod Sciences Stereo Max, lk nw, will trade fr Optimod XT chassis or BO. J Aughney, KLCE, POB 699, Blackfoot ID 83221. 208-785-1400.

Orban 8100A XT2, 6 bnd limitr chass, brnd nw, \$1500. A Pavao, KYNO, 2125 N Barton, Fresno CA 90703. 209-255-8383.

Orban 8000A Optimod, excel cond, on-air now, \$1500. G McCoy, KZEN, 1606-1/2 16th, Central City NE 68826. 308-946-3816.

Texas Audio Prisms (2) & RCF5 card. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.



This stereo processor can be pre-programmed with 5 different presets to "call up" for format changes, etc. Unit has slow-AGC, 5-band compressor, and either an AM or FM peak limiter. Computer/modem control option available.
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MICROPHONES

Want to Sell

EV RE-20, new in box, \$315. K Thomas, POB 207, Atlantic Beach FL 32233. 904-388-7711.

EV RE16 mic, \$185; AKG D-1000E, \$70. G Robinson, 803-722-7611.

Want to Buy

EV 666 w/matching desk stand, C-clamp & connector, paying \$50. D Sites, 5809-K Cambridge, Springfield VA 22152.

Good used mics for recording purposes, esp. EV, Shure, Sennheiser, AKG, B Miller, Grapevine Stds, 2525 Imlay City, Lapeer MI 48446. 313-664-1995.

RCA 44 or other old ribbon or condenser mic, have RCA 77 to trade. R Van Dyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

Serious Collector will buy or trade for a RCA 44A, BK-10, 30A lapel ribbon, 6225A carbon, PD-31, SK-39, BK6A model only, American D-44 & DR330. J Webb, 15117 Hamlin, Van Nuys CA 91411. 818-769-6738.

Neumann, Telefunken, etc, vintage tube mics, also RCA 44 & 77's. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Neumann U87's, U47, U67 or any kind of Neumann's or commercial mics, any cond. J Price, 2651 Globe, Dallas TX 75228. 214-321-6576.

Pre 1960 ribbon or condenser mic. R Van Dyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

MISCELLANEOUS

Want to Sell

Broadcast operators handbook by Harold Ennes, original 1947 copy from Rider Publishing, BO. P Keogh, 2511 Memorial, Green Bay WI 54303. 414-499-1336.

Dial phones (6), some multiline type, \$30/all pls shpg. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Keith Monks Mark II record cleaning system. C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Luxo mic arm 1/12" riser, new, \$40. G Robinson, 803-722-7611.

Radio Shack 100 lap top computer, virtually unused, mint cond, 24K RAM, \$300; Extel Teletype printer AH11R, \$50. B Umberger, 51 S Main, Clearwater FL 34625. 813-446-0957.

RCA racks (2), 82". BO. J Miller, KGNQ, 908 Frontview, Dodge City KS 67801. 316-227-4444.

Tandy-Radio Shack TRS 80 model II line printer V, 2 disk drive, full manuals, 4 programs, \$425/package. P Mueller, KUTA, Hwy 191 N, Blansing UT 84511. 801-678-1161.

Tandy TRS-4P computer w/2 disk drives, software & manuals, now in use on automation system, ready to sell, \$350/BO. C Springer, KLMR, POB 890, Lamar CO 81052. 719-330-2206.

Unique coil of used bdct equip, for sale or trade, list too large to pub but incl: Gates xmtrs, Sparta console, Revox 77's, cart machines, turntables, EQ, racks, unipole tower, all items being used at present in Class IV AM stations in N Central FL, station gear & property w/residence also available. E.A. Slimak, POB 1195, Hawthorne FL 32640. 904-481-2310.

WE 2565 HKM telephones (4), new, \$20 ea/BO. R Price, KWIK, 259 E Center St, Pocatello ID 83204. 208-233-1133.

ADC BJT-2033 (3) Ultra Patch bay w/3" rear interconnect panel, \$500 ea; also spare parts for Rust remote control, spare parts for ATC cart machines, univ sound outdoor paging speakers, GE sodium vapor lamp, call for prices and details. B Gelhaus, WDV, POB 73, Cheltenham PA 19012. 215-635-4815.

Advent 1000 videobeam TV projector, complete as is, \$150, pick-up only located in NYC area, \$150. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

ATT Merlin 410 phone system w/4 lines in & 10 stations, includes wires & 8 phones, 35 yrs old. M Hendee, KUNQ, POB 30, Houston MO 65483. 417-967-3353.

Canon female chassis mount, used 3 pin XLR female on right angle bracket, 60 pcs will sell entire lot only, \$30. R Nimtz, Univ of Notre Dame, POB 1088, Notre Dame IN 46556. 219-239-6423.

Cushman Trackster small two-man snow cat modified for deep powder snow, excel cond, w/trailer & spares, \$3500/BO. D Barton, KMTI, POB K, Monti UT 84642. 801-835-7301.

Extel teleprinter AF-t1, BO. M Cramer, WGBA, 1391 N Road, Green Bay WI 54307. 414-494-2626.

Keppo PRM48-6 48 volt pwr supply, 0-6 amps max, new in box, \$150. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

NCR 7900 VDT's (2), \$75 ea; NCR line printer w/stand, \$1000; (2) Applied Digital Data System VDT's, \$50 ea; (2) Data Comm line printers, \$75 ea; Western Union Telex TTY-style terminal w/stand, \$50; (9) removable hard disks, \$100 ea. T Weedon, WMTV, 6802 Putnam, Madison WI 53711. 608-274-1515.

Pole contactors (3), 120 V coil, 60 A, \$50; 160 A, \$100. Dave, 209-467-0317 evenings only.

Radio Shack TRS-80 computer monitor, keyboard, expansion interface, quick printer, as is, \$20. P Russell, Bowdoin College, Sills Hall, Brunswick ME 08011. 207-725-3066.

Reliant 16 computer phone system w/16 complete telephones, built in intercom system & 6 line capability, excel cond, \$1000; also Telrad phone system w/3 stations, can expand to 8 stations, \$450. V Clough, WZFX, 225 Green, Fayetteville NC 28302. 919-486-4991.

Sonex One natural white, unopened boxes, \$150 ea pls UPS. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

Sparta tech manuals for xmtrs & audio products. Write for list. D Peluso, KFM Radio, POB 15223, Las Vegas NV 89114.

Tec attenuators mono pots for RCA BC7A board, gd cond, some w/cue, \$40 ea; Shalco attenuators, stereo pots in gd cond w/cue. B Arnold, 700 Productions, 105 Dorado Court So, Middle Island NY 11953. 516-924-9020.

1976 Chrysler mobile studio, custom, all Lex-an bldt mobile studio, incredible visibility, \$12 500. M Esberg, WVMT, Box 620 Malletts Bay Ave, Colchester VT 05446.

Info on doing freq searches (the old way) w/maps, table, etc., for AM & FM; Info on tower erection, guying etc, anything dealing w/tower structures; old engineering proceedings, both NAB & SBE. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Manual for CBS Mdl 450 dynamic presence EQ; junk FM xmtr, prefer 1 kW or less; junk STL xmtr or rcvr; 6th edition of NAB engineering handbook. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Manuals for McMartin TBM 2500 RF amp, McMartin TBM 3500 mod mon, Gates CB77 turntables, Gates Level Devil agc amp, Garron STE-100 stereo phase enhancer. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Broadcast operators handbook by Harold Ennes, original 1947 copy from Rider Publishing, BO. P Keogh, 2511 Memorial, Green Bay WI 54303. 414-499-1336.

Want to Buy

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

Computer w/complete hardware & software for small radio station combo. L Maierhofer, WTGC, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Old Broadcasting Yearbooks & Gates catalogs. P Hunn, WZZZ, Lakeshore Rd, Fulton NY 13069. 315-593-1313.

Brush Cleveite headphones, smaller black hard plastic cans, & cords etc. J Taylor, WGBA, Box 467, Quincy IL 62306. 217-223-7700.

RCA CT-100, CTC-5 color TV monitors or home sets, early vintage or early studio monitors. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

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MONITORS

Want to Sell

Belar AMM-2A AM mod mon, excel cond, \$750. J McMahan, WAMD, POB 970, Aberdeen MD 21001. 301-272-4400.

Gates M-5693, needs freq coil, gd for parts, w/tubes & manual, \$50. A Wilkerson, WLIL, POB 340, Lenoir City TN 37771, 615-986-7561.

Gates GTM 88S stereo FM mod monitor, gd cond. F Konwinski, WSOY, 1100 E Pershing Rd, Decatur IL 62526. 217-877-5371.

McMartin TDM-2000B on 92.1 MHz, works perfect, BO. M Cooney, KBRK, 227 22nd Ave, Brookings SD 57006. 605-672-1430.

McMartin TBM-4500A FM stereo mod monitor, \$800. G Wachter, KFRF, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

McMartin TBM-3700, TBM-2200, TBM-2000A FM stereo monitors & SCA monitor, all in gd cond. C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Motorola Conelrad-EBS monitor, tube type, BO; General Radio mod monitor, BO. P Mueller, KUTA, Hwy 191 N, Blansing UT 84511. 801-678-2261.

TFT 760 EBS unit w/gen, decoder & AM rcvr, just rebuilt by factory, \$800/BO. M Patton, WXOK, 6819 Cezanne, Baton Rouge LA 70806. 504-292-4189.

Belar RF amp for AM, \$75. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

FM receiver module for TFT-760 EBS unit, tuned to 102.9 MHz, BO. M Patton, WXOK, 6819 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

McMartin TBM-4500A FM stereo mod mon, \$800. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Want to Buy

Belar FM mod mon for xmtr site, WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

FM monitor w/RF amp. D Van Zandt, WJLU, 2596 S.R. 44, New Smyrna FL 32069.

MOVIE PROD EQUIP

Want to Sell

DeVrys PH-405 (2), mint 35mm portable projectors, ext tube amps & spkrs, reels, lamps, access... \$1800/ea or \$3200/pr. J Vengroskie, Soundscenes, 11700 Old Columbia Pk Ste L-3, Silver Spring MD 20904. 301-622-9318.

Arriflex 16-BL w/12-120mm Angenieux lens, matte box, Cine 60 battery belt, 2-400' mags, Miller FH tripod w/Cine 60 Snap-Loc, Spectra light meter, Arri shoulder pod, B & S dolly, changing bag & many filters, 12 yrs old, light use, well maintained. North Star AV Corp. Bid via FAX 203-322-4993.

Bolex 16mm movie cam, 3 lens turret, excel, \$300; Eiki 16mm, STM snd proj, mint cond, \$399; Bolex EBM pwr grp, ESM motor w/NiCad & charger, \$399. H Deans, 170 Grand St, Wht Plains NY 10601. 914-949-5920

Chinon 7000 Super 8mm sound proj, record & PB sound, excel, \$199; Bolex 8mm H8 3 lens, 8mm proj, viewer rewinds & splicer, excel, \$99; 16mm sound feature films sev titles, nice color, \$99 ea. H Deans, 170 Grand St, White Plains NY 10601. 914-949-5920.

Kem 8 plate film editor w/16/35mm heads, \$20,000. J Workman, Maritz Comm, 600 W Lafayette, Detroit MI 48226. 313-963-1200 X501.

Kodak Marc 300 16mm pageant film projectors in working order w/spare lamps (2), \$75 ea. P Russell, Bowdoin College, Sills Hall, Brunswick ME 08011. 207-725-3066.

Model 1036 5 Gang Ediquipt; Model 816 portable hot splicer, 16mm, Maier Hancock; Beaulieu crystal sync; Guillotine splicer, 16mm; Craig editor viewer, 16mm, KE-16; Duplikin III & IV; (2) Arion Omni-Mate, 2+ Arion dissolve units; Beaulieu R-16 w/17 to 68mm lens; B&H wide angle w/case, filters, battery & charger; Singer Graflex 16mm, items are all in gd cond & are offered on a BO price, singly or all items. M Fiedler, 5346 Dupont Ave So, Minneapolis MN 55419. 612-822-0013.

RCA 35mm film recorder, excel cond, \$3500; Moviola 35mm upright (1) Moviola (1) Pix sound head, \$5000. J Gaffney, Ross-Gaffney, 21 W 46th, NNYN 10036. 212-719-2744.

Want to Buy

Bolex H-16 16mm movie camera, detachable view finder wanted, also other accessories. L Mertz Jr, 1660 Stoke Park, Bethlehem PA 18017. 215-694-0521.

Non-profit organization needs donations of movie cameras & equipment for missionary outreach ministry. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Mitchell 16 & 35mm cameras & access; Zeiss 9.5mm distagon, reasonable, need not mint. J Kreines, DeMott/Kreines Films, 5330 Kennedy Ave, Millbrook AL 36054. 205-285-6179.

RECEIVERS & TRANSCIEVERS

Want to Sell

Avcom EBS-100 system, \$120; Micro-Control telco DC-9 remote control; studio & xmtr units, 9 chnl, gd cond, \$1500. J Clarke, WRKU, 4531 Belmont Ste C, Youngstown OH 44505. 216-759-0579.

EF Johnson Radio 8700 mobile radio, like new, 800 MHz trunked, gd unit, w/antenna & speaker, BO. R Price, KWIK, 259 E Center St, Pocatello ID 83204. 208-233-1133.

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McKay/Dymak AM-10 wideband Am tuner, \$195. G Wachter, KFRF, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Motorola T1878C Pulsar II mobile radio telephone, \$550. D Woodcock, WNW, 5606 Medical Circle, Madison WI 53719. 608-271-1025.

Regency HX-1000 30 ch hand-held scanner w/access, excel cond, \$175. B Hoover, Colorburst Comm, Box 39, Valier PA 15780. 814-938-7237.

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Sony ICF-Pro 80 150 kHz-223 MHz MW/SW, VHF, FM portable receiver w/VHF converter, 40 memories, new, \$175; Johnson PPL 6000, 20 W UHF, 2 chnl transceivers, 467.675 MHz, 462.675 rpt & 462.675 talk around (2), \$60 ea. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3068.

Tonmeister TRE-3N NBC hotline receiver; ITC/3M FB-1 telco interface. M Seguin, WVM, POB 620, Colchester VT 05446. 802-655-1620.

Wegener 1600 w/1622, 1645, 1646, 1606-01, 1605-03 cards, SMN country, BO. J Miller, KGNO, 908 Frontview, Dodge City KS 67801. 316-227-4444.

Bearcat BC140 10 chnl programmable scanner, \$50. P Russell, Bowdoin College, Sills Hall, Brunswick ME 08011. 207-725-3066.

McIntosh MX110 FM tuner/preamp, w/custom road case, excel cond, \$150. M Ashley, Swing-Street Studios, 620 Bercut, Sacramento CA 95814. 916-446-3088.

McKay/Dymek AM-10 wideband AM tuner, \$195. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Motorola Maxar 80 w/MRT I, 55 watt VHF high band base station w/CTCSS on 151.775 w/Motorola radio telephone interconnect, like new cond w/manuals & schematics, \$1800. C Kimbrough, WRXO, POB 1176, Roxboro NC 27573. 919-599-0268 aft 6PM.

RCA Tac Tec (2) UHF 2 chnl handhelds, one has blown RF PA, w/leather holsters & drop in charger, \$100/both. G Wilson, WGTE, POB 30, Toledo OH 43692. 419-243-3091.

KLH Model 21 small FM mono table radio, working or not wanted for parts unit. J Roper, Imperial Snd Sid, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

REMOTE & MICROWAVE EQUIP

Want to Sell

MCI STL system, composite used only one month. 945.5 MHz. New \$5995, used price \$3400. One system only! Call Dan 713-774-3314.

Marti RPT-2S, 25 watt RPU xmtr, new cond, \$1200/BO; Comrex LXR single line freq extension decode, \$350/BO; WE KS-20159L4 line EQ, gd cond w/cases (2). M Black, WEOS, Geneva NY 14956. 315-789-8970.

Enterprise Elec WR-100-5 color weather radar w/NTSC output, 550 KW/8' parabolic antenna in fiberglass dome, BO with or without 80' self support tower. D Roden, WHNT, 1701 Monte Sand Blvd, Huntsville AL 35801. 205-533-3676.

Harris 10' dish w/stand; Harris SPCP receiver, BO. D Agnew, 5601 So 27th, Lincoln NE 68512. 402-421-2223.

M/A Com 23 GHz video microwave system, one audio ch & video 2 ch capability, rebuilt by M/A Com 10/88, \$4250/BO. K61CU TV, 941 'O', Ste 902, Lincoln NE 68508. 402-476-6115.

M/A Com 23VFM microwave system, video plus 1 audio chnl, 2 chnl capability, rebuilt by M/A Com 1/89, 23.925 GHz, \$4250/BO. S Kafka, K61CU-TV, Ste 902, 941 O St, Lincoln NE 68508. 402-476-6115.

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Merrimac MS-1 satellite tracking controller, Z-80 based micro processor, call for info, \$1500; Realistic 32-1221 complete 2 piece FM wireless mic system, \$40 ea. P Russell, Bowdoin College, Sills Halls, Brunswick ME 04011. 207-725-3066.

Moseley PCL 505-C STL, BO; Scala PR 450U 4' grid dishes (2), BO. J Kosobucki, KLDA, 5161 Maple, Des Moines IA 50317. 515-266-6060.

Moseley TRC-15, worked when removed, BO. M Cooney, KBRK, 227 22nd Ave, Brookings SD 57006. 605-672-1430.

Moseley DRS-1 20 chnl expandable digital remote control system w/extra spare parts & boards, \$1250; Comrex single line PLX II transmit & RLX receive unit, \$1250/system. G Wachter, KFRF, 631 N 1st Ave, Phoenix AZ 85003. 602-258-6161.

Moseley TRC-15A studio end of remote control, BO cash or trade for Moseley PCL-505C receiver. P Parks, KYKR, 27 Sawyer, Beaumont TX 77702. 409-838-3911.

Moseley 1600 like new, 92 kHz subcarrier card & Belar SCA monitor, \$4300. B Poole, WTHP, 1607 Country Club, High Point NC 27260. 919-887-0983.

Moseley PCL505 composite stereo microwave system on 945.0 MHz, gd cond, just removed from service, \$2500. B McCann, KKWY, 5 Triad Ctr, Ste 480, SLC UT 84180. 801-328-9800.

Moseley PBR-30A, working when removed from service. C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Complete satellite reception system for Transtar oldies channel, w/Wegener 1601 mainframe & all equip needed for automated operation, like new, used 1 yr, BO. B Belz, WCCZ, New Smyrna Beach FL 32069. 904-427-1550.

Moseley PCL-505C composite STL system, gd cond, w/manuals, tuned to 947.000 MHz, receiver & xmtr, \$3500/BO. J Knudsen, KWDJ, 7351 Lincoln, Riverside CA 92504. 714-688-1570.

Wegener 1601 receiver, extra cards for SMN-1621, 1645, 1646, perfect, \$1700; Scientific Atlanta 6603 video receiver down converter, excel cond, \$700. J McMahan, WAMD, POB 970, Aberdeen MD 21001. 301-272-4400.

Catel CA-2000 FM modulator & stereo gen for cable systems, like new, manuals, \$800. J Corcoran, KWWW, POB 638, Wenatchee WA 98807. 509-662-7135.

Comrex PLX-R single line freq extension receive unit, \$200. M Black, WEOS, Geneva NY 14456. 315-789-8970.

Fairchild Dart 384 to trade for a 7.5 kHz card, will consider purchase if price is right. G Dow, WBKN, POB 711, Brookhaven MS 39601. 601-833-6221.

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Gentner TEL-9 telephone interface dual buss 9 & 5 line opt 1A2 keyset system, \$2500. B Gellhaus, WDVTV, POB 73, Cheltenham PA 19012. 215-635-4815.

Marti RR 30/150 161.70 MHz, rck mnt or cntr op, wrkg when rplcd, \$550. M Hendee, KUNQ, POB 30, Houston MO 65483. 417-967-3353.

Microdyne 1100-PCDR(5) demod/recvr, EC, analog rec w/mans, 3 yrs old, \$1300. J Mabb, WHUC, Hudson NY 12534. 518-828-3341.

Microdyne 1100-FCC(X1)R(DC)L satllnt/TV recvr, EC, analog rec w/mans, 3 yrs old, \$1200. J Mabb, WHVC, Box 123, Hudson NY 12534. 518-828-3341.

Moseley MRC-1600 remt cntrl, 4 yrs old wrking cond, wireline, \$2500. A Pavao, KYNO, 2125 N Barton, Fresno CA 90703. 209-255-8383.

Moseley SCG8 (3), 1 185 kHz, 2 67 kHz, nvr used, \$2500/all or BO; Moseley PCL-606, used 3.5 yrs, lk nw, \$10,000 firm. J Evann, KNTI, 75 4th St, Lakeport CA 95453. 707-263-1551.

Moseley PCL-303 STL-xmtr & receiver, in gd cond, \$1000. R Bauer, KCPX, 434 Bearcat Dr, Salt Lake City UT 84115. 801-485-6700.

Moseley DRS-1 20 chnl expandable digital system w/extra spare parts & boards, \$1250; Comrex single line PLX II transmit & RLX receive unit, \$1250/system. G Wachter, KFYI, 631 N 1st, Phoenix AZ 85003. 602-258-6161.

Moseley PCL-505C cmpt STL sys, exc cnd, tuned to 947 MHz, \$3600. G McCoy, KZEN, 1606-1/2 16th, Central City NE 68826. 308-946-3816.

Moseley MRC-15 stud end of MRC-15 unit, slr or trd for Moseley PCL-505C recvr. P Parks, KYKR, 27 Sawyer, BMT TX 77702. 409-838-3911.

Wegener 1601 mainframe, compl sys for SMN cntry cst-to-coast incl pwr sply 1683-08, 1606-02, 1645, 1646, 1622 cards & on brd downcnvtr. Less than 1 yr & in excel cond, \$1800/BO. T Randall, KJJQ, Box 790, Brookings SD 57006. 605-692-9102.

Symetrix 108, xtr cntrl unit fr scrngng, \$2000. T Kuhl, Programmed Comm, POB 738, Syracuse NY 13214. 800-553-5688.

Want to Buy

Harris/Farion FP12MP prblc ant for prblc microwv on 12 GHz. D Dain, WKSU, Kent State Univ, Kent OH 44242. 216-672-2135.

Moseley PBR 15AR PC boards: TU, sub aud mtr proc 51A5327, sib carr demod 51A5331, sub carr gen 51A5320, alarm xmt 51A5335; SU: sub aud up conv 51A5315, sub carr gen 51A5320 (110 Kz pref), alarm det 51A5322. V Thompson, KTOT, Box 2810, 575 Pine Knott, Big Bear Lake CA 92315. 714-866-3434.

Stereo 950 MHz STL system & (2) Scala paraflector STL antennas. B Rathman, KRVM, 200 N Monroe, Eugene OR 97402. 503-687-3370.

Marti RPU receiver tuned to 161.760, but will consider anything. R Fess, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Marti, RMC, 2AX to include: studio unit RMC-2 AXS xmtr, RMC 2 AXT (A), RMC 2 AXT (10) or RMC-2 AXT (25), D Staats, WADC, 703 Market St, Parkersburg WV 26101. 304-485-7354.

Moseley 606/C STL. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

Moseley TR-1S remote control head, studio unit only. J Kennedy, Bond Bdcgt, 309 W Main, Greenville IL 62246. 618-664-3300.

RCA TTR-1 remote microwave rcvr & xmtr link. A Weiner, Britton Rd, Monticello ME 04760. 207-538-9538.

SA 7300/Dart 380 digital satellite rcvr w/15 kHz dual audio card & one cue card for satellite network reception. M Hoskins, KMON, N 210 Rainbow Motel, Great Falls MT 59401. 406-761-1000.

Satellite automation system w/manuals, complete system. B Carr, WRED, 1201 Fremont Pk, Woodville OH 43469. 419-836-9696.

STATIONS

Want to Sell

AM station on 1580 kHz, new studio & office bldg at xmtr site, in South Middle TN. Satellite news, dish included, outstanding local, sports coverage, \$200K cash. A Wilkerson, WLIL, POB 340, Lenoir City TN 37771. 615-986-7561.

Class A FM, Montana, ski resort area, can upgrade to class C1, cheap, joint venture, \$10,000 minimum, only \$50,000 full price. M Gottesman, POB 761, Laramie WY 82070.

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Current station owner looking to acquire high power AM at a gd price. Turnarounds, day-timers, & dark stations OK. Must include FCC city grade coverage map. Mr. Stevens, POB 732, Langley SC 29834.

All remaining radio station assets for sale. Transmitter, tower, air studio console, TT's, cart decks, R-R's & more. All working order, sold as package, min \$7500. For list write RLL, 7711 Wessex Ln, Columbia SC 29223. 803-788-6465.

AM station for sale, smll mrkt nice start up, lvg qrtz, gd fshg & hntg, stud twr all on sm lnd makg \$, 125 miles frm Seattle or Portland. E Kazmark, KAZZ, POB 1369, Deer Park WA 99006. 509-276-8817.

FM Class A & AM 1,000. Rtrng, price to sell, RI Est avail. P Robillard, 1803 N 1st East, Haynesville LA 71038. 318-823-0105.

Will sell up to 45% of 10 kW AM undr constrct, SW Montana. Station will srvc Bozeman, Butte, Helena, Dillon & Livingston, NE Idaho & Yellowstone Natl Park. Also unopposed FM appl for Class C bfr FCC. Golden Empire Bdcgt, POB 710, Ennis MT 59729.

Will sell 40% of prtblc Am in Lubbock TX, val r l estate, 2 trcts incl, owner retirg, lib trms. D Ballard, KLFB, 4410 10th St, Lubbock TX 79416. 806-791-1747.

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Looking for AM, FM or CP in east for right ica/terms. H Kozlowski, 703-631-0197.

AM constr prmt, prfr non-drctnl 1 kW or less. P Hunn, WZZZ, Lakeshore Rd, Fulton NY 13069. 315-593-1313.

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Harris MS-15R gd cond, w/manual, \$495. L Vollmar, WOBT, POB 738, Rhinelander WI 54501. 715-362-6140.

Moseley SCG-4T sub-carrier generator, \$300/BO. M Cooney, KBRK, 227 22nd Ave, Brookings SD 57006. 605-672-1430.

Moseley SCG-3T working when removed. C Knapp, KUMR, G-6 Library UMR, Rolla MO 65401. 314-341-4388.

Gates M-6146, matches M-6095, gd working cond, \$350/neg. S Neumann, WRPS, POB 5343, Rocky Point NY 11778. 516-744-3704.

Motorola 1300 C-Quam exciter & Motorola 1310 C-QUAM mod mon, \$5500/both. T DeCapua, WLKK, 18 W 9th, Erie PA 16501. 814-456-7034.

Wilkinson SGI-E stereo gen, \$800/BO; Collins 27-M stereo gen, \$250. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

Want to Buy

American Electronic Lab 2213 operators & service manual needed. D Willey, Life Bdcgt, POB 96, John Day OR 97845. 503-575-1640.

FM stereo gens any kind reasonable, with or without exciters. Joe, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

SWITCHERS (VIDEO)

Want to Sell

Cohu 9501 8 input SEG, w/6 wipes, int-ext keyer, mix function, w/manual; Telemation TSG-300GL genlocking color sync gen, \$500/both. TFG, Box 9, Wethersfield CT 06109. 203-527-2972.

Grass Valley 1600-4S master control switcher, stereo, machine control, excel, BO. R Rickett, WUAB, 8443 Day Dr, Parma OH 44129. 216-845-6043.

Crosspoint Latch 6139BK 16 input video switcher w/model 7239 automated controller, \$17,000/BO. E Martin, Maxwell Prod, 2208 Terrace View Dr, Louisville TN 37777. 615-970-2192.

Crosspoint Latch 6112, 8 inputs plus black/colorizer, (2) full ME's chromakeyer, DSK, gd cond, \$3100. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

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Ampex 456 1", (3) NAB 1" reels, 406 1" 4-NAB reels, 407 1" 3-NAB reels, 456 1/4" 20-bulk hubs. S Cronen, 312-945-3555.

Audiopak A-2 carts, (50), some need to be re-wound, BO. Brian, WEZQ, 205-487-3261.

Betacam 20 min & 30 min tapes, Sony, Fuji, 3M, Ampex, also Betacam metal SP tape; 3/4" videotape, 5, 10, 15, 30, 60 min. J Workman, Maritz, 600 W Lafayette Bl, Detroit MI 48226. 313-963-1200.

Videotape, 3/4", 15 min, \$4; 30 min, \$5; 60 min, \$7, gd cond. J Workman, Maritz Comm, 600 W Lafayette, Detroit MI 48226. 313-963-1200 X501.

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Want to Buy

Aristocart cart pads, need approx 200 for the old black square Aristocart carts that were made in Canada. E Fess II, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

RCA 16" Thesaurus or other transcriptions. W Davies, Virgo Prod, 5548 Elmer, N Hollywood CA 91601. 818-761-9831.

Top 40 record library's rock oldies from the 50's, 60's & 70's, in fair cond, albums as well as 45's, no tapes. B Coleman Jr, WIST, Box 460, Lobelville TN 37097. 615-593-2294.

Video tapes: classic movies & cartoons of classic films that are in the public domain, for LPTV, would buy or rent. Dee, 334 N State, St Ignace MI 49781. 906-643-9494.

Jaz-LP's, B Rose, Program Recordings, 228 E 10th St, NY NY 10003. 212-674-3060.

Transcriptions, 16", 7" to 10" blank recording discs, pre 1960 bctt equip magazines, catalogs, instruction manuals. R Van Dyke, Squires Ave, E Quogue NY 11942. 516-728-1327.

TAX DEDUCT EQUIP

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

Christian Bdcct Ministry seeks donations of production equipment to construct studio. We need everything top to bot'om, to begin producing several non-profit bdcct venture. We'll pay postage charges. TGATS, Inc., POB 42, Medford OR 97501. 503-773-3200.

ED FM needs 4 bay antenna, carts, records, any format. M Koscak, WSKB, Western Ave, Westfield MA 01085. 413-562-1950.

Elementary school needs donations or bdcct equip, anything in gd working cond, will pay shipping chgs. Linda Minton, KdSTAR, 1325 N Shumway Ave, Chandler AZ 85225. 602-786-7120.

Non-profit missionary station in El Salvador needs 8008's in any cond so long as the bases, pins & plate caps are gd, will pay shipping. Also need 892R's for xmtr, will pay shipping. J Counter, YSLE, 5484 San Patricio Dr, Santa Barbara CA 93111. 805-967-6410.

Non profit station seeks donation of 16mm movie cameras & equipmt in any cond. J Cunningham, KEOR, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Radio station at small liberal arts college is looking for donations of bdcct equip. Cart machine compressor, FM exciter, EBS monitor, etc. Will pay shpg or pick up. B Luginbuhl, Bluffton College, Box 1327, Bluffton OH 45817. 419-358-8015 X214.

Non-profit educational station upgrading our service, needs stereo 950 MHz STL system & (2) Scala STL antennas. B Rathman, KRVM, 200 N Monroe, Eugene OR 97402. 503-687-3370.

Amateur radio club seeking TV equip to be used in ATV projects. Need any type of TV equip, working or not, will pay shipping & give tax deduction certificate. Gene Kirby, Union County ARC, 13613 US 36, Marysville OH 43040. 614-261-8871.

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HELP WANTED

CE, AM/FM. Background in multidirectional antennas a must. Provide resume w/work history & brief description of your experience with AM directional & all FM related information. Working knowledge of FCC rules necessary. Include industry references & salary requirements to: Ray Worth, Genesis Broadcasting, 1750 Howe Ave Ste 500, Sacramento CA 95825. E.O.E.

Immediate opening in Wisconsin. Send resume, references to Jerry Brown, VP/Engineering, Joyner Communications, POB 1125, Cary NC 27512. EOE, no phone calls please.

Well-known New Age radio host, Joyce Keller. Advice, interview format. Proven ratings winner. Entertaining, therapeutic, informative, currently on Natl TV seeks radio hosting position. 516-587-2013.

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Assistant Mgr in medium mkt. AM looking to move on to more challenges, hands on all operations. Write to Radio World, POB 1214, Falls Church VA 22041. Attn: Box 7-3-89RW.

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Experienced combo ENG/Anchor, user friendly school of hard knocks, trained bottom line orient. Aggressive audio, Texas AM/FM TV entry level. P McKaig, Rt 4 Box 18299 # 29, Alice TX 78332. 512-664-1106.

Morning Team w/zest ready to do the best, call Sam for demo tape, 501-225-8529.

SD air personality seeks position on air. Preferably in 5 state area of FL, 5+ yrs exper, dependable & reliable. BC Songradi, Box 75, Revillo SD 57259. 605-623-4543.

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Bdct professional seeks sales opportunity w/AM, FM or related industry, all markets considered. Reply: Box 492, Clemson SC 29631.

CE, FCC General, ASEE, Ham seeks CE, Asst CE or group CE w/radio station(s). Former radio CE Boston, Houston, Miami & Ft Lauderdale. Nondrinker. M Gottesman, POB 761, Laramie WY 82070.

CHR gladiator w/11 yrs OM/PD/MD/AT exper seeks new challenge. Call Jim, 304-233-8937.

Engineer, 21 yrs exper, FCC gen, SBE, NARTE-Master Cert. seeks major market, CE

AM/FM position. Exc ref & exper trk. KJ Benner, POB 17291, St Paul MN 55117.

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Sm Mkt announcer looking to move up, 2-1/2 yrs exper as PD, prod mgr & DJ (AC, top 40 & newstalk), Prefer So CA but will relocate. L Dorrell, 731 N Balsam, Ridgecrest CA 93555. 619-375-8888.

AOR/CHR air talents seeks employment in West states area. For resume write N Adams, 674 Floyd Dr, Sandy UT 84070. 801-571-8365.

Available July 1, 7 yr professional seeks OM/PD for startup or turnaround FM or combo. Prefer Midwest, but will relocate anywhere for progressive management. For T/R: POB 201, Pratt KS 67124, by June 15. 316-672-6959.

Degreed eng (BSEE) w/5 yrs RF exper, seeks position. Experienced w/AM/FM shortwave. Willing to relocate, US/Internat. Write to Al Muick, POB 306, Fogelsville PA 18051.

For more information on a 7 yr exper announcer, w/show prep, copywriting & production skills write: S.C.S., 312 Robertson, Sulphur Springs TX 75482.

Former owner/GM w/major mkt exper, SF Bay area, seeks mgmt position w/med to large mkt station(s), prefer West Coast, exper in all phases, incl turnaround. M Seeber, 408-371-8819.

Male broadcast school grad seeks DJ position, over 3 yrs exper in music & sports, will relocate. P Rappaport, 24380 Summerhill Ave, Los Altos Hills CA 94022. 415-948-9250.

Mature, topical, witty, 7 yrs in business seeking AOR gig, smooth pipes, will relocate. Sky King, 1783 Lancer Pl NW, Wash DC 20009. 202-265-5383.

Morning drive personality looking for new opportunity. Adult communicator, A/C & CHR background. John, 619-240-9264.

Newcomer willing to learn radio, Ham & some tech exper, willing to start from bottom. S Neumann, 3 Pearl Rd, Rocky Point NY 11778. 516-744-3704.

PD, Sales, announcer looking to get back into radio. BS in communications & business. K Robel, 2141 N Lakewood, Chicago IL

TAX DEDUCT . . . wtb

Any FM under 1500 W & AM under 250 W for new school FM station, any equip to get on the air; also carts, consoles, TTs, etc, tax receipt given. S Neumann, WRPS, POB 5343, Rocky Point NY 11778. 516-744-3704.

Bauer Mdl 660, FM exciter, for spare parts, need spare xtal, 89.9415 kHz, power supply, RF amp & FM exciter modules for the Granger/Bauer mdl 660, working or not; also needed are 1-5/8" flange connectors, 90 degree elbow, 1-5/8" to 3-1/8" flange adaptor, N to 1-5/8" flange adaptor EIA 3-1/8" -1-5/8" EIA reducer. B Rathman, KRVM, 200 N Monroe, Eugene OR 97402. 503-687-3370.

Christian broadcasting company needs mod mon, stereo mon, SCA mon, 500 watt xmtr w/exciter, mono R/P & P/B carts, 7/8" transmission line, prefer solid state equip, will give receipt for tax write off. D Willey, Life Bldg, POB 96, John Day OR 97845. 503-575-1840.

Christian College in Utah is looking for equip for small NCE FM station. Need 1 or 2 kW FM xmtr, antenna, tower, about 100' console, cart machines, mics, EBS, processing equip, etc. Also test & office equip along weasy listening & Gospel music tapes & LPs. Will pay shipping or pick up. Salt Lake Baptist College, 3769 W 4700 South, Kearns UT 84118.

Computer equipment available. Will donate for tax deduction Data General Nova/4 System w/2 tape drives, Wang computer w/2 terminals, (2) Hazeltine 1500 terminals, J Davis or D Green, KJOI, 6430 Sunset Blvd, Los Angeles CA 90028. 213-469-9968.

Expressive Comm Inc a non-profit educ corp seeks new/used bdcnt equip, tower, xmtr, studio. M Scheuerman, WAPN, 904-677-4272.

Group home working w/troubled teenagers looking for video equipment. R Scott, ISOT Inc, Box 35, Canby CA 96015. 916-233-4601.

Marti stereo/dual STL system, 950 MHz band, educ station needs 2 complete systems w/combiners & antennas, prefer recent, Marti STL-10 xmtrs & R-10 rcvr units, Scala Paraflector antennas, but will consider any comparable system. B Rathman, KRVM, 200 N Monroe, Eugene OR 97402. 503-687-3370.

Non-commercial Christian FM station seeks 25 kW FM xmtr, high power antenna & coax. E Welch, WKCL, POB 809, Lapson SC 29456.

Nonprofit missionary station in El Salvador needs 8008's in any cond so long as the bases, pins & plate caps are gd, will pay shipping; also need 892R's for xmtr, will pay shipping. J Counter, YSLE, 5484 San Patricio Dr, Santa Barbara CA 93111. 805-967-6410.

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EICO 277 audio generator, \$50. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

Fluke DMM 8050A, excel cond, \$375. J Claybrook, WMJJ, 530 Beacon Pkwy W Ste 600, Birmingham AL 35209. 205-942-9600.

Leader LAG-120A AF signal gen, \$200; Leader LSG-16 RF signal gen, \$75, both units in excel cond, original boxes w/manuals. B Turner, Turner Audio, Box 788, Ridgefield CT 06877. 203-438-1603.

Potomac 120E AM field strength meter, \$1100/BO. P Huback, 1209 St Joseph St, Gonzales TX 78629. 512-672-3516.

B&K 1260 NTSC video pattern/sync gen, mint cond, \$1200. B Hoover, Colorburst Comm, Box 39, Valier PA 15780. 814-938-7237.

Bird 3128 Wcher alarm RF power monitor, up to 10 kW, 450 kHz to 2300 MHz, mint cond w/manual, \$350. R Sumner, CAVU Comm, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Heathkit IM48 audio analyzer, tube type, gd for parts w/manual, \$60 pls shpg; Heathkit IM58 distortion meter, gd for parts, w/manual, \$60 pls shpg. L Spivey, WLLS, Hwy 231 South, Hartford KY 42347. 502-298-3268.

HP 350D attenuator, 0-110 dB in 1 dB & 10 dB steps, 600 ohms, 5 W, DC-1 MHz, mint cond w/manual, \$195. R Sumner, CAVU Comm, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

HP 524B freq counter w/200 MHz plug in, BO. B Humpherys, KUSU, Utah State Univ, Logan UT 84322. 601-750-3133.

Tektronix 491 spectrum analyzer, 10 MHz-12.4 GHz, mint cond, w/manual, \$2900; Tek 7L5 spectrum analyzer plug-in, 20 Hz-5 MHz, mint cond w/manual, \$5900; HP 141T spectrum analyzer w/8552A/8555A, 10 MHz-18 GHz, excel cond w/data, \$7900. R Sumner, CAVU Comm, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Tektronix 454 portable 150 MHz dual trace scope, calib sweep delay & Mod 163D, mint cond w/man, \$825; Bird 8890 dummy load, oil cooled, 2.5 kW, DC to 2.4 GHz, 50 ohm w/N(F) con & new resist, excel cond, \$595. R Sumner, CAVU Comm, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Tektronix 491 spectrum analyzer, 1.5 GHz to 40 GHz, gd cond, to trade for solid state field intensity meter (FM) or 100 MHz scope also Solid State. L Spivey, WLLS, Hwy 231 South, Hartford KY 42347. 502-298-3268.

Tektronix 547 w/LL20 plug in & manuals, sell separately or together, BO. C Springer, KLMR, POB 890, Lamar CO 81052. 719-330-2206.

UREI 200 X-Y plotter w/Model 2010 audio testing frequency detection module, precision plotted readout on chart paper for testing freq response of tape recorders, audio gen, etc., \$2000. J Miller, Sound Patterns, 28475 Bridge, Garden City MI 48135. 313-422-2373.

WE KS-14243 75 ohm RF attenuator, rack mount type, gd cond, \$50 pls shpg; WE KS-15658 noise figure test set for 3-5 GHz, poor cond but works, \$15 pls shpg; McMartin TBM 3000 FM freq mon, workd, \$30 pls shpg. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

Air cooled dummy load, 10 kW, like new, \$1200; 15 kW heat exch type water cooled load, excel cond, self contained, \$1500. J Mitchell, WJKL-TV, 315-673-9049.

Altronic 5715 15 kW FM water cooled dummy load w/spare resistor, \$400. JA Bobaw, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

B&K, Tektronix, Nicolet FFT, level recorder, beat freq oscillators, spectrum analyzers, sound level meters, plus more, call for complete list. G Guarino, Sorcerer Snd, 19 Mercier, NUNY 10013. 212-226-0480.

Delta TCA-5-EX RF ammeter, excel cond, AM Delta base current meter w/toroidal current transformer, calibrated in Delta Lab on 6/16/87, includes all documentation & calibration data in original box, \$400. P Stage, WKVI, POB 10, Knox IN 46534. 219-772-6241.

Eico 277 audio generator, gd cond, \$50. S Weber, KGRV, POB 1598, Winston OR 97496. 503-679-8185.

HP 330B dist analyzer, tube type, gd cond, \$50. T Weeden, WMTV, 6802 Putnam, Madison WI 53711. 608-274-1515.

Simpson 379 battery tester or swap Simpson mdl 377 DC meter for above. J Roper, Imperial Snd Std, RR31 Box 405, Terre Haute IN 47803. 812-877-2663.

Simpson 458 oscilloscope w/manual, old but works & looks like new, \$200/BO. R Fess, WLRB, 119 W Carroll, Macomb IL 61455. 309-833-5561.

Techn-Physic Laboratorium ME 102B wow & flutter meter, made in Germany, serviced by Gotham Audio of NY, BO. C Kimbrough, WRXO, POB 1176, Roxboro NC 27573. 919-599-0266 aft 6PM.

Tek 526 vectorscope, needs HV transformer, gd CRT, complete, very clean, \$250. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Tek 529 waveform monitors (9), clean, well maintained cond, \$200 ea. J Perez, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

Want to Buy

Potomac Instruments FIM-21 or 41 AM field strength meter. D Murray, WCCW, 121 E Front, Traverse City MI 49684. 616-946-6211.

Distortion analyzer in gd workable cond, late tube-type unit preferred. F Kavenik, WNVN, POB 187, Vernon Hills IL 60061. 312-680-5066.

General Radio 684-A modulated osc maint/operation manual or photo copy. B Caihamer, WMBI, 820 N LaSalle, Chicago IL 60610. 312-329-4304.

Potomac Instruments FIM-71 FM-VHF-TV field strength meter. P Douglas, KWGN, 6160 S Wabash Way, Englewood CO 60111. 303-740-2222.

TRANSMITTERS

Want to Sell

Collins 21-E 5 kW AM's (4), Gates BC-5E (3), RCA BTA-5T (1) Choice \$8700. 1 kW AM's, Gates BC-1G (2), Gates BC-1F (3), Gates BC-1J (2), Collins 20V3 (2), McMartin BA-1K (2), \$2000-\$5500. Jerry Kautz, Armstrong Transmitter. 315-488-1269.

BE 3.5K & exciter, currently on air in Arkansas, will consider owner finance of up to half or discount for all cash. You pick up or reimburse crating/shipping charges, \$19,900. 501-444-9544.

FM TRANSMITTERS

3.5 KW 1978 McMartin
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20 KW RCA BTF-20E
10 KW CCA 10000D
Optimod 8000 & 8100
FM Exciters
STL- Marti & Moseley
PMA Marketing
414-482-2638

Carrier current 50 W home brew xmtr, 19" x 16" x 16", adjusts 2 Ws to 50 W w/instruction book, \$400. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

CCA FM 10,000D 10 kW FM w/10DS exciter, will re-tune & help load, 3 phase, \$12,500. R Henry, WPLO, 505 Josephine, Titusville FL 32796. 407-267-3000.

CSI T1A, new, 500 W AM xmtr, still on pallet. P Rondeau, Radio Hanover Inc, POB 234, Hanover PA 17331. 717-637-3831.



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CSI FMT-1 1 kW FM includes Bext 80W exciter, spare tube, tuned to 100.1 MHz, ready to ship. BO. D Fredeen, WBRR, POB 545, Bradford PA 16701. 814-368-4141.

Gates 1 kW w/RCA BTE 15A exciter w/stereo gen & SCA gen, gd cond, BO. D Agnew, 5601 So 27th, Lincoln NE 68512. 402-421-2223.

SUPER-GEN

This high-performance FM Stereo Generator has selectable pre-emphasis, overshoot-controlled lowpass filters, digital pilot/subcarrier synthesis and built-in overmod protection. CBS/NAB's "FMX" system is available as a plug-in option.

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Gates FMS-1B FM w/Collins 310Z-1 exciter, 1 kW; Gates FM-10G, 10 kW FM. M Ripley, KOZE, POB 936, Lewiston ID 83501. 208-743-2502.

Gates/Harris FM-1G needs minor repair, w/all tubes & manual, tuned to 93.5, \$4500/BO. A Wilkerson, WLLI, POB 340, Lenoir City TN 37771. 615-986-7561.

Harris FM 2.5K, 8 yrs old, gd cond, MS exciter, new tube, gd spare tube, \$15,000. J Denison, Esprit Comm, 4510-A S 14th, Abilene TX 79005. 915-691-9292.

McMartin BA-1K gd cond, \$3000. H Henderson, KDAP, POB 1129, Douglas AZ 85607. 602-364-3484.

RCA BTE-10C/BTS-1A exciter, stereo gen, metering panel & CBS Volumax, stereo, in 4' rack w/manuals & spares, \$7000 pls shpg. T O'Laughlin, O's Own Eng, Rt 1 Box 41, Bamereid WI 53507. 608-924-2001.

Acrodyn T210M/V LPTV xmtr 10 W low band VHF, low hrs, avail immed; Scala Yagi-5 element ant, \$5000. S Olson, WSSM, 1 Odana Ct, Madison WI 53719. 608-276-9454.

Gates BC-5B (2) 5 kW AM, excel cond, one tuned to 1590 kHz the other to 580 kHz, plenty of spares, BO. D Barton, KMTI, POB K, Monti UT 84642. 601-835-7301.

Gates M-6095 FM exciter, 10 W, gd cond, w/manual & 94.1, \$350/neg. S Neumann, WRPS, POB 5343, Rocky Point NY 11778. 516-744-3704.

Harris TE-3 FM 10 W exciter, w/Orban base-band card, tuned to 104.1, \$1400/BO; Collins A825W 10 W, tube type exciter, needs minor work, tuned to 99.5, \$650; Harris MX-15 exciter tuned to 106.1, recently aligned & calibrated by Harris, \$4500/BO. WVIS, POB 487, Frederiksted, St Croix VI 00840. 809-778-5199.

Harris 3.5 kW, 3 yrs old, excel cond w/Harris exciter & Orban 8100A Optimod, must sell for upgrade, on 96.7, also includes ERI single bay antenna. BO. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

Harris FM 2.5 kW w/Versa Count exciter, top cond, \$16,500. G McCoy, KZEN, 1606-1/2 16th St, Central City NE 68826. 308-946-3816.

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Harris FM 3.5 kW, excel cond, incl exciter, Optimod 8100A & ERI snl bay 96.7 antenna, will del & install if nec. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

TEST EQUIPMENT

Want to Sell

B&W audio osc, \$200; B&W dist meter, \$300; (3) Comrex TCB-1 phone line couplers, \$100 ea; Gates SSA-3 silence sensor, \$50. B Clark, WFAS, Secor Rd, Hartsdale NY 10530. 914-693-2400.

Simpson 458 oscilloscope, old but works, manuals, \$200/BO. R Fess, WLRB, 119W Carroll, Macomb IL 61455. 309-833-5561.

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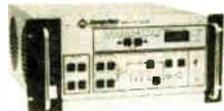
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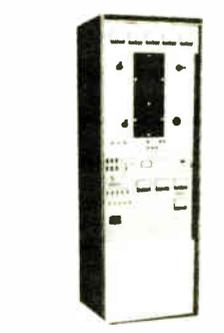
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RCA TTU-30C 30 kW UHF, complete & on the air, chnl 45, can be returned to ch 30-51, \$70,000. J Mitchell, WJKL-TV, 315-673-9049.

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Wilkinson 2500 E. E Kazmark, KAZZ, POB 1369, Deer Park WA 99006. 509-276-8817.

Want to Buy

1 kW UHF trnsmtr, trnsltr or amplifier, mst adapt to output chnl 61, all ages & types cnsdrd. S Kafka, K61CU-TV, Ste 902, 941 O St, Lincoln NE 68508. 402-476-6115.

AM xmtr 5 kW, late mdl for gospel station, will pay \$10,000 to \$15,000 pls tx write off on balance. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

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We are looking for AM/FM/TV/STL transmitters, exciters and STL equipment for all power levels and all ages. Call us and turn your old equipment into cash. We will arrange dismantling and removal.

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Any FM 1-3 kW, any cond; also 1 kW AM any cond. D Kohn, KESM, 200 Radio La, El Dorado Spgs MO 64744. 417-876-2741.

FM xmtr, 1-5 kW for NCE station, will pck-up w/out exciter OK. D Van Zandt, Cornerstone Radio, 2596 State Road 44, New Smyrna Beach FL 32069. 904-427-9000.

AM major manuf late 2.5 or 5kW, wth stp down; also a 3.5-5kW and a 500 to 1000 W. L Maierhofer, WTGC, 101 Armory Blvd, Lewisburg PA 17837. 717-523-3271.

Collins 20 kW xmtr & 550' guyed tower in gd cond. D Radke, KWWK, 1220 4th Ave SW, Rochester MN 55902. 507-288-1971.

FM xmtr, 2-4 kW, will pick up at your site; also a 10 kW FM xmtr for EDFM. D Van Zandt, WJLU, 2596 S.R. 44, New Smyrna FL 32069.

FM xmtr 4-5 kW. J Stromquist, WNCB, 2816 Hagberg, Duluth MN 55811.

FM 2.5 to 5 kW for class A FM in Wash state, less thn 15 yrs old & in gd cond. R Larson, 509-453-6296.

Looking for 10-25 kW xmtr for 93.3 MHz, ERI antenna & feedline. R Wachter, KNSX, 3418 Douglas, Florissant MO 63031. 314-872-2660.

RCA BTA-250 manl/schmics needed, will pay copying costs. P Deets, WFHR, Box 8022, WI Rapids WI 54495. 715-424-1300.

TV xmtr for 432.25 MHz ATV ops, any cond. G Kirby, WMRV, 13613 US 36, Marysville OH 43040. 614-261-8871.

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Want to Sell
Tubes including 4CX250B, 4CX250R, 6146B, 3CX1500A7, 4CX3000A & more. We carry lg inventory, all major brnds (EIMAC, Amperex, RCA, etc.) Call Stew at 1-800-842-1489.

Used 813's, \$20; 872A's, \$10; 8008's, \$10; 5894 w/socket & tuning assy, \$35; (4) 7289 tubes w/RF socket parts, \$28/all. J Cunningham, Rt 2 Box 113B, Stonewall OK 74871. 405-265-4496.

REBUILT ELECTRON TUBES

Partial List: 6623, 23791, TH150, 6425F, 5604, 6696, 6697, 5681, 5682, 5671, 7804, 3CX10, 000H3, 3CX20, 000H3, 4CS5000A, 4CX35, 000C

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508-584-4500

684's (15); 80's (2); 502A (5), never used, \$75/all. A Wilkerson, WLIL, POB 340, Lenoir City TN 37771. 615-986-7561.

GE 833A's (2), one new, \$100, one used, \$55. J Strong, WJFM, 120 Wildwood, Mt Zion IL 62549. 217-877-1130.

EIMAC 8169/4CX3000A, \$75; EIMAC 8170/4CX5000A, \$975, both new. A Emerald, KGGA, 8956 Swallow, Fountain Valley CA 92708. 714-962-5940.

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TURNABLES

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Russco Studio B in gd cond, \$80; QRK SF4H13A w/tonenarm, gd cond, \$125. J McMahon, WAMD, POB 970, Aberdeen MD 21001. 301-272-4400.

Technics SP-15 (2) compl w/preamps, excel cond, \$1000. D Agnew, 5801 So 27th, Lincoln NE 68512. 402-421-2223.

Want to Buy

Technics SL-1200 MKII (2) in new cond w/Stanton 600A carts, also (2) in vgc w/Stanton 661A carts w/mans, \$325 ea. D Davis, KMBA, 1217 Valencia Dr NE, Albuquerque NM 87110. 505-255-2431.

Denon DCD 810 CD players, used 1 month (2), \$240. JA Bowab, WDLT, 2402 Wolf Ridge, Mobile AL 36618. 205-344-3698.

Gates M-6442 stereo TT preamps (2), excel cond, BO; Gates Level Devil M-5546A, works, BO. R Fess, WLRR, 119 W Carroll, Macomb IL 61455. 309-833-5561.

McMartin/QRK 3-spd wrk hrse w/one arm cart & stylus, excel cond, \$150/BO. T Randall, KJJC, Box 790, Brookings SD 57006. 605-692-9102.

Neumann AM 32 B disc mastering lathe, var ptch & dpth, cmplt sys in gd wrkg cond w/lathe, stereo SX 68 Neumann head, stereo electr, VG 66 solid state, microscope, etc, \$8500/all. R York, Jewel Records, 1594 Kinney, Cincinnati, OH 45231. 513-522-9336.

QRK Ultimate II stereo-phono preamp & pwr sply, gd cond, \$100/BO. M Patton, WXOK, 6819 Cezanne Ave, Baton Rouge LA 70806. 504-292-4189.

QRK 12-C 3-spd w/arms & Gates preamps (2), \$35 ea. M Ashley, SwingStreet Studios, 620 Bercut, Sacramento CA 95814. 916-446-3088.

Russco Studio Pro B (2), gd cond, BOM Black, WEOS, Geneva NY 14456. 315-789-8970.

Shure M-64 stereo TT/UTIC preamp, \$40. M Kuehl, 1418 N Stevens, Rhinelander WI 54501. 715-369-4007.

Sony CDP 55 tray CD player w/auto stop, perfect cond, \$300. R Wachter, KNSX, 3418 Douglas, Florissant MO 63034. 314-872-2660.

Technics SP10-MKII, new, never installed, \$800/BO. R Bruce, UAR Slids, 8535 Fairhaven, San Antonio TX 78229. 512-690-8888.

TV FILM EQUIP

Want to Sell
Complete RCA color 16mm film & 35mm slide chain, (2) TP66 16mm film proj w/optclt & mag snd, TP7 35mm slide proj, TP55 mltrlxr & TK27 color cam w/2 sts of xtr tbs, \$3000. J Krepol, RNDL, 6147 Walker, Phila PA 19135. 215-624-1050.

GE 240 telecine cam, Eastman mdl 2 pneumatic mltrlxr, Spctrm dual drlm slide proj, Eastman 285 16mm TV film proj, little use, \$3000/all. J Perez, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

PAL film chain equip: Hitachi FP-20S 3 tube Saticon cam w/zoom lns & schmics, EIKI 16mm telecine proj, excel cond, misc monitors, 3/4" & 1/2" PAL VCR's also avail. J Garvey, Video Yesteryear, Box C, Sandy Hook CT 06482. 203-744-2476.

RCA FP10 16mm film rcdtr/prdcr, \$500 or trade for 1/2" VCR. J Workman, Maritz, 600 W Lafayette Fl, Detroit MI 48226. 313-963-1200.

VIDEO PROD EQUIP

Want to Sell
Hotronic AD51-TFS frame sync/TBC, \$4000; Thomson-CSF 7011 chroma insert keyer, \$1250. H.M. Dyer Electronics, 2982 Wixom Rd, Milford MI 48042. 313-685-2560.

Canon UA Series assrtd mle, fmlc, cble & pnl mic cncntrs; Trompeter LPL-75 vid ptch plgs, 1" pin spacing (24), \$3 ea. B Humpherys, KUSU, Utah State Univ, Logan UT 84322. 801-750-3133.

CBS Labs 8400 RGB, cmpste vid enhncr, intr prblm w/man, \$100. J Cochran, Gateway Video, 225 Ross, Pittsburgh PA 15219. 412-471-3333.

Cezar The Controller, brnd new edit cntrlr/ls w/sme cbls, BO; Cezar EA-3X, new edit cntrlr/ls w/sme cbls, BO. B Hoag, 2814 Hearthside Ct, Marietta GA 30067. 404-973-8918.

Conrac 9", 14" B&W monitor, 1/2 & fl rck mntrs, svrl avail, BO. R Rickety, WUAB, 8443 Day Dr, Parma OH 44129. 216-845-6043.

Video equipment rack. M Bejarano, Falcon Comm., 6923 Forbes, Seabrook MD 20706. 301-794-5754.

Quick-Set QHT-1 Hercules, tripod w/QHD-1 dolly, frctn hd, vgc, \$350; Panasonic NV-A950 editg cntrlr, ex cnd, \$100. R Sumner, CAVU Comm, 3322 Applegate Ct, Annandale VA 22003. 703-560-0233.

Sony PVM-5300 (3) 5" color monitors in 19" rack mount, needs new CRTs, units new but dropped, call for info, \$175. P Russell, Bowdoin College, Sills Halls, Brunswick ME 04011. 207-725-3066.

Vital VI-500 color stab amp w/cable EQ, w/manual, \$100; Cohu 2614-400 video waveform multiplexers (2), \$50 ea; RCA MI-4069B1 RCP for RCA TR-50 VTR. B Humpherys, KUSU, Utah State Univ, Logan UT 84322. 801-750-3133.

Bosch Compositor dual chnl char gen, (2) kybds, graph cmpse cnsle, election return pckg dsply unit, gd wrkg cond, \$6000; Quantel DPE 5000 Plus dual chnl dig effects sys, (2) cntrl pnls, nds pwr sply, \$3500; RCA TK-76 3 tube color camera (2), one working one not, fair to gd cond, \$500/both. R Yerema, World Video Prod, 10625 Scripps Ranch, San Diego CA 92131. 619-695-1045.

Bogen 132 head 116, heavy duty tripod w/dolly, \$150; Quick Set camera pedestal head mdl 4-52304-9, pedestal model 4-74500-6, \$75. R Nimitz, Rm 9, CCE, Notre Dame IN 46556. 219-239-5465.

Lenco PCE 466 RGB color encoder, \$1900; videotape 1", 30 min & 60 min, less than 10 passes, gd cond, \$15 & \$22.50. J Workman, Maritz Comm, 600 W Lafayette, Detroit MI 48226. 313-963-1200 X501.

Magnavox 1012L vid motion dctor, as is, working cond, \$75. M Rakoff, 114-41 Queens Blvd, #148, Forest Hills NY 11375. 718-591-0002.

Norelco PC-72 (3) color studio cameras w/(3) Peerless pedestals CCU's & cables, two in gd cond, one needs a tube, complete package, \$8500; Sony BH-500 1" portable VTR C format, gd cond, \$4500; NEC digital effects system includes squeeze zoom flip options, multi freeze etc, gd working cond, \$8500. R Yerema, World Video Prod, 10625 Scripps Ranch Blvd, San Diego CA 92131. 619-695-1045.

Quantel DPE-5000SP single chnl dig vid effects; Bosch Compositor I 2 chnl char gen sys. P Douglas, KWGN, 6160 S Wabash Way, Englewood CO 80111. 303-740-2222.

Sony VP-5000 3/4 plrs (8) w/jog & shttl, \$400-\$800; Sony SEG 2000-A spec effects gen 6 wipes genlock, \$2600; Sony DXC-M3 3 tube cam ENG Canon lens, \$2985; Sony 4800 3/4 fld rcdtr w/Portabrace case, \$1875. T Zingale, TZ Comm, 213-477-5803.

Telechrome 3200 video dist amps, rack of eight, gd cond, BO. M Cramer, WGBA, 1391 N Road, Green Bay WI 54307. 414-494-2626.

Videotek VM 8PRW 8" color mon RGB switching, \$675; Tektronix 528-A waveform mon, \$1099; Videotek RS-10A 10 input video/audio switcher, \$675; URIE graphic EQ, \$275. T Zingale, TZ Comm, 213-477-5803.

Vidfont MK14-A char gen w/dsk drv, little use, \$4000; RCA TK-44 studio cams, gd overall cond w/Angineaux 18x15 300m lenses (3), \$3000 ea; Central Dynamics VSP414 spc effects prod swtchr, gd cond, \$4500. J Perrez, WJKL, 3342 Perry, Syracuse NY 13215. 315-673-9049.

Want to Buy

Sony PSA 101 manual. F Haynes, 1718 N 79 Terr, Kansas City KS 66112. 816-654-2407.

VIDEO TAPE RECORDERS

Want to Sell

Panasonic NV-8030 time lapse logging VCR, w/tapes (2), BO; Panasonic NV-9100A U-matic 3/4" machine, gd cond, BO. R Rickety, WUAB, 8443 Day Dr, Parma OH 44129. 216-845-6043.

Panasonic NV9500, NV9200, NV950 3/4" edit system, gd cond, \$2000 set; (2) Panasonic NV9500, NV9200 3/4" VTRs, heads OK, need tune up, BO. H Larson, Matrix Mobile TV, POB 536, San Luis Obispo CA 93406. 805-544-5657.

Panasonic AG-6810S VHS HiFi & nrml audio pro duplctr w/Dolby, 50 hrs on machine, like new, \$500. P Russell, Bowdoin College, Sills Halls, Brunswick ME 04011.

Sony VO-6800 portable 3/4" U-matic VTR, AC-PS, 8-NP1's w/charger, kangaroo case/strap incl., \$2950.

Want to Buy

Sony BetaCam BVV 1A, rebtl by Sony w/Portabrace cstm case & comp cble adptr, & jam sync opt & Dolby, also a Bogen tripod w/fluid hd, lk new. MRG Prod Assoc, 516-489-1071.

Panasonic AG2200 only. Grace Dalzell, Premier Film Video & Recdng, 3033 Locust, St Louis MO 63103. 314-531-3555.

Sony BVH-2000, 1" Type C, Type 2 control panel or Type 3 internal TBC, gd working order. J Stephens, KFDA, POB 1400, Amarillo TX 79189. 806-383-2226.

Amper/Sony 1" Type C w/TBC, must be in gd working cond. G Sive, POB 239, Bonsall CA 92003. 619-749-7662.

ACTION-GRAM

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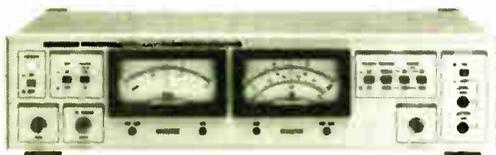
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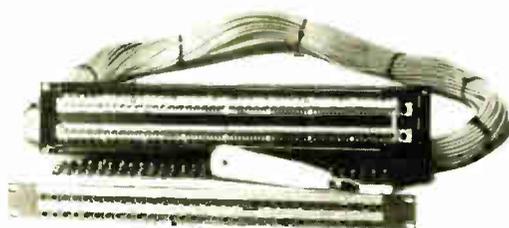
CD jitter meter

Leader Instruments has introduced the LJM-1851 CD jitter meter. The instrument performs simultaneous measurements of jitter (3T) and HF levels (3T or 11T) for the eight to fourteen modulation (EFM) signals used in CD disc players.

The sigma measuring mode of the LJM-1851 computes the jitter within \pm one standard deviation to produce a near steady state reading.

The EFM signal level is indicated as a peak to peak value for the 3T or 11T bit component and is selected by pushbutton.

For information, contact **Joseph Fisher at Leader: 516-231-6900**, or circle Reader Service 28.



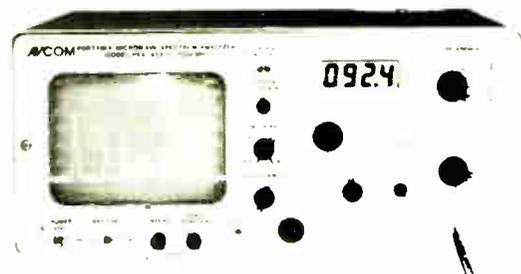
Pre-wired patch bay

Audio Accessories, Inc. has developed a series of pre-wired patch bays. The units incorporate the KRONE punch-down terminal blocks.

The patch bays are available with either a connect or a disconnect block, and with 24, 26, or 32 long-frame 1/4" jacks per row.

Audio Accessories' patch bay units can be supplied in a self-contained chassis.

For information, contact **Tim Symonds at Audio Accessories: 603-446-3335**, or circle Reader Service 44.

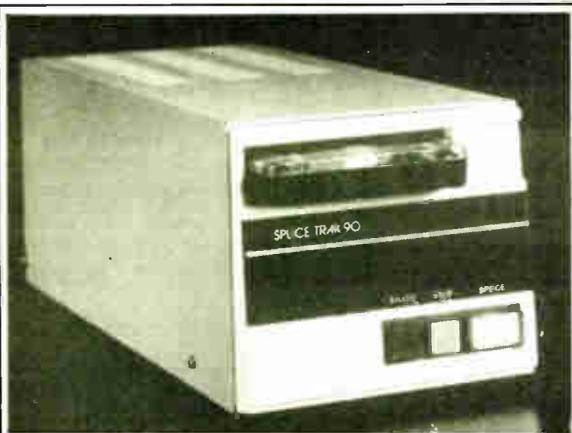


Portable spectrum analyzer

AVCOM has unveiled a new portable spectrum analyzer, model PSA-65A. The device covers frequencies through 1000 MHz in one sweep with a sensitivity greater than -90 dBm at narrow spans.

The lightweight, battery- or line-operated analyzer include options such as frequency extenders for Satcom and higher frequencies, audio demod for monitoring, log periodic antennas and a carrying case.

For information, contact **Pete Gaglio at AVCOM: 804-794-2500**, or circle Reader Service 11.



Splice finder/eraser

The Splice Trak 90 from Broadcast Electronics is a high-speed eraser/splice finder for broadcast audio tape. Dual full track erase heads provide 90 dB of erasure.

For information, contact **Bob Arnold at Broadcast Electronics: 217-224-9600**, or circle Reader Service 33.



Line voltage regulator

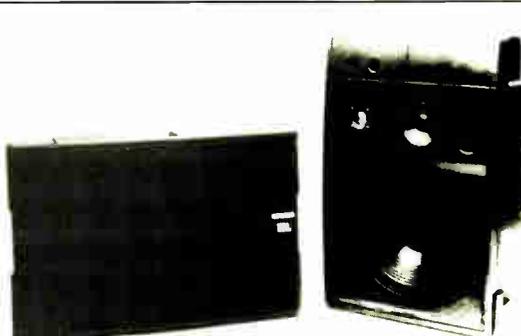
New from Furman Sound is the AR-117 line voltage regulator. The device accepts input voltages from 99 to 129 volts AC and converts them to the North American standard 117 volts.

The AR-117 uses a toroidal multiple-tap autotransformer, with the proper tap switched electronically at the voltage zero-crossing.

Housed in a single 1.75" rack mount chassis, the AR-117 has eight regulated convenience outlets on the rear panel.

One of the features of the Furman AR-117 senses dangerously high overvoltages and shuts down the output before damage is done.

For information, contact **Joe Desmond at Furman Sound: 415-927-1225**, or circle Reader Service 54.



Monitor system

The JBL Control 10 monitor is designed for use in audio-visual presentations in corporate and other applications.

The molded polypropylene foam enclosure was engineered to accept a number of mounting accessories. Loudspeaker components are all magnetically shielded, for safe use near magnetically sensitive electronics.

For information, contact **Bill Threlkeld at JBL: 818-893-8411**, or circle Reader Service 18.

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Radio World

July 12, 1989 Issue Use until October 11, 1989

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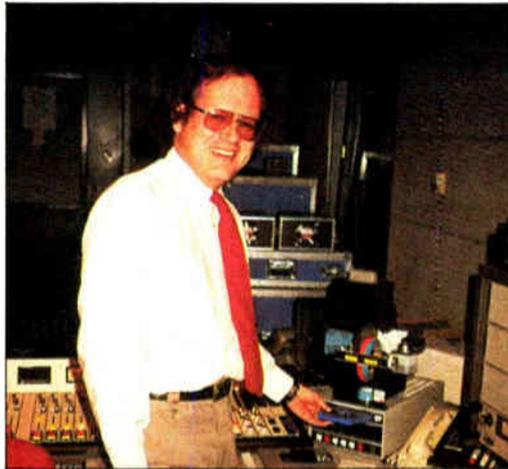
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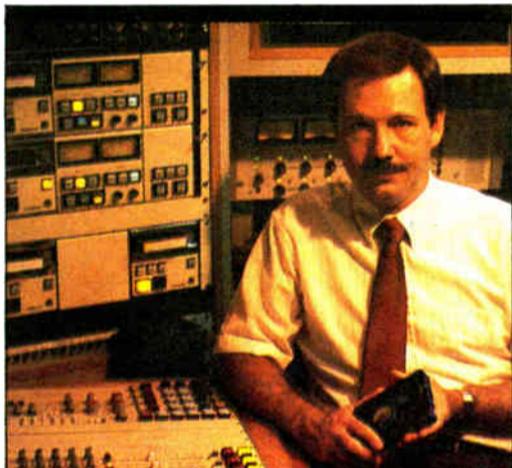
Mike Callaghan, C.E.
KIIS, Los Angeles, CA

"From time to time we evaluate other carts, but we've never found anything as consistent or dependable as AA-4s. We're very happy with them."



Gerry Dalton, C.E.
KKDA, Dallas TX

"We've used AA-4s for years. The highs are cleaner than other carts we've tried, and the response is more consistent."



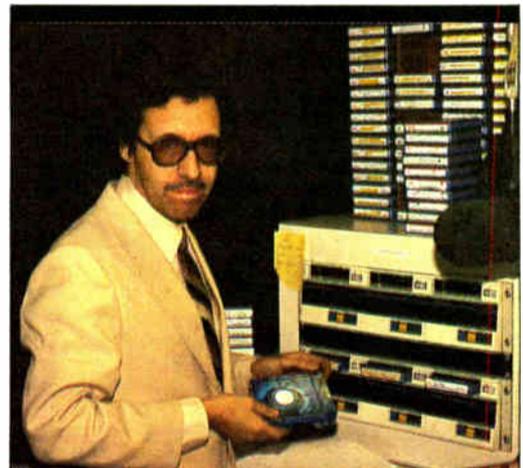
Ray Klotz, C.E.
KZLA/KLAC, Burbank, CA

"We've been using AA-4s ever since we built our current studio in 1984. We tested several different carts and machines, and AA-4s were our choice. We're very satisfied."



Don Cook, C.E.
WOVV/WIRA, Ft. Pierce, FL

"In the tests I've run, Audiopak carts give the best performance consistently. They're also simpler to maintain and re-load. We dub a lot of music off of CDs. Quite honestly, when the machine's in good shape, I can't tell the difference. They definitely do the job."



Skip Voros, C.E.
WMVP/WLUM, Milwaukee, WI

"We've been using Audiopak AA-4s for five years, and we've had nothing but success with them. They've been very good to us."



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This cabinetry is very clever, unbelievably strong, and (of course) square--*precisely*. It has that Wheatstone major market look. So contact Wheatstone for furniture, consoles, or prewires.



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