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Radio World

NAB94
See pp. 59-71

Vol 18, No 5

Radio's Best Read Newspaper

March 9, 1994

DCR to Begin Satellite DAR Service

by Frank Beacham

HORSHAM, Pa. Digital Cable Radio (DCR), the digital audio service with 30 channels of music and special programming, is expanding beyond its cable television

roots to be delivered nationwide this summer on direct broadcast satellite.

The premium, commercial-free audio service is expected to become the first to deliver its programming directly from satellites to consumers located at any fixed

location in the United States.

DCR, a partnership between General Instrument, Sony Software, Warner Music Group and several leading U.S. cable operators, will supply its programming to DirecTV, a unit of General Motors Hughes Electronics. DirecTV, headquartered in Los Angeles, is scheduled to begin a limited roll-out of its DBS service in April and to expand to a full launch later in the year.

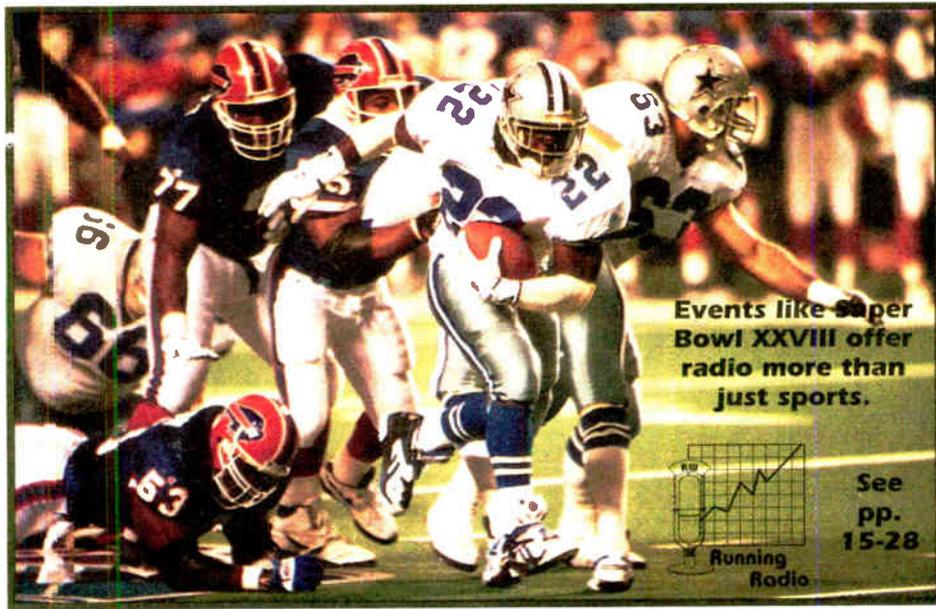
"This (DCR's announcement) will shock the broadcasting industry," said John D. Abel, executive vice president of the National Association of Broadcasters (NAB). "This is the equivalent to the guys coming in from Japan with inexpensive cars in the 1960s. It shocked the automotive industry eventually, and it (digital audio via satellite) will do the same for broadcasters. We cannot stop digital."

Not just cable

To shed its cable-only roots, the audio service is changing its name to "Music Choice" from Digital Cable Radio, though the corporate entity will retain its original name. Music Choice will retain the current programming lineup which includes 30 around-the-clock channels that include classical, jazz, blues, hip-hop, modern rock, contemporary country, new age and other formats. The name change will be launched to cable operators on May 2.

Perhaps of greatest importance to DCR, the Music Choice service will be offered as

a basic service in DirecTV's Personal Choice II package which will be offered at \$29 a month. This means DCR will not have to market the music service as an optional premium service as it now does with cable television subscribers. And, since Music Choice will work through



Events like Super Bowl XXVIII offer radio more than just sports.



See pp. 15-28

in depth

Broadcasters Are Careful Compression Customers

by Randy Sukow

WASHINGTON It is difficult to gauge the broadcast industry's attitude toward digital audio compression systems.

Compression systems are selling well. The proliferation of new digital RF and studio equipment with compression options suggests a market for them. The cost benefits of squeezing two, four or more signals into channels that used to carry only one signal are not questioned.

But the current anxiety about the proliferation of compression systems in the broadcast chain, especially when compression potentially means noise and distortion from "dueling algorithms," originated from broadcasters.

Compiling radio industry opinions on compression has been surprisingly laborious. *RW's* request for individual station managers' and engineers' experiences with compression drew a disappointing response. (See box, page 13).

In lieu of the survey, *RW* contacted several radio engineers from a wide range of market sizes, to record their experiences with audio compression and plans for future compression use.

Most were generally satisfied with the compression systems they were using, but

cautious about adding other compression systems to their facilities.

They also tended to be less optimistic about remedies for audio artifacts than equipment manufacturers and algorithm developers. But many broadcasters share manufacturers' desire for a system to use just one compression system in the broadcast chain and eliminating multiple analog-to-digital conversions.

Satisfied customers

The most satisfied engineers have not had serious trouble with dueling algorithms or other compression artifacts.

"Generally, the problems have been solved by just adjusting the hardware. There haven't been problems with the software," said John Nielsen, chief engineer at KTTS-AM-FM Springfield, Mo.

KTTS receives satellite feeds from ABC Radio that are compressed with Scientific Atlanta's SEDAT system. It also operates various digital audio effects machines and will soon have ten 360 Systems DigiCarts with optional AC-2 compression.

Nielsen has heard some transcoding problems at his stations, but nothing that could not be corrected. "Most of the time, when

continued on page 11



Digital audio channels will be tuned through DirecTV/Thomson's 18-inch dish and receiver.

DirecTV's existing home receiver, a separate set-top receiver will not be required for the music channels.

"This is a big opportunity for us for two reasons," DCR President Dave Del Becarro said. "Automatically huge numbers of people will be exposed to Music Choice. It doesn't have to be sold. We'll

continued on page 8

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NEWSWATCH

Infinity Fined Again

WASHINGTON The FCC has once again levied fines on several Infinity Broadcasting stations that air the syndicated Howard Stern Show.

The indecency fines, totaling \$400,000, were for Stern broadcasts in August, September and October, 1993, which are violations of the FCC's no-indecency programming hours, 6 a.m.-10 p.m. The stations involved were WJFK (AM), Baltimore; WXRK-FM, New York; WYSP (FM), Philadelphia and WJFK-FM in Manassas, Va., a station that

serves Washington.

The FCC said that Infinity's "continuing course of apparent misconduct in broadcasting indecent material is troubling, but (the FCC) concluded that under existing circumstances, monetary forfeitures were the appropriate remedy for the cited violations."

The Commission has previously fined Infinity several times, in excess of a million dollars so far (none has been paid, yet) for indecency, and hinted that the violations could impact approval of Infinity station transactions.

A recent district court decision seems to undermine the FCC's indecency rules,

but it went ahead with the latest action. In a press release on the latest fines, the Commission, however, said that "we do not read the Court's decision to restrict our ability to enforce against broadcast indecency, except with regard to the midnight to 6:00 a.m. safe harbor period..."

The FCC also acknowledged that the court ruling "has raised issues regarding our enforcement program that can be most appropriately addressed in a rule-making proceeding. Accordingly, we will exercise our discretion...to limit our response to these latest broadcasts to monetary forfeitures."

On the air, Stern has said the FCC has singled him out for alleged violations, but ignores other radio personalities that also air similar or worse material.

Harman Acquires Studer

WASHINGTON Harman International has added Studer Revox, based in Regensdorf, Switzerland, to the list of professional audio companies it now owns.

Last month, Harman, the parent company of JBL Professional, Soundcraft, Allen and Heath, DOD, Lexicon, BSS and AKG, acquired the pro audio side of Studer. The consumer hi-fi division of Studer was excluded from the deal, but "negotiations with interested buyers are still in progress," according to a Studer press release.

"With the takeover of Studer Revox, the Harman group will have an unmatched range of products in the professional audio sector," the press release said.

Some of Harman's companies sell competing products, such as Studer's Dyaxis line and the AKG digital workstations.

Studer U.S. had recently consolidated most of its business operations in Menlo Park, Calif. The Studer company has subsidiaries in the U.S., France, Canada, Germany, Great Britain, Japan, Singapore and Austria.

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LISTENER IMPRESSION

Sony Introduces AMAX Stereo Walkman

by John Gatski

WASHINGTON Although the AMAX voluntary AM tuner performance standard has been in effect for about two years, manufacturers have been slow to produce radios that meet the criteria.

Designed to spur the quality of AM tuner performance, best described as dismal over the last 20 years, the joint electronics industry/broadcast industry AMAX standard requires that radios have a bandwidth of 50 to 7.5 kHz (6.5 kHz for portables), adjustable bandwidth, noise blanking (battery portables are exempted), and external AM antenna connection (home units).

Recent FCC action on AM improvement, including adoption of Motorola's C-QUAM stereo transmission standard and preference for AM stereo stations in the new expanded band, has contributed to the need for better AM radios.

Hopefully, Sony's new SRF-42 AM stereo/FM stereo portable is a sign of more AMAX-quality radios to come. The \$34.95 portable "walkman"-type radio features AM stereo-mono/FM stereo, manual tuning, headphone jack and headphones, and removable belt clip. The band selector switch has three positions: FM stereo, AM mono and AM stereo. The radio is powered by two AA batteries. The unit is manufactured in Malaysia.

In listening tests with the SRF-42, I sampled the radio through various head-

phones and via connection to a home hi-fi set up. As mentioned in past **RW** radio/tuner evaluations, Washington, D.C. does not have a lot of AM stereo stations, so I tuned in the ones I am familiar with: WMZQ-AM (1390 kHz), a country station; and WWDC-AM (1260 kHz), a golden oldies station. Although no performance measurements were made, listening tests revealed the SRF's AM sound is much improved over the mono, narrow-band AM (usually about 2.5 kHz) of most modern AM tuners.

To really enjoy the SRF-42, however, you should invest in better headphones. The SRF-42 comes with a basic "jogger" headphone setup that does not do the radio justice. The headphones sound okay, and their lightness is good for the on-the-move folks, but the SRF-42 offers more than the OEMs can provide.

I tried a two-year old set of Sony MDR-P1 closed headphones, which cost about \$24. The high end and the bass immediately came to life when I tuned into WWDC and WMZQ. Next, I auditioned the SRF-42 with my studio-quality Sony MDR-V6 headphones, which cost about \$100. Again, a marked improvement in the audio. The highs were brighter, the stereo separation was wider and the bass was deeper.

A welcome side benefit of the AM stereo mode is that mono stations sound better because of the extended bandwidth; the highs are brighter, but without stereo. The AM stereo chip is Sony's portable C-

QUAM chip that is designed to operate with less battery power. On the negative side, when you open up the bandwidth, there also is an increase in typical AM noise. Remember, there is no noise blanking requirement for the AMAX battery portables.

I also connected the SRF-42 to the hi-fi via a portable CD interconnect. There was a sense of stereo space in the AM mode, and the sound was more open than most mono AM radios, but I preferred the headphone sound. Anyway, the SRF-42 is not designed to be a home tuner—although the FM stereo mode did sound pretty good on the home system.

My review sample did have some quirks. Initially, the battery compartment would not open, but I attributed its stubbornness to a couple of hours' storage in the cold confines of my car. Also, since the SRF-42 has manual tuning and a small tuning scale, it was a bit hard to dial in some stations. But once they were tuned in, they locked on and did not drift from stereo—either on AM or FM.

Also, in my opinion, the radio's selector switch needs an FM mono position. There are times when the listenability of distant or hard-to-tune stations can be enhanced

by going mono. The SRF-42, however, is not alone in not having a mono FM option; many car radios don't have the feature either—and they probably need it the most.

Most of the user comments about the SRF-42 have been positive. The National Association of Broadcasters (NAB) also has been impressed with the SRF-42; at its booth at the winter Consumer Electronics Show (CES), NAB provided demonstrations along with the Denon TU-680 NAB home tuner. But as good as the SRF-42, the GE Superadio (re-viewed in **RW** last year), the Denon, and the high-end Carver TX-11b home tuner are in providing the best AM sound available, I can still hear a difference between FM stereo and AM stereo. In repeated comparisons of WMZQ's AM and FM signals on radios I have auditioned, the FM always has tighter bass, a smoother midrange and more high frequency content.

But this is not a knock on the SRF-42. Compared to other portables and most home and car AM tuner sections, it is a 1000 percent improvement in sound! Sony has come up with a product that AM stereo broadcasters can be proud to have their audiences listen to.

For more information, contact Sony at 800-847-SONY; or circle Reader Service 193.



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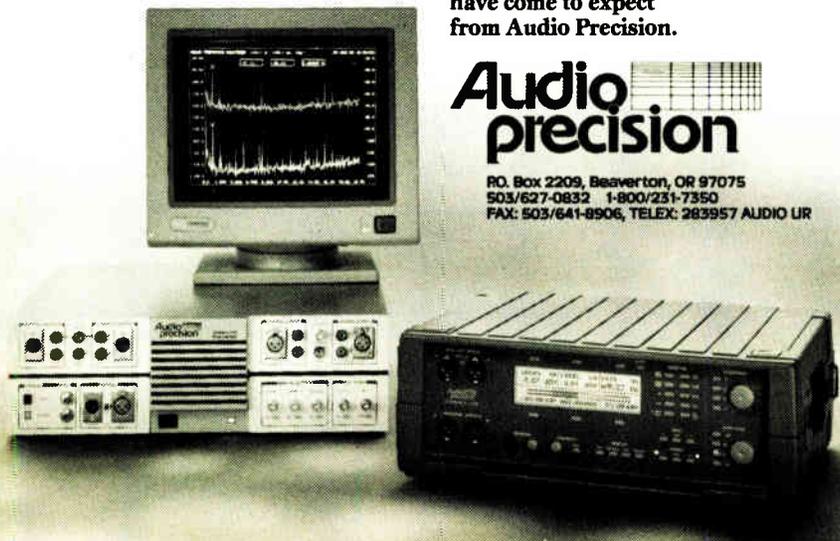
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Abuzz with Good Radio Stories

WASHINGTON Have you noticed that the air seems a little electric these days? It always seems to get that way right before NAB time. News of impending announcements and breakthrough introductions is simmering just below the surface, waiting for that moment when the NAB exhibit floor officially opens.

Fortunately news travels fast and I've got a tidbit or two to help whet your appetite for NAB. Two of radio's big-name companies, Arrakis and Gentner, have formed a strategic alliance that has resulted in the introduction of a new technology protocol and product system.

The protocol, GAP², defines the method of linking telephone technology to hard disk studio systems and will serve as the platform for an entire series of new products from both companies.

If it seems that every other story in the news these days is about the digital "superhighway," perhaps it's because companies on the move these days all seem to be forging an "on-ramp" for themselves. Arrakis' Mike Palmer and Gentner's Russell Gentner view their

Gentner is in booth 2612; Arrakis is just down the aisle at 3912.

★ ★ ★

Last time out I gave you a rundown of the nation's top 13 radio markets. This time out, I thought you'd like to know



CRC's Gonzales, Barret L. Alley, president, and Richard Santiago, general manager.

what the top-billing stations in the U.S. are pulling in and who they are. I turned once again to Broadcast Investment Analysts (BIA) Investing in Radio 1994.

To no one's surprise, WGN(AM) Chicago ranked No. 1 in the country with 1993 revenue of \$41 million; KABC(AM) in Los Angeles ranked No. 2 with \$32 million; WFAN(AM) in New York is third with \$30 million; KLOS-FM and KOST-FM, both in L.A., ranked four and five with \$28 million and \$28 million, respectively; WINS(AM) in New York ranked No. 6 with \$28 million; KGO(AM) in San Francisco ranked seven with \$26 million; WABC(AM) in New York ranked No. 8 with \$25 million; KRTH-FM in Los Angeles ranked No. 9 with \$25 million, and WLTW-FM in New York rounded out the top 10 with \$25 million.

Take note that six of the top 10 are AM stations, and New York and Los Angeles each boast four of the top 10 billers.

★ ★ ★

One of the many great things about the U.S. is its ability to absorb immigrants and turn them into winners. Immigrants turn their hands at many trades, and radio

broadcasting is no exception. The folks at Cadena Radio Centro (CRC) in Los Angeles reach 87 percent of the U.S. Hispanic population with 80 affiliates in 62 cities (roughly 15.5 million people). CRC serves its audience in Spanish.

Recently, CRC was awarded the Golden Mike Award for the best radio network news service from the California Radio and Television News Association. The network received the award for its investigative series on Mexicans who risk their lives crossing the U.S.-Mexico border.

"Routes to the North" was produced by CRC's News Director Antonio Gonzalez and was based on his undercover experience. Gonzalez actually negotiated with a "coyote," (the underground guide and contact for the trek), navigated the sewers of Tijuana, crossed the Tijuana river and entered the U.S. for a \$350 "freedom" fee. He proceeded to adopt an assumed identity, obtained a green card and a social security number for a \$75 fee. Congratulations CRC—I look forward to hearing more from this daring bunch.

★ ★ ★

Much of the information we put in *RW* every two weeks is determined by who are readers are and what they expect from us. *RW* welcomes input from all of you. I'm particularly encouraged by the great response elicited by some of the new things we are doing, particularly in Running Radio and Studio Sessions. Keep the letters coming!

I would like to remind you as well that I'm looking for good articles written by Contract Engineers, based on their experiences. It is estimated that well over half of all radio stations' technical service needs now are provided by outside contract engineers instead of full time or even part

time chief engineers who are employees of the station.

Our bimonthly series devoted to the trials, tribulations, concerns, business practices, case studies, client relations, horror stories, and whatever else is helpful or enlightening to contract radio engineers is picking up steam. I'd like to see it turn into a forum, written by you, for your colleagues.

Remember, topics are wide-ranging, but focus more on the business of contracting rather than the pieces which deal with fixing specific hardware. Such articles also are very welcome, but will appear in John Bisset's *Workbench*.

Participate in this forum by submitting articles, preferably in WordPerfect (via modem or diskette).



Russ Wood was named vice president for marketing and sales for Bonneville International Corp. Wood will assist and support sales efforts at the various Bonneville divisions, coordinating development and implementation of multidivision marketing and sales projects, designing and implementing company-wide sales training, and enhancing communication among the sales departments.

Jeff "Ozzie" Sattler is the new vice president and general manager at Group W's WLLZ(FM) in Detroit. Prior to this, Sattler was GM of KCKI(FM) in Tulsa, Okla.

CBS News' Dick Reeves retired last month after 34 years with the company. Reeves joined CBS in 1960 as a news writer at WCBS(AM) New York and was part of the team that launched that station's all-news format in 1976. Reeves had been anchoring several of the CBS Radio "News-on-the-Hour" segments.



companies' alliance as a vehicle for delivering "the promise of the digital highway to broadcasters today." Said Palmer: "With Gentner's dominance in telephone, and Arrakis' dominance in digital storage and studio equipment, these products will make it easier for broadcasters to choose the right technology path to meet both current and future needs."

Be sure to stop by their respective booths and see what they will be introducing.



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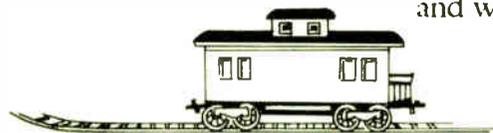
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Fair share

Dear RW,
This letter is in response to the letter to the editor from James B. Wood of Inovonics and the "Readers Forum" item about the Electronic Industries Association's solicitation of funds to defray the costs of digital radio testing (RW, Jan. 12).

What is wrong with asking interested parties to share the costs of digital radio? Radio broadcasters tell us that digital radio technology is critical to radio's future. Yet EIA has to take the lead on testing and scant few dollars have been offered or contributed by broadcasters for any testing other than in-band, on-channel (IBOC) system testing.

Systems proponents, EIA and electronics manufacturers have committed roughly \$1 million on digital radio testing while NAB has committed to split costs with EIA and proponents for IBOC testing. The level of funding budgeted (some \$50,000) pales in comparison to the testing required, especially since over 40 percent of the testing program is to ensure that these new DAR systems will protect existing AM and FM broadcasters from interference.

It's time to step up the financial commitment. For the electronics industry, digital radio will be one of a few exciting products consumers will want. For broadcasters, it will be the only way to compete.

It's time the broadcasters stepped up to the plate so that they can stay in the game.

Gary J. Shapiro, group vice president
Consumer Electronics Group
Electronic Industries Association
Washington

Stern reproof

Dear RW,
The editorial "A Call to Action" (Jan. 26) nearly made me blow out a major

artery. I would expect such content in "Broadcasting," but it amazed me to see it in RW.

Infinity's proposed purchase of stations in Los Angeles and Washington would give them two FMs in L.A. and an AM with two FMs in D.C. Based on recent trends, it's sensible to assume that Infinity plans to create duopolies in both cities.

Duopolies mean engineering, on-air news and support staffs will be chopped. In the real world, this means more unemployment for radio people.

Duopolies and mergers have gutted radio at the expense of quality. It has put a few more dollars into the bank accounts of investors who, for the most part, are so alien to radio that they wouldn't know a cart machine from a salad shooter.

So what if the FCC is shy a commissioner or two or three? Maybe Infinity will be inconvenienced by waiting a few extra months to enhance their revenue stream. The commission is crumbling from a funding and manpower crisis that makes the editorial's concerns seem puny.

The engineer in charge of the Seattle FCC field office was answering the office phone the last time I visited. His office clerk left last year and he wasn't allowed to hire a replacement. They can only take calls a few hours a week to reduce the workload on the few remaining people. Check any FCC field office in the country for a similar story.

Many D.C. staff people are gone too. They haven't been replaced because of a hiring freeze. Now they have been saddled with Cable Act enforcement. The FCC infrastructure is about to pop a hernia.

Nearly all of the important work on issues quoted in the editorial, "DAB, AM band expansion and new RF radiation regulations," is done by staff, not commissioners. Without a competent staff, the commissioners have little to do but debate policy. Let's not decry the shortage of a commissioner or two, let's push for FCC funding.

As to the "outrages to the First Amendment," it's outrageous that the Infinity case has been twisted into a miniature constitutional crisis. Howard Stern's mouth brings in millions of dollars to Infinity's revenue stream.

If Mr. Stern's free speech stopped pulling in megabucks, he'd be canned in a New York minute. In such an unlikely event, Mr. Stern's free speech rights would take a back seat to Infinity's right to profit. That's show biz, sweetheart.

What's this sedition about a corporation's First Amendment rights anyway? Stroll down to the local courthouse and take a look at the names of those who gave their lives to protect this country. How many corporate names are etched into those bronze or granite memorials? Infinity's grand daddy didn't die to defend the American way.

Where is Infinity's support for the Pacifica Foundation stations during their ongoing free speech battles with the FCC? Is free speech less important if it's not done for profit? People who pervert

Just Another Digital Tool

Digital audio data compression (the broad term for what is actually data reduction) is a flourishing topic that can be examined from many angles.

One angle is the broadest view. Radio station operators, afraid of the possible audio damage created by multiple passes of compression, should look at how all other media approach data compression.

TV uses it. Compression is the basis for high definition television, interactive video, 500-channel cable systems and other high-speed video data services of the near future.

Wired and wireless telephone companies, newspaper and book publishers, computer software developers and music recording houses are using compression in some form. Some have been using it for many years.

Compression is nothing more than a form of computer bit manipulation—one of many tools all media will use in the digital era. Questions of whether to use it, or which algorithm to use, will eventually not be important.

In the future, radio stations will compress signals to participate in a digital audio radio (DAR) service. Stations will need compression to transmit several different types of data besides audio when the DAR transition is complete.

As stations in 1994 prepare for that future, the compress-only-when-necessary argument seems a bit extreme. Some station operators do not need it, but will find it does little or nothing to damage their audio and saves them money.

The problems of dueling algorithms and multiple digital/analog conversions may soon right themselves if California Digital Audio's daX, Scientific-Atlanta's SEDAT OSI and single-compression-system approaches almost certainly to be developed for other algorithms are successful.

The safest course of action starts with learning as much as possible about a compression system before making an equipment or service purchase. Then try to stay with that same algorithm in as many applications as possible when compressing more than one link in the broadcast chain.

After all, the best way to take advantage of future technology is to not be afraid of current technology.

—RW

the First Amendment for money deserve to have their tongues ripped out and sold to the highest bidder.

If it takes five years for Infinity or Westinghouse or Gannett to take over a few more stations, what has the public lost? Survey your readers. If trafficking in radio stations doesn't come up as one of their top three reasons for the current lame state of radio, I'll personally kiss Howard Stern anywhere but on that mouth.

Sandra Woodruff
Issaquah, Wash.

time and use its output to feed the air check machine. With a simple capacitor across the mute relay coil (to keep it pulled in for a while longer), the timing can be adjusted to get the recorder to record six seconds before the mic is turned on and then six seconds after it is turned off.

This would be unavailable when the delay is needed for its intended purpose.

Stuart Engelke, chief engineer
WWDJ(AM) Hackensack, N.J.

Kudos to Rowland

Dear RW,
I'm writing to applaud you for running Steve Rowland's Radio Documentary Series. Being a graduate student at Central Michigan University in the broadcasting department and hoping to eventually produce radio documentaries myself, I find this series invaluable.

I hope to see more articles in RW dealing with this aspect of radio production in the future.

Leslie A. Clingman
Mount Pleasant, Mich.

Thanks John

Dear RW,
Thanks to John Diamantis for his article on the allure of vacuum tubes. I'm happy to hear I won't have to throw away my old tube checker after all.

Frank Luepke
KIWA-AM-FM Sheldon, Iowa

Correction:

Burt I. Weiner's name was misspelled in the Feb. 9 "Readers Forum." He can be contacted at 818-409-0185.

Another way

Dear RW,
Regarding the article about quality air checks (RW, Jan. 26), another way to get more of the air signal on the air check tape is to use the profanity delay unit.

Simply feed audio to the unit all the



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—PRINTED IN THE USA—

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Radio World
March 23, 1994

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Radio Withstands L.A. Quake's Fury

Editor's note: The following is Marvin Collins, chief engineer for KFI/KOST in Los Angeles, first hand account/report on the aftermath of the Northridge, California earthquake in January. The quake caused billions of dollars in damage to homes, business—including audio equipment companies—but most radio broadcasters escaped extensive damage.

by Marvin Collins

LOS ANGELES "Wow! What a wake up call that was." I thought to myself as my wife and I were awakened at 4:31 a.m. Monday, January 17. Immediately, I realized a substantial earthquake was in progress.

I told my wife to remain in bed and avoid being injured by falling or broken objects.

I figured the earthquake was not all that bad because we never lost power at my house. Once the shaking stopped and my wife calmed down a little, we ventured out of bed to check for gas leaks, water leaks and to see what had crashed to the floor. We were fortunate to have no major damage—only a few items fell to the floor and even fewer were broken.

On the air

After making sure the house was okay, I took a moment to make sure that KFI and KOST were still on the air. I was relieved that they were. (I learned later that both stations went off the air for a short interval while the emergency generator restored power. The studio location was without commercial power for five hours. The AM transmitter site in La Mirada, 25 miles away, and the FM site on Mt. Wilson, 17 miles away, never lost power. At all three sites, power was never lost during the hundreds of aftershocks in southern California, several dozen of which were in the three to five on the Richter scale.)

After I returned to bed, I continued listening to radio and watching television until after sunrise. The quake soon turned out much worse than I had initially thought. At a magnitude 6.6 on the Richter scale quake, it resulted in some very strong acceleration forces in certain areas of southern California. Watching television showed the enormity of the damage to southern California. In the west San Fernando Valley, major freeways were knocked down.

Radio dependent

For many people, radio (via battery-operated receivers) became the main source of information about their damaged neighborhoods.

Radio broadcasters fared quite well in the quake. Studios suffered with computer terminals on the floor, monitors off the wall, etc., but with one exception all remained on the air or were able to return to the air moments after the shaking stopped. The one exception was KWNK, licensed to Simi Valley with studios in the Fallbrook Mall in the west end of the San Fernando Valley, very close to the epicenter of the Northridge earthquake.

KWNK owner, Manny Cabranes, reported electrical power was lost at the mall for several days. Also power was lost at the KWNK transmitter for 48 hours. Neither location had a backup power source. At the KWNK studio, even after power was restored, inspection of

the mall had to take place. It was three days before KWNK staff received approval from the mall management to enter their studio. Once inside, it was determined that the damage to the studio was mostly cosmetic.

KWNK has an LMA agreement with XETRA and both stations are broadcasting sports programming from the San Diego XETRA studios as well as KWNK studios. With the KWNK studios out of commission, there were large blocks of programming that needed a studio in the Los Angeles area.

For example, sports personality Jim Rome normally does his weekday 11 a.m. to 3 p.m. show from the KWNK studios. Sportscaster Rick Schwartz does a 7 p.m. until midnight show from the KWNK studios. Howard Friedman, the XETRA/KWNK operations manager, called KFI asking if studio space could be used for these shows. With the short notice inherent in an earthquake, a plan was put in place where a small KFI production studio could be used.

Using Switched 56

It was fortunate that KFI recently installed Switched 56 capability. IDB Communications normally provides uplink service for XETRA. The satellite serves as an STL to the XETRA transmitter site near Tijuana, Mexico. The output of the same satellite/STL is normally received at the KWNK studios in the Fallbrook Mall.

It was fortunate that XETRA had program circuits to and from IDB Communications in Culver City, which are normally used for the L.A. Kings hockey games. A Switched 56 connection was made between the KFI production studio and IDB Communications. IDB simply made the appropriate patches and 7.5 kHz bandwidth audio traveled to the XETRA studios in San Diego.

The IFB/mix minus audio was sent from the XETRA studios via the program line

to IDB and then patched into the full duplex switch 56 circuit to the KFI production studio, where Jim Rome and Rick Schwartz monitored pre-delay programming in their earphones.

Thanks to the Switched 56 capability it took all of half an hour to have the KFI production studio turned into an XETRA/KWNK studio. This arrangement continued for nine days until the KWNK studio in the Fallbrook Mall was restored to normal operation.

The KWNK transmitter was able to go back on the air as soon as power was restored. In order to receive programming at the transmitter site, a small satellite dish was borrowed from California Digital. The satellite receiver was removed from the studio and installed at the transmitter site to receive the satellite/STL signal from their San Diego studios.

All-news station KFVB was able to remain on the air and provide earthquake coverage, but it lost the flashing beacon lights on their tower. The earthquake probably caused a failure of the lighting transformer that feeds power to the flashing lights.

Expanded AM-Band Stations Could Be on Air by Summer

by John Gatski

WASHINGTON If the FCC doesn't encounter massive resistance to the new expanded band (1605 kHz-1705 kHz) allocation process, stations may be on the air by summer, according to FCC AM Branch Chief Jim Burtle.

As of mid-February, Burtle said the FCC's computer model is trying to come up with the best allocation scheme that might accommodate about 200 of the nearly 1,000 stations that applied for the expanded band. Some 50 kW daytimer stations have even applied—apparently willing to forgo the big power signals for the ability to get a nighttime signal. The FCC, however, has its eye on full-time stations that generate a lot of interference.

Under Docket 87-267, the "AM improvement" docket, the FCC will implement the expanded band as one method to reduce interference and crowding on the existing band. Successful applicants will be allowed 10 kW daytime and 1 kW nighttime power authorization. The stations also will be encouraged to convert to AM stereo. They will be allowed to simulcast on their original frequency and the new one for up to five years.

Protection contours for the expanded band will include an 800 kilometer co-channel and 200 kilometer first adjacent (except for the stations next to the high frequency stations on the existing band).

Burtle said the FCC is close to having a complete allocation scheme "within a month or two," but not everyone will be happy. The maximum would be 200 stations if we lived in an ideal world," he said, hinting that even fewer stations may be accommodated in the new band without interference.

Burtle said the specific timetable for stations getting construction permits to make necessary technical changes (such as transmitters, duplexers, AM stereo generator, stereo boards, etc.) will depend on how many petitions of reconsideration are filed by stations that are not pleased with either their allocation or their rejection for a slot.

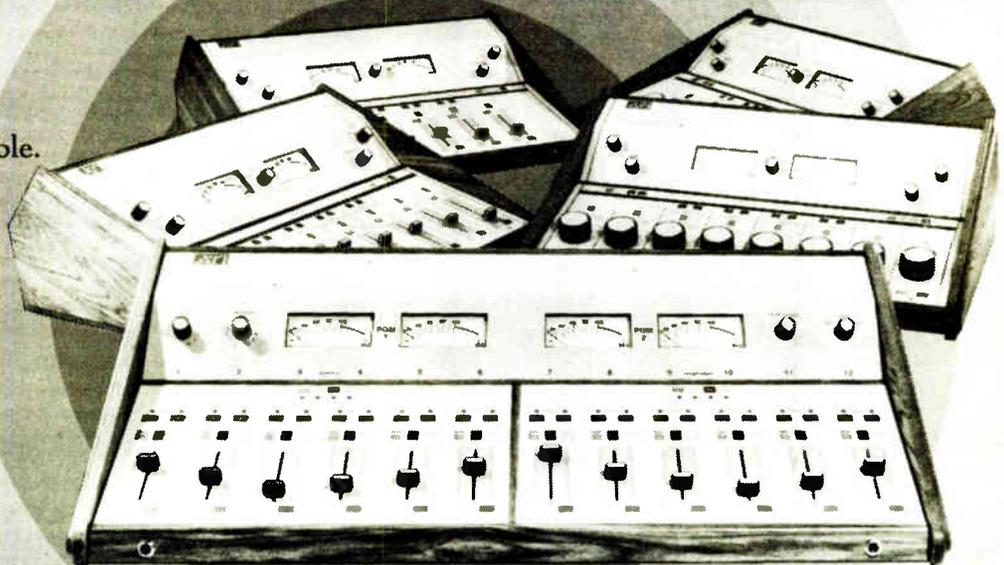
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DBS Digital Audio Expected in 1994

► continued from page 1

develop critical mass quicker. And, secondly, we will be showcased through all the DirecTV venues like Sears, Circuit City and others."

Music Choice will be a beneficiary of a \$120-plus million marketing campaign directed at selling consumers the benefits of video and audio media beamed directly from satellites. In the world's first

deployment of a totally digital television and audio delivery system, Thomson Consumer Electronics, who is building the RCA-brand consumer satellite receivers, has teamed with DirecTV and Hubbard Broadcasting's United States Satellite Broadcasting (USSB), provider of a second DBS service on the same satellites.

The \$1 billion project is the first major competitor to cable televi-

sion in the United States and is the first mass market programming service to ever deliver digital TV pictures and compact disc-quality sound on all channels.

A Hughes-built communications satellite—named DBS-1—was successfully launched from French Guiana on Dec. 17, 1993, on a French-built Ariane rocket. It is the first of two DBS satellites that will beam down the DirecTV

and USSB program services across the United States.

To receive Music Choice and the other programming services consumers must purchase the new Thomson-built RCA-brand DSS digital satellite receiving system, whose basic model is set to go on sale for \$699 in April. The DSS (Digital Satellite System) package consists of an 18-inch user installable satellite

dish, a set-top receiver/decoder and a remote control.

Local dealers

The DSS receiver package and programming services offered by DirecTV and USSB will be offered through RCA consumer electronics dealers, traditional satellite dealers (known in the trade as TVRO dealers) and the National Rural Telecommunications Cooperative, an alliance of 700 telephone and electric systems serving rural and suburban areas in the lower 48 states.

Thomson recently unveiled a large retail display for the RCA DSS system and announced stringent dealer requirements for handling the satellite package.

"A key to successful RCA DSS sales will be the marriage of hardware and software at retail," said Gilbert M. Ravelette, Thomson's vice president of brand management. "The dealer must commit to that philosophy or the effort will not reach its full potential."

Efforts will be made to sell both DirecTV and USSB program packages to purchasers of the hardware. Programming on the two services does not overlap and allows subscribers to customize premium channel selections.

Currently, according to Del Beccaro, DCR has 125,000 subscribers on cable television systems. He would not predict how many subscribers the DirecTV alliance will bring. "It's hard for us to project and DirecTV doesn't say. The analysts are looking for a million to a half million subs in the first year," he said.

After cable television and DBS, Del Beccaro said telephone is the next major distribution outlet for Music Choice. "There are test markets going on and ultimately they will provide digital audio services," he said.

A DCR Coup

As for direct satellite-to-automobile service, Del Beccaro said "the technology still needs to move. It must get better." As for DCR's chief competitor, Digital Music Express (DMX) of Los Angeles, Del Beccaro said the DBS announcement is as "reaffirmation" of his company's leadership. "The fact that Sony and Warner came to us. The fact that DirecTV picked us is a reaffirmation that we are the lead horse from a long term strategic standpoint," he said.

Keno Thomas, DMX's executive vice president of marketing, said his company would "take the high road" in responding to its competitor's announcement. "It would be foolish for me to say we would not have liked to have been part of DirecTV," he said. "But overall this is a good day for the category of digital audio because it will put some heat on the cable side and help the marketplace realize how valuable digital audio can be."

Thomas said DMX is exploring ways other than cable to distribute audio to potential customers.

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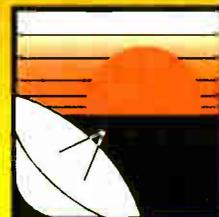
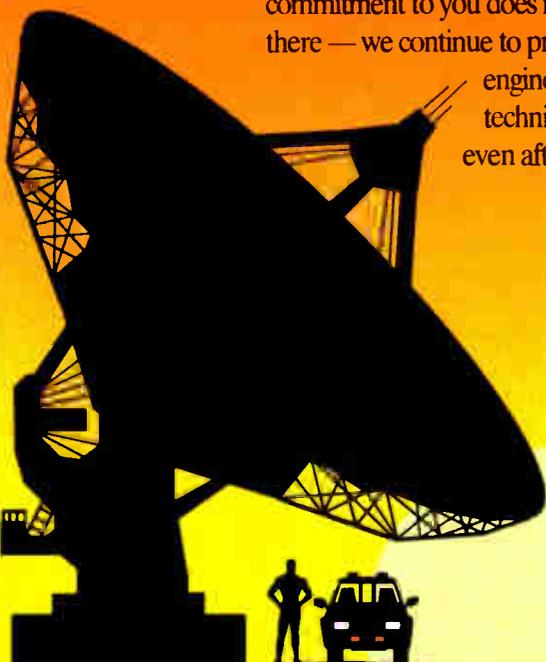
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Mixers with legendary headroom, ultra-low noise and unique features that make using them easier.

Mixers so good that they're regularly used to create major label compact discs, feature movie soundtracks, and more commercial production work than you can shake an RE20 at. For example, our CR-1604 16-channel mic/line mixers are used nightly on the Tonight Show, Arsenio Hall, Conan O'Brian and David Letterman Shows¹.

Our mixers have also covered hundreds of thousands of miles with acts like Peter Gabriel, Madonna, Whitney Houston, Paula Abdul, Bruce Springsteen, Reba McEntyre, Alabama and Michael Jackson¹. Compared to the relative security of a station production room, a six-month world tour is about the most brutal test that any electronic component can go through. Our mixers have a reputation for being bullet-proof on the road — even when loading dock mishaps and power surges have taken out everything else in the same rack.

As for use at broadcast facilities, well, we're not total newcomers. A quick scan of our warranty database shows that over 70 U.S. radio stations already have Mackie mic/line mixers in place.

Does that mean you folks aren't as conservative as everybody says? If so, call your favorite broadcast supply house, or dial us toll-free for complete information on Mackie's line of mixers.

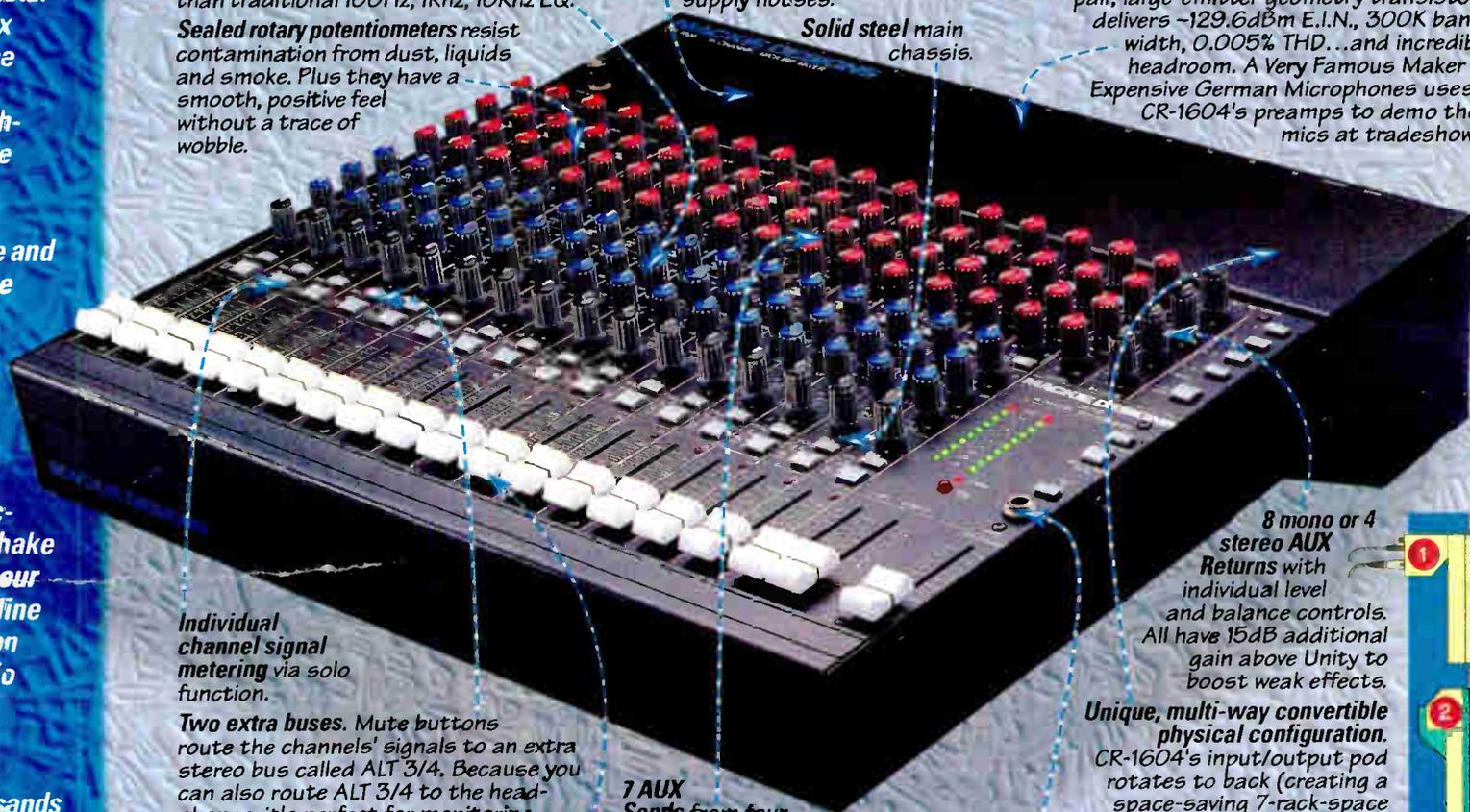
If you are conservative, keep an eye on us, anyway. We want your business even if we have to wait five years.

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The Mackie Designs 16x2 CR-1604 Mic/Line Mixer. Suggested retail price, \$1095². Available at America's top broadcast supply houses.

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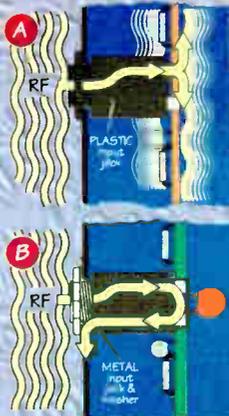


Solid steel main chassis.

Individual channel signal metering via solo function.

Two extra buses. Mute buttons route the channels' signals to an extra stereo bus called ALT 3/4. Because you can also route ALT 3/4 to the headphones, it's perfect for monitoring advance audio cues: Preview a signal that hasn't been brought up in the mix yet...then add it by unmuting the channel.

UnityPlus gain structure gives high headroom and low noise at the same time. Set the fader to center-detent Unity Gain, press channel solo to monitor the channel via the CR-1604's LED meters, adjust the input trim ONCE, and you're ready. Because there's 20dB MORE gain available on the fader, you won't need to constantly re-adjust the trim.



Maximum RF protection. Most compact mixers use plastic jacks that transmit RF to the main circuit board where it's re-radiated and picked up by anything that rectifies (A). The CR-1604 uses metal jacks and washers plus a shunting capacitor to de-rail RF before it gets to any circuit traces (B). A Radio World reviewer tested a CR-1604 on a transmitter hill with 3 VHF TV and 1 FM sticks plus several microwave repeaters and shortwave transmitters. When he plugged in a notoriously RF-prone microphone, he detected NO RF.

Not shown: Inserts on Chs. 1 thru 8, main left/right bus inserts, phantom power switch, balanced/unbalanced main stereo outputs and separate mono output. XLR10 Mic Preamp Expander connects to the CR-1604 pod to provide 10 more preamps complete with trims and phantom power.

7 AUX Sends from four knobs. AUX 1 can be used as an effects send or headphone monitor cue via the MON. Sends 3 & 4 become AUXs 5 & 6 when the SHIFT button is pressed. All sends give you 15dB more gain above Unity so that you can get tons of effect even when the channel fader is pulled down.

Powerful headphone amp (with volume control) drives any phones to head-banging levels even an AOR production person will appreciate.



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8 mono or 4 stereo AUX Returns with individual level and balance controls. All have 15dB additional gain above Unity to boost weak effects.

Unique, multi-way convertible physical configuration. CR-1604's input/output pod rotates to back (creating a space-saving 7-rack-space mixer shown in Fig. 1), or to front (10 rack spaces, shown in Fig. 2) with our optional RotoPod bracket. Use the CR-1604 on a tabletop with jacks on the same plane as the controls via the RotoPod bracket (Fig. 3 below), or jacks to top (Fig. 4 below). Our XLR10 Mic Preamp Expander can also be added in any of these configurations.

Rugged design and construction. Including mil-spec, double-sided, thru-hole-plated fiberglass circuit boards (horizontally-mounted on brass stand-offs for impact-resistance), double-parallel-wired faders for 2-times redundancy, and electronic protection against power surges, impedance mis-matches and static discharges.

Better-than-digital specs and headroom. The CR-1604 has a dynamic range of 108dB and an internal S/N ratio of -116dB (versus compact discs' 96dB dynamic range.) This means you're getting a mixer that can handle the output of digital workstations, CDs and DAT tapes without overload.

¹ Mention in this ad denotes documented usage only. Mention is not intended to infer endorsement by any of the television shows listed.

² Price is slightly higher in Canada.

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Data Reduction Aids Some Stations

► continued from page 1

you are working with digital, live-assist automation equipment, the problem is human error," he said.

Vern Killon, director of engineering for KRVN-AM-FM Lexington, Neb., said he has had "excellent results" with his AC-2 studio-to-transmitter links (STLs) and Digital Compact Cassette (DCC) recorders with ISO/MPEG Layer 1. Killon also receives SEDAT feeds (which he says sometimes have a harsh edge, even after adjustment) and experimented with apt-X equipment, but opted not to purchase it.

From his network vantage point, Bob Donnelly, general manager of ABC Radio's satellite operations, said digital compression artifacts are not a major affiliate concern. "Most of the concern we get from stations has to do with (satellite) signal integrity. I would say those issues are also more in the forefront in Switched 56 and ISDN environments," he said.

Extreme caution

ABC was, however, a sponsor of Herb Squire's dueling algorithm tests (see story, page 35) and Donnelly is among those who believe broadcasters should closely monitor compression distortions.

The relative lack of concern about compression at some stations may be tied to the dwindling numbers of engineers on staff and growing number of managers overseeing technical operations.

Contract engineer Jim Addie of Addie-Tech, LaGrange Park, Ill., said he was working with a station setting up a stereo ISDN remote. "They probably don't know that there is going to be data reduction, and I don't think they care, because if they had to do it any other way than ISDN, they wouldn't do the remote. It's too expensive to do it any other way," he said.

Full-time station engineers, even those who have not had major problems with compression, tend to agree with Donnelly's call for caution.

"I have mixed feelings about compression,"

said Gary Wachter, chief engineer, KFYZ(AM)-KKFR(FM) Phoenix, who receives a SEDAT feed and works with a compressed digital audio workstation, but has not experienced any transcoding algorithms. "If I can do without it, I prefer to,



but in some limited bandwidth areas—telephone communications and STL links—it's a necessary evil at this point."

Duopoly-related

Many broadcasters have little or no compression in their operations, but are planning to install it in the near future.

"Everything is still analog here... We still have a lot of ITC cart machines that just haven't reached the end of their life cycles yet. But within six months or so we might be seeing some changes," said Larry Waggoner, chief engineer at KFH(AM)-KXLK(FM) Wichita, Kan., where SEDAT and a few CD machines are the only traces of the digital age.

But KFH-KXLK are two of four stations set to be sold to a group in the process of establishing a four-station duopoly in Wichita "and we expect they'll be making some changes" once the deal is complete, Waggoner said.

The FCC's new radio ownership rules, which encourage radio market consolidation duopolies and local marketing agreements, are often the trigger for digital equipment purchases.

WRLT(FM)-WRLG(FM) a recently formed duopoly of Class A stations in the

Nashville area, installed a Moseley DSP-6000 STL with apt-X compression to deal with scarce available microwave spectrum. Compressed WRLG signals were needed to form an adequate STL path when WRLG's studios moved in with WRLT. Chief Engineer J. Gibson Prichard said.

The stations also receive SEDAT and MUSICAM satellite feeds and are planning to install an AC-2 program storage system. Prichard has had few problems with the systems, although he said male voices and other low-pitched audio is sometimes damaged, which he attributes to apt-X.

Anti-algorithm

Some stations do not compress their signals at all and have no immediate plans to start, citing both quality or economic reasons.

Herb Squire, chief engineer of classical and jazz programmed WQEW(AM)-WQXR-FM New York, who raised the temperature of the dueling algorithm debate last year, uses only one compressed ISDN link for basketball broadcasting and occasional remotes.

"We're not typical at this point because we don't take a lot of material from outside, and what we do take is mostly on analog phone lines. It's not an issue yet," Squire said. He does not plan to store compressed music because the cost of hard-disk memory is going down fast enough to allow for uncompressed libraries.

"Data reduction should be used when that is the only alternative you have for getting from point A to point B," such as a difficult STL path, he said.

Gordon Carter, chief engineer of commercial classical station WFMT(FM) Chicago, who participated in subjective listening test of compression systems for National Public Radio (see story, page 32), is in a situation similar to Squire's.

"We haven't really found the need for it," Carter said.

continued on page 13 ►



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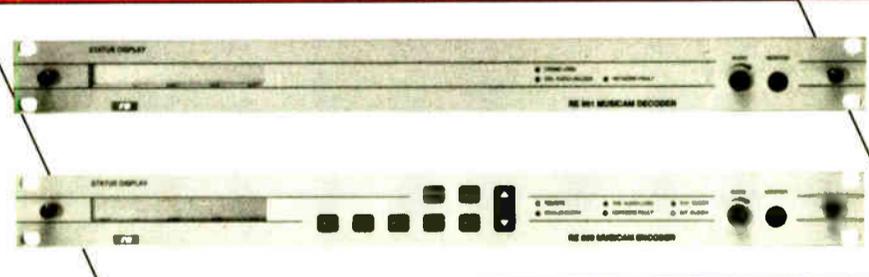


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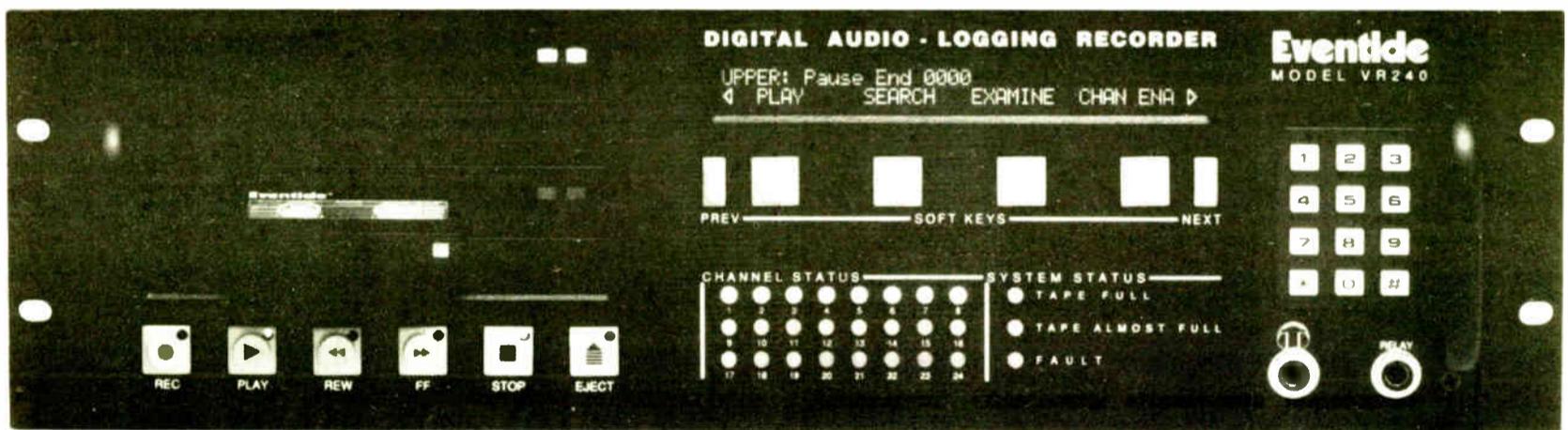
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One-Scheme Approach Viewed Favorably

► continued from page 11

WFMT used a compressed ISDN remote link for a short time, but an advertising client provided the equipment and when the client left all compression ended. The station was also a test facility for Sony's MiniDisk system with ATRAC compression. But the station opted against buying the system because there was little pre-recorded classical music available on MiniDisc.

Reservations

Carter also had reservations about subjecting classical music, with its wide range of volume and pitch levels, to heavy compression. Jazz music was even more adversely affected by compression during the NPR tests, he said.

WRLT-WRLG's alternative rock format is more "forgiving" of compression errors, Prichard said. "You can't tell whether the effects of the compression are something that they were trying to do in the studio when they recorded the album."

The effects are more noticeable during jazz and new age programs the stations air on the weekends, Prichard said.

Regardless of any past experience with compression systems, engineers seem interested in pursuing the idea of one compression system throughout the broadcast chain, as California Digital Audio Systems Inc. (CDAS) is proposing for MUSICAM (see Part I of this report, Feb. 23).

The final decision on DAR should determine the single algorithm in broadcast studios, Tony Masiello, vice president, technical operations, CBS Radio said. CBS supports MUSICAM

through its involvement in the USA Digital in-band, on-channel DAR development. "It will allow a station to stay digital as much as possible—analogue in the microphone and then the next time it's analogue is when it's on somebody's speaker."

Open-ended architecture

"I would like to see a data-reduction system in an open-ended architecture where the actual data transmission doesn't depend on a particular encoding and decoding

process," Addie said. Stations would instead be able to choose their own compression approach and stay with it throughout their operation.

But the single-algorithm approach will not help those stations that have already invested heavily in compression equipment. "I don't think that's a bad argument, but if you're using various manufacturers' pieces of equipment, you can't do that," said KRVN's Killon.

For budgetary reasons, it will be several years before KRVN upgrades to a single-compression-system operation.

□ □ □

RW Associate Editor T. Carter Ross contributed to this report.

RW's In-Depth Audio Compression continues on page 32.

RW Poll Gets Low Response

RW's survey of digital audio compression users in the radio industry was a bust. The Dec. 8 and 22, 1993, and Jan. 12, 1994, "Readers Forum" pages, included invitations to radio station managers and engineers to submit their experiences with compression—setbacks and benefits—as well as their opinions on future applications of compression.

The survey drew only four responses, one of them from an equipment company president, Robert Easton of 360 Systems.

Perhaps Easton's letter explains the low response level. "After delivering thousands of DigiCarts over the years, we haven't received a single phone call from the broadcast industry about the quality of Dolby AC-2 data compression," he said.

In spite of broadcasters' concerns about compression reported elsewhere in this issue, most broadcasters may be fully satisfied with their equipment purchases and found sufficient remedies for whatever compression artifacts they have encountered.

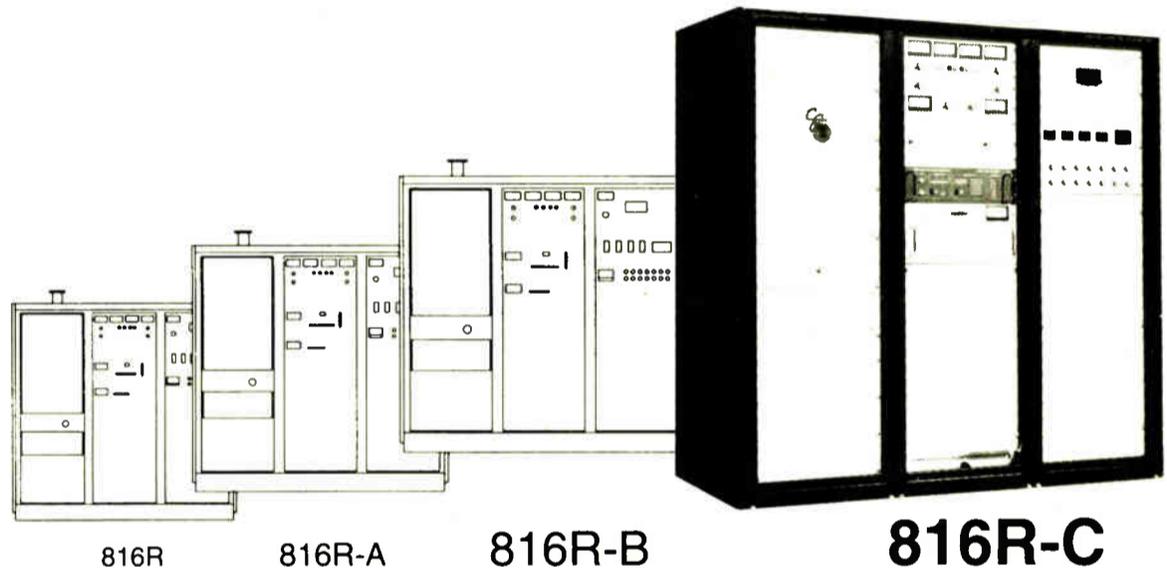
The three engineers that did respond agreed that dueling algorithms are potentially a serious problem.

"I view the problems associated with data reduction systems as very serious since they are likely to become standardized at some point, and we will have to live with them," Jim Addie, an Illinois-based contract engineer, said.

The two station engineers responding, said they would make the same purchases of compression equipment or services if they had it to do over again.

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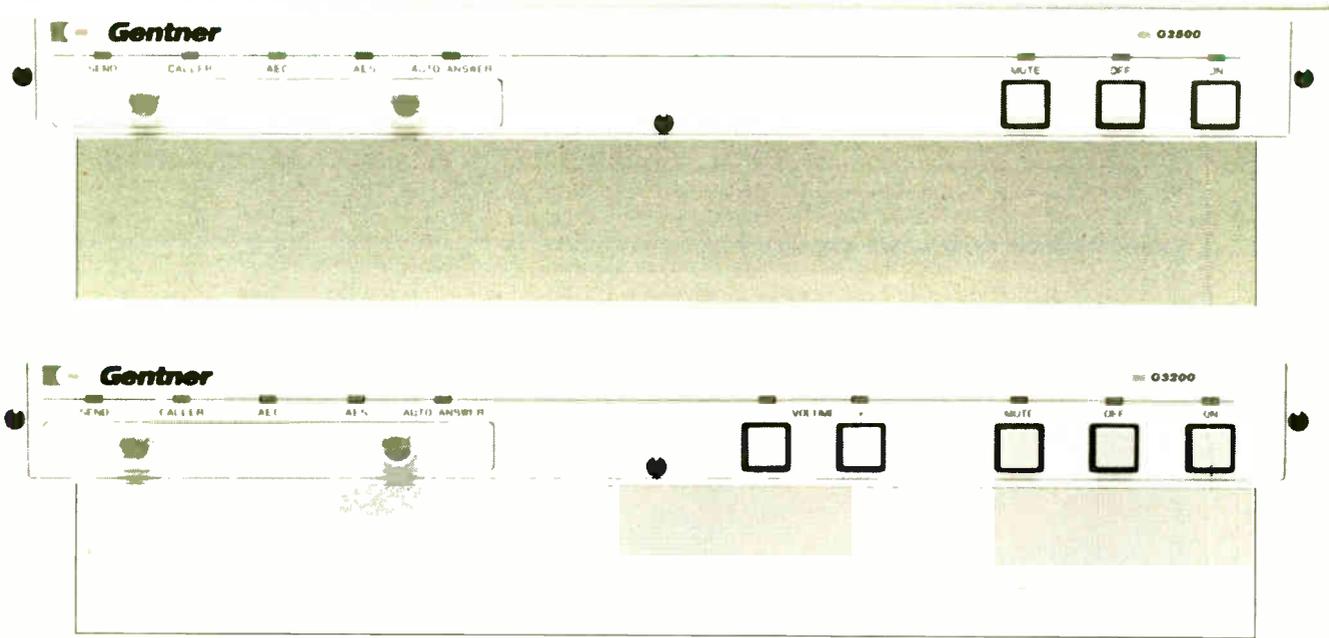
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Running Radio

Assess Your Station's Needs. See **Uplink** page 17

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Generation X Aims at Mainstream Radio

by Charles Taylor

WASHINGTON If R.E.M., The Cure and Soul Asylum are your radio artists of choice, then "X" just might mark the spot for you.

"Radio X," a newly formulated radio for-

market, has been the target of intense examination and deliberation in advertising and retail circles. The faction's interests and beliefs, not to mention its \$125 billion worth of buying power, have been picked, pawed and pondered by everyone from car manufacturers to political parties vying for

to take dominant elements of the target group's preferred music—just left of mainstream—and bring them into the mainstream. This mark would fall somewhere between the youth market's current enchantment with rap, "gangsta" and hip hop, and the late-20s demographic's consolation in Mariah Carey, Jon Secada and (eek!) perhaps even Michael Bolton.

"Generation X is not satisfied with radio today. No one is giving them what they want," insists Cheryl Broz, a consultant with Shane Media and the 29-year-old developer of Radio X. "This is a provocative format with an attitude—a top 40 method with an AOR approach."

Sample hour

A sample hour of the format's catalog might include INXS, The Pretenders, the Psychedelic Furs, Talk Talk, The Cure and Duran Duran—many of the artists that 18-29 year olds developed their musical

leanings with. Broz says these artists are carefully balanced with new acts often heard on traditional modern rock stations such as Beck, Spin Doctors or Nirvana.

"I'm all for supporting these acts, but the key is to be familiar," Broz acknowledges. "Too much new music makes the station sound uncomfortable."

In other words, the music is hip, but not too, the artists on the edge, but with enough mainstream success to have delivered them from college-level popularity.

Roots in modern rock

Such a format is no doubt rooted in modern rock radio, which attempts in most major markets to be the cutting edge outlet. College radio, usually low power, pushes the limits further, serving as the true renegade and often first level of acceptance for many artists.

Radio X draws elements of this brand of radio in its personalities and liners, but makes it agreeable to the middle ground of its age demographic through music that dares to be different from top 40's balladry and rap extremes, but

continued on page 21 ▶



Generation X Consultant Cheryl Broz

mat, hopes to revolutionize the airwaves by appealing to a hip, trendy demographic that marketing gurus label "Generation X."

The group, which generally characterizes streetwise, societally disillusioned 18-29 year olds struggling with a resistant job

the forceful youth vote. And justifiably: the age bracket comprises more than 46 million Americans, according to Advertising Age magazine.

Radio X, offered by developer Shane Media as a CD library and consulting package, aims



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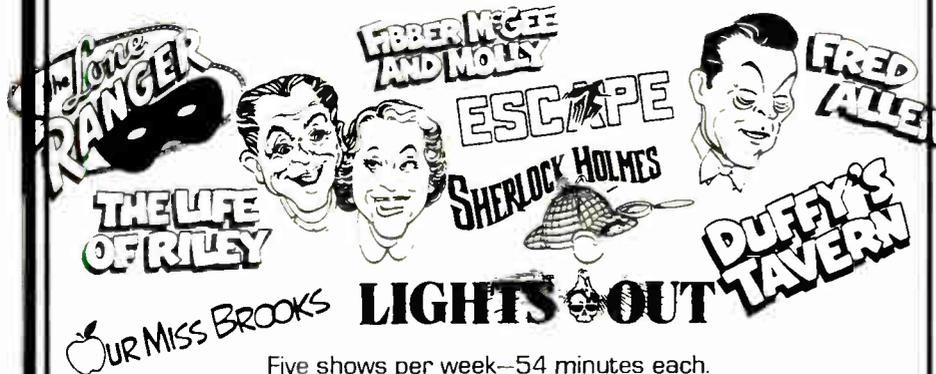
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UPLINK

Assess Your Station's Engineering Realistically

by Karl Baehr

ALBUQUERQUE, N.M. This year, KBE celebrates its tenth anniversary. We've been through many stations during that time, and one thing that continually amazes me is that many operators tend to neglect that which is their very life's blood: the sound of their radio station. It seems that many adopt the "if it ain't broke, don't fix it" attitude and that engineering only becomes important when something is broken. This puts the engineering department pretty far down on the totem pole and always in crisis management.

This time out I have enlisted the assistance of our consulting engineer in Houston, Rick Jones at System One Studio Concepts. In fact, the process we will discuss is the same process we initiated at a client of ours in that area recently.

Following is a list of 10 things you can do right now to improve your station's engineering:

- Assess where your station stands technically. Take a look at your EBS, logs, tower lighting systems, remote control system (particularly if you are using a remote monitoring service), STL, studio and production room equipment and transmitter site.

A great way to get a bearing is to use the FCC self-inspection report. Rick would be glad to get a copy to you and you can call him at 713-946-1946.

- Once you have a gauge as to where you are now, identify the weaknesses. Proceed systematically and schedule what is to be done, do not go about it randomly. Prioritize any modifications or fixes or replacements. Depending on your condition, you may want to improve your processing or add to your studio/production room equipment.

Give yourself time to evaluate your options. Do you want to just order new equipment or put out the word and maybe find a good used piece of gear?

Clean as a whistle

- Clean everything! Don't just polish the knobs and clean the heads. Get out that shop vacuum and get the dust, cobwebs and crud out of all your gear. Piles of dust and dirt help to retain heat and you could be cooking your gear to death. Most electronic gear does not need any help generating heat.

Keep in mind that a majority of problems associated with automated cart/tape systems can be attributed to misalignment and/or calibration.

- On line with my opening comment, sit down with your engineer and set up effective parameters for repair/replacement and budget. Trust his judgment; if you do not for some reason, find someone who's judgment you do trust. Pressure to put on a bandage where surgery may be required will only affect your overall performance negatively. Do not develop a relationship where your engineer is hesitant to tell you what is really needed as he feels you will say "no" if it costs anything.

- When was the last time you visited your transmitter site? Are all the systems out there as efficient as they can be? Remote, STL, phones, ventilation, cleaning? Proper transmitter maintenance

will of course enhance your performance and the longevity of your transmitter, thus minimizing the possibility of catastrophic failure.

new or even used transmitter!

- If you have backup systems, generators, UPS, transmitters, EBS, phone or

should your primary systems fail.

Make sure that every backup system is functioning properly and that your staff know how to engage them beyond fumbling through a manual they may have never read. Which brings us to...

Write the manual

- Together with your engineer, develop a logical, easily understood manual that includes vital functions such as transmitter control, how to shunt to backup systems, who and when to call for help, the whole process, step by step. If I was paid for everytime I got a call in the middle of the night, "...we're off the air,"

continued on page 21 ►

One thing that continues to amaze me is that many operators tend to neglect that which is their very life's blood: the sound of their radio station.

bility of catastrophic failure.

An hour or so here and there for your engineer costs a damn sight less than a

lighting systems, these require regular testing and maintenance too. The purpose for these systems is a safety net

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FOR C.T.
DATE 7/30/93 TIME 10:25
M John Mehron
OF WNUA
PHONE 312/645-9550

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CAME TO SEE YOU	<input type="checkbox"/>	WILL CALL AGAIN	<input type="checkbox"/>
WANTS TO SEE YOU	<input type="checkbox"/>	RUSH	<input type="checkbox"/>
RETURNED YOUR CALL	<input type="checkbox"/>	SPECIAL ATTENTION	<input type="checkbox"/>

MESSAGE Mid-day numbers look great Telemarketing really worked!

SIGNED _____

IMPORTANT MESSAGE

FOR Courtney Thompson
DATE 1/20/93 TIME 1:30
M Dave Kendrick
OF KKSF
PHONE 415/788-2022

TELEPHONED	<input checked="" type="checkbox"/>	PLEASE CALL	<input type="checkbox"/>
CAME TO SEE YOU	<input type="checkbox"/>	WILL CALL AGAIN	<input type="checkbox"/>
WANTS TO SEE YOU	<input type="checkbox"/>	RUSH	<input type="checkbox"/>
RETURNED YOUR CALL	<input type="checkbox"/>	SPECIAL ATTENTION	<input checked="" type="checkbox"/>

MESSAGE Cume up 68% as a result of the cassette box mailer
Call asap!

SIGNED KOF

IMPORTANT MESSAGE

FOR Courtney
DATE 5/12/93 TIME 11:20
M Skip Schmidt
OF KOAI-FM
PHONE 214/691-1075

TELEPHONED	<input checked="" type="checkbox"/>	PLEASE CALL	<input type="checkbox"/>
CAME TO SEE YOU	<input type="checkbox"/>	WILL CALL AGAIN	<input type="checkbox"/>
WANTS TO SEE YOU	<input type="checkbox"/>	RUSH	<input type="checkbox"/>
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TECH TALK

Radio Should Consider Its Role on Info Highway

by Judith Gross

NEW YORK Did you ever feel like this? Driving along at a reasonable speed, you look over to your left and see these humongous trucks and fast foreign cars zipping along in the same direction—only a lot faster.

Then it hits you: you're on the access road when you ought to be on the six-lane. And there isn't an entrance ramp any-

where in sight. That's how radio station owners and managers may begin to feel if all this talk of the information superhighway keeps on.

The question fueling fears these days is: will radio, now 70-something, be left behind in the dust?

No easy answers

There is no easy answer to that question, but it's one the

NAB Board heard something about at a Futures Summit held during its annual legislative forum. Speakers ran the gamut from high tech companies (Microsoft) to advertising (Saatchi & Saatchi), and the Board is to be lauded for at least starting to think about the problems and opportunities of the new world that has suddenly opened up by the marriage of telephone, computer and

program provider.

In part, that marriage has been forced, with decisions like the one allowing the phone companies to get into providing video services. In part, it has been merely forged by new technologies looking for a profit center. But what radio managers need to do is look at what's out there, at how the overall picture is changing and at where they may seize an opportunity or

head off a pitfall while there's still time.

What's out there?

Anybody's list of what technologies radio should be scrutinizing will be somewhat arbitrary at this early stage. My own list includes those which I believe speak the most directly to radio's place in our electronic age.

Data Compression/Multiplexing: We've already had a glimpse of some of its potential in DAB. Spread spectrum techniques also fit in here. The key point here is the possibility of splitting up one signal stream into several simultaneous signals. Also, data compression through phone lines and satellite will extend the reach of a signal or replace "wired," "local" or "in person" methods, such as we've seen in the audio recording industry.

Cable: In the home, radio may have already felt the sting of competition from digital cable radio. Or some stations might have found a new opportunity to be carried as part of a cable service. Now there are plans to offer services like this off satellite.

Direct Satellite: It was a threat when talks of DAB first surfaced, and it has not gone away. It may well become real only after radio has become fully digital from end to end, but the technology is within reach and at some point, a direct from satellite audio service is a likely reality.

Direct Downloads: Radio has been a music pioneer over the last few decades—the first place you could hear a new recording, or hear enough of it to decide to buy it. As hard disks team up with modems, phone lines become digital, and all three become more advanced, there is the possibility of direct downloads of new recordings to the consumer.

Data Transmission: Whether through subcarriers and/or some form of digital multiplexing or a new way of high speed data transmission, broadcasters, with their installed base, are uniquely poised to answer the demand for data transmission. The NAB's John Abel astutely tackled this possibility in his talk at the Futures Summit, and it's one that could play a large role in radio's future.

Interactive Service: Once a signal is digitized, technology has done its job to make interactive service a reality. The rest is up to the receiver manufacturer and the service provider. How about a foolproof way to determine ratings, without the need to write in a diary? Or a voice-

continued on page 48 ►

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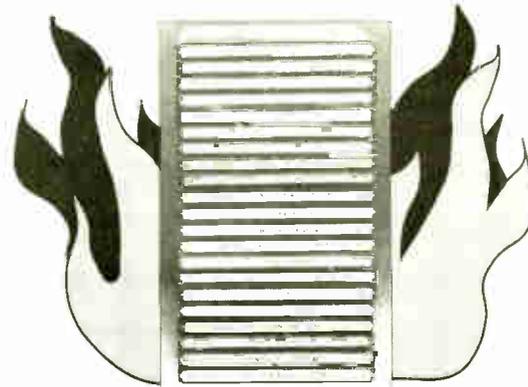
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Reader Service No. 34

Maximize Sales While the Answer is Yes

by Bob Harris

DALLAS I just violated one of my own major rules of salesmanship. It involved Super Bowl XXVIII in Atlanta. Our firm produces incentive travel packages for all major sporting events, like the Super Bowl.

We were hosting about 150 people from companies like Frito Lay, Ore-Ida Foods, Glidden Paint, Neiman-Marcus, Cooper Tools, Texas Commerce Bank, as well as some radio stations.

The Super Bowl has truly become one of the biggest "events" in America. It is so much more than just a football game. The biggest stars of radio, TV, movies, politics, sports, as well as football, are all there.

Forgetting the rule

There are parties and people everywhere, and that's how I broke my sales rule. I have always believed that you should never stop selling when the last thing the client said was "yes."

Just like a radio station, our firm sells packages. The packages include the basics: room, meals, transportation and game ticket. Most radio station packages include the basics. What I failed to do, and I think many radio salespeople fail to do, is sell the extras.

I didn't offer my clients the opportunity to buy more from me. I didn't give the people who had said "yes" to spending money with me the chance to spend more money. I didn't ask for the additional order.

And it would have been very easy. Once they bought our basic package, I could have given them the opportunity to buy optional extras, like the official NFL Tailgate Party. After spending the weekend with my

clients and seeing how much money they spent on other entertainment and gifts, I know I missed the boat by not offering them the chance to buy more from me.

I bet that 80 percent (that old 80-20 rule again) of America's radio salespeople stop selling when the client says "yes." If you've just sold someone and they are in a buying mood, why not ask for some optional extra buy. Why not offer to double their schedule with "overnights" for just 10 percent more? Why not try to add a few dollars with an additional sponsorship?

Care for some fries?

When I sold for KLIF Talk Radio here in Dallas, Sabrina Burks, now sales manager of the station, always used the analogy of fast food restaurants' suggestive selling line, "Do you want fries with that hamburger?" to demonstrate her point.

And to bring that suggestive selling point home, if you watched the Super Bowl you saw a McDonald's commercial telling you to order the "Super Size" Coke and fries for just 39 cents more. Just think how many millions of dollars that will add up to for McDonald's if just one percent of their patrons order the "Super Size."

For radio sales people, I think the rewards can be just as big, but you must be creative. When your clients says "yes" to your proposal, be ready to ask for additional business. Don't revisit the order you just got, but offer an option or two that makes your station even more of a win-win investment.

Certainly every salesperson knows, or should know, that you must "ask for the order." (I always say "ask for the BIG order.") But how many of us ask for the

order after we just got an order? Don't stop selling when they've just said "yes"!

You should go into any sales call (cold, hot or just drop-in) armed with a menu of results-oriented options to present. You certainly don't stop selling when they say "no," do you? The sales process has just begun. So you must have more than one option to present when they say "no" to your first proposal.

By the same token, when they say "yes," bring out your next proposal (that you know will work for the client), and ask for the order again. Even if you are turned down, you have lost nothing. But what if your prospect says "yes." Maybe that

"yes" to that extra order will be enough to put you over your monthly goal.

To be successful in any endeavor, you must go the extra mile, put in the extra time and act like a winner. Keep asking for the order, even after they say "yes," and you're on your way to being a sales winner!

□ □ □

Bob Harris is a sales and marketing consultant to the food manufacturer, food broker and radio industries, and is based in Dallas, Texas.

He can be reached at PSM, 900 East Park Blvd., Suite 130, Plano, TX 75074; telephone: 214-424-9660, or fax: 214-578-7084.

Keep Those Cards and Letters Coming

It was extremely gratifying to hear from so many old and new friends after my first **Radio World** column. When good people you haven't heard from in a long time call, like Joe Vincent, former honcho with the RAB, and Greg Hilton, building a country dynasty in Salt Lake City with KSOP, it really makes one feel good.

And new friends like Tom Lewis, who lives here in Dallas and was kind enough to bring me his copy of **RW** with my first column, before I had even gotten my copy. And Rich Reinhardt, a rookie salesperson with KLYV, Dubuque, Iowa, and Rod Knodel, GM at KCLI, Clinton, Okla., and Donald Sabatke, who created the "Tower of Power" sales promotion that ran on over 500 stations.

Thanks to all of you and the many others who wrote or called. I do want to hear from you; this column is for you, not me. What would you like to hear more about, what's troubling you, what great ideas do you have to share?

Our future column will be devoted to stations that create and use their own newspapers or magazines to get more business, just like Art Suberbielle, owner of KANE, New Iberia, La., does with his superb "Acadiana Lifestyle" monthly newspaper.

If you add revenue with some form of print, I'd like to share your story with **RW** readers. Please contact me at PSM, 900 East Park Blvd., Suite 130, Plano, TX 75074, 214-424-9660; FAX: 214-578-7084.

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Assess Station Needs Realistically

► continued from page 15

what do I do? I can't get the transmitter to come back up." Save yourself some time, prepare a manual and review it with everyone during a staff meeting.

- With regard to maintenance and logging, make sure that equipment and engineering logs are maintained at all sites where equipment is located. These logs should contain all preventive and corrective maintenance records for studio and transmitter equipment. Review

these logs on a regular basis.

- Make sure you have current tech manuals on hand for all the equipment your station owns. These manuals sometimes have a way of "walking off," which is easy to prevent. Inventory all of your manuals. Put an ID sticker on them with a serial number. If the manual is loose-leaf, put individual stickers on each section and note how many pages/inserts are in each section and catalog them accordingly.

Make it clear that your engineer is responsible for those manuals and have an agreement to this effect. Review your library periodically to make sure your manuals are current and all is there. This

is not to create suspicion, but the fact is that without a current tech manual on the piece of equipment being worked on, your engineer may be flying blind. If you lack manuals your engineer feels are important, order them.

- With regards to logging and reporting, establish a protocol for reporting and what is done when discrepancies are found. Require your engineering staff to prepare status reports and a review of the station's engineering every week. Review them with your engineers to maintain timelines and communication.

Set and maintain a regular maintenance schedule with your engineer. Develop a

checklist with your engineer and review it every week. In most cases relatively low-cost maintenance offsets major expenses due to a lack of attention.

The main thing to remember is this: no matter how good your programming is, if your on-air sound is below par, you are restricting your station's overall performance. Next time out, 10 things you can do right now to improve your relationship with your network. Until then...

□ □ □

Karl Baehr is president of KBE "Broadcasting By Design," a radio consulting firm providing support services for satellite radio stations and produces the Actual Radio Measurement (ARM) electronic survey system. He can be reached at 505-828-0488; or fax: 505-821-4226.

Xers Are Target Of Radio

► continued from page 15

accessible all the same.

Such a hybrid capitalizes on top 40's mainline appeal, while discouraging the feeling of listener exclusivity that some feel modern rock fosters.

"A lot of modern rock jocks are talking down on Generation X," Broz says. "On Radio X, the jocks must be real, they must be themselves and they have to relate to the listeners and their music."

The big question, however, is whether or not an audience that already thrives on bucking the mainstream will accept a radio station that purports to deliver to an alternative crowd and yet, ironically, is precise in not straying terribly far from the center line. It's an intriguing paradox.

No doubt Radio X's motive is not to break new ground. It instead aims to capitalize on the brewing of the next major mainstream musical trend—the modern rock movement.

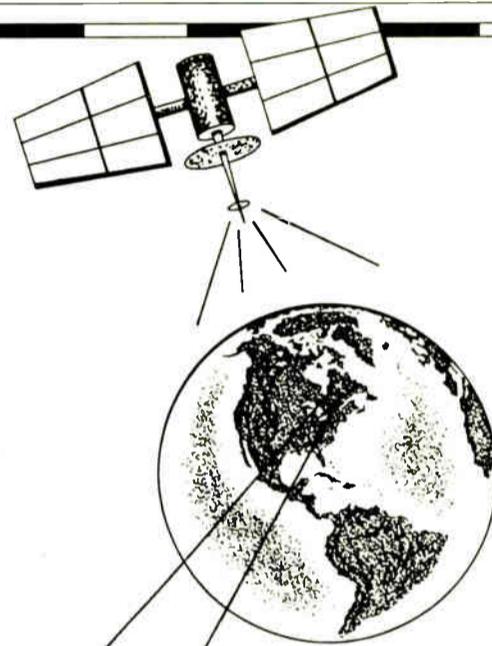
Rap, like any musical fad, from disco to house music, will eventually see its peak. The stronger variables of the genre will entrench themselves into top 40 and other formats in the longer term, and the search for the "next big thing" will ensue. Radio X offers a jump on it.

I've said for some time that modern rock is the ripest category from which tomorrow's CHR radio will shape its playlists. Already, New York's Z100, historically one of the nation's most popular stations, has dramatically changed its direction over the past six or so months—away from the predominant heavy street and urban core that top 40 radio has driven into the ground since the beginning of the decade.

Likewise, 99X in Atlanta, Georgia, long regarded as an innovator in the Southeast, switched from its mainstream moniker of Power 99 a couple years ago to a more progressive sound.

"It's difficult for Generation X people to find their own corner of the stage," Broz says. "This kind of radio can reach them in every market. As long as it's tailored for each market, it can work anywhere."

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March 9, 1994

MANAGER'S NOTEBOOK

Job Descriptions Can Help Management

by Sue Jones

BURKE, Va. Radio Stations employ a small number of people compared with other organizations generating the same amount of business and revenue. The number of staff members could be as few as one but usually does not exceed 50. In organizations this size, everyone knows the reporting structure and his or her basic job responsibilities. So why is it important to even develop position descriptions?

The answer is they are another management tool. Just as satellite delivered programming can be used to change an inefficient period of operation into one more efficient, position descriptions provide the infrastructure to manage the station's operations more efficiently and cost effectively. Taken as a whole, position descriptions are the blueprint of an organization. They define the parts of an organization and detail every part's specifications.

Several advantages

Before you discount position descriptions as a waste of time, after all, "everyone knows what a DJ does," consider these advantages:

- Management's review and analysis of all the organization's position descriptions may uncover overlapping duties.
- Periodic reviews may also identify employee responsibilities that might be more effectively assigned to another position.
- A complete set of position descriptions will assist management in structuring or restructuring the organization, if necessary, for either growth or downsizing.
- They are the basis for determining employee classifications and compensation levels.
- They assist the organization to comply with various federal laws such as the Fair Labor Standards Act that regulates minimum wage, overtime and child labor standards; Equal Pay Act; and Title VII. Position descriptions contain essential information which help determine exempt and non-exempt classifications (determines if you are required to pay overtime), equal pay for equal work, and the existence of artificial employment barriers.
- They can be used to compare position descriptions with other organizations in the broadcast industry for establishing industry standards for salaries and job related duties.
- They help determine and set the pay scale of positions.
- They are essential for recruiting, performance appraisals, organizational structure and analysis of relative worth of jobs in relation to each other.
- Annual Management reviews ensure equity and consistency in personnel policy.
- They can help you avoid penalties, civil suits related to the federal labor laws. Willful violation of those regulations can result in heavy fines or imprisonment of the officers and directors.

Components

With that as a backdrop for all the reasons your station should have them, the next step is to look at what a well written position description should contain. Good position descriptions define the job to be accomplished. Descriptions help individual employees understand what the job

entails and what the station expects of him or her. They encourage high employee productivity. They define the standards to measure the employee's performance against stated objectives and expectations.

A complete position description should include sections that address qualifications for the position. For example, do you want to require your chief engineer to be SBE certified? Perhaps you want the chief engineer to have the SBE certification but you may not require it for the assistant engineer who is subordinate to the chief who will be supervising the assistant's work.

They should include job knowledge requirements. Do you want to require a specific number of years' experience for any of the positions? In some stations, you may have a sales manager with subordinate senior and entry level sales representatives. Do you want your managers to have a minimum number of years' supervisory experience before you hire them?

If you include these specifications in your position descriptions, it eliminates non-qualified people from being selected for the position either from the recruiting process or from unqualified internal hopefuls when a senior position in their career

group becomes vacant.

A well written position description would also include the assigned duties and responsibilities for the position. Do you require your on-air talent to make personal appearances for special promotions? If so, how frequently is it required? Once a month? Twice a month? Will they receive additional compensation for these appearances? This information could be critical in the recruiting process and at performance evaluation time.

Do you require your traffic director to work more than eight-hour days, if necessary, to generate weekend program logs?

More details

Position descriptions should also include information about coordination with other

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PROMO POWER

RUNNING RADIO

March 9, 1994

Whose Voice Represents Your Station?

by Mark Lapidus

WASHINGTON You're eavesdropping on a DJ, answering the request lines. Callers are making song requests; they're also asking questions and making statements about your radio station. Many of these are emotional: "I love your station"... "I want those concert tickets"... "Your new morning guy blows"... "That party you guys put on was incredible"... "Is your night DJ single?"... "The Top 100 was awesome"... "I'd like to run that race you were just talking about."

Your listeners clearly feel they have a

bond with you. Because communication is vital to any good relationship, let's examine the main methods you can use to communicate on-air, including the scheduling, writing and producing of live liners, recorded promos and station IDs/drops.

A lot of work

Lots of hours go into the logistics of contests and activities. Unfortunately, the last element (which is also the most important) is the writing, recording and scheduling of announcements that promote these endeavors. Instead of throwing this vital task to one per-

son, assemble a programming team which could include your promotion director, program director, production director and, for big projects, the general manager.

Brainstorm on unique copy angles. Discuss how frequently announcements should air, when the pre-promote starts, when the main copy airs and how many days to run follow-up announcements. Set the number of live versus recorded spots. Finally, assign tasks and deadline dates.

You would never put a stack of commercials in the control room and tell your DJs just to rotate them evenly. Yet many stations still do this with their own promotional announcements without pondering which are the most important. Devise a system that allows you to schedule announcements easily and how

station might look: :00-recorded top of hour ID; :10-recorded station drop; :20-recorded promo; :30-live liner stop set; :35-recorded station drop out of stop set; :45-live liner into stop set and at :50-recorded station drop out of stop set.

In this scenario, you'd make sure that the live liner and recorded promo contained totally different information. Another common approach is to air recorded promos first in stop sets. This is fine as long as live liners are not read directly into them—it's too confusing.

Live liners

These announcements are read live by your DJs. These may be written in outline form so that the announcers totally ad-lib them. However, if you have any DJs (particularly part-timers) who are not good at ad-libbing, an outline form presents problems. I prefer full copy. Those with a talent for ad-libbing will have no problem doing so with a complete script.

Effective liners are shorter than twenty

Assemble a "promo" programming team which could include your promotion director, program director, production director and, for big projects, the general manager.

many to air each hour. Most music scheduling computer programs allow you to do this right on the DJ's music log.

If it's more convenient, log them manually page by page on either the music or commercial log, or invent a separate hot clock. Assign a letter or number to each announcement. This designation goes on the announcement and the log. The toughest problem to tackle is how many to air each hour; this depends on your format and number of stop sets. You may even wish to vary this according to daypart.

Here's how a midday hour for an AOR

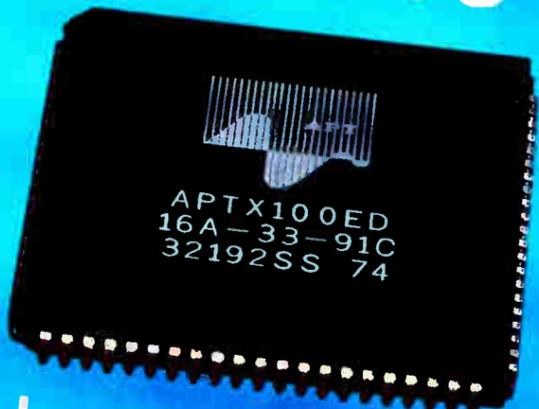
seconds without too much detail. If necessary, write several liners about the same subject, stressing a different detail each time. With music formats where DJs commonly talk over song intros such as oldies, country, CHR or AC, these can be read over the intro of songs, cutting down on the clutter that a listener may perceive.

Recorded promos

Hopefully, you've selected one voice for your station. While there are certain promos that require one of your regular DJs, the best approach is to utilize

continued on page 27 ▶

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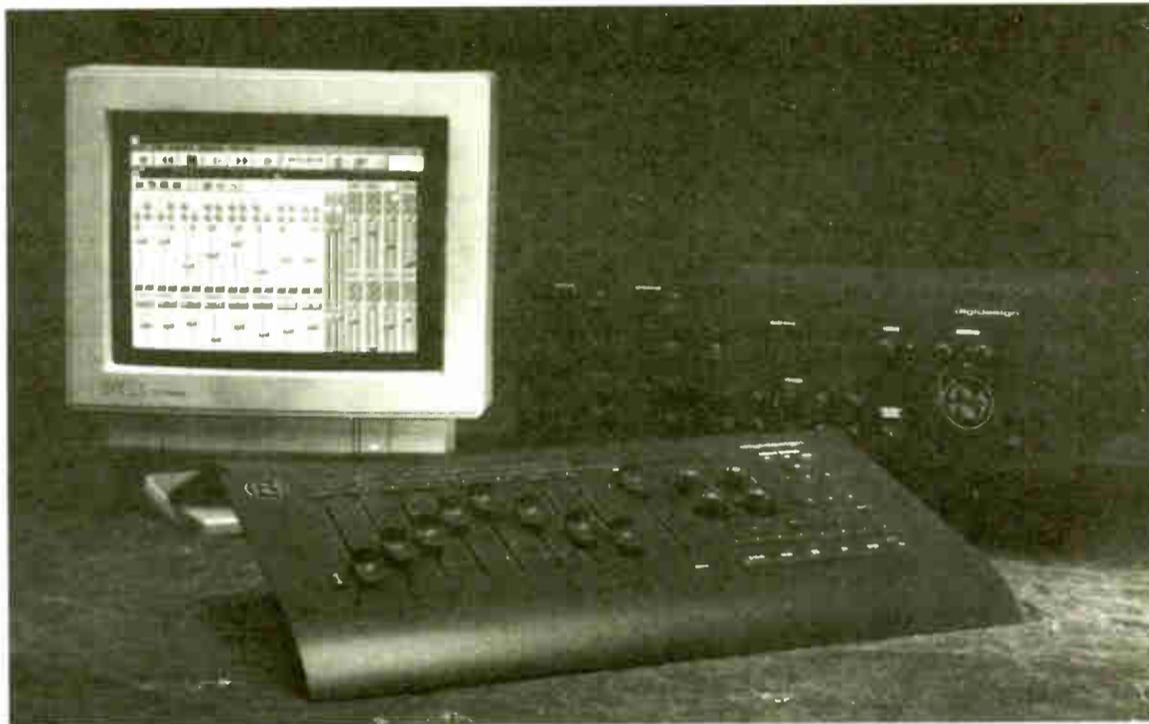
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INSIGHT ON RULES

Computer Models Weighed for AM DAs

by Harold Hallikainen

SAN LUIS OBISPO, Calif. The FCC began a reexamination of its AM directional antenna performance verifications rules and policies in June 1993.

The petitioners for the rule change—consulting engineers duTreil, Lundin & Rackley; Hatfield & Dawson; Suffa & Cavell, and Silliman & Silliman—say modern computer models give a more accurate analysis of the radiation pattern by using recently developed modeling techniques (such as NEC and MININEC) than the current field strength analysis methods.

Also, because many AM arrays are now located in urban and suburban areas where measurement of array patterns is difficult and expensive, computer modeling is considerably less expensive than sending people out with field strength meters.

Computer modeling may result in a more accurate representation of the actual radiated pattern.

With arrays that are simple to model (series-fed uniform cross-section towers on level ground) and accurate sampling systems, it's possible to adjust the array to calculated parameters and walk away. Of course, the accuracy of the sampling system is critical.

Two samples

Ben Dawson of Hatfield and Dawson says it might be interesting to measure each tower's feed in two different ways, with a loop on the tower and a base current sampling transformer. Another "two-sample" approach might be to sample both the base current and voltage.

I can imagine a Delta TCT sampling transformer with two outputs, one for current, the other for voltage. You would then run two sample lines back to the antenna monitor. If everything is calibrated properly, you could directly mea-

sure the base voltage, current and the phase angle between the two. From these measurements, power and driving point impedance could be easily calculated.

If the model has correctly determined the tower driving point impedances, it should be possible to build a directional array using calculated inductor and capacitor values. You would set up each component with a bridge, turn on the transmitter and see the array parameters (current and voltage magnitude and phase) come up very close to that predicted—no more field strength readings.

Is this a good thing? It certainly looks like it would save money for stations if they have a good sampling system.

Proponents say computer modeling results in a more accurate representation of the actual radiated pattern than doing field strength measurements along the ground. Our existing FS measurement techniques suffer inaccuracies due to the closeness to the ground (E and H field do not have their free space relationship), local reradiation (typically from overhead power wiring) and terrain variations.

A more accurate method of determining the actual field pattern could decrease interference as arrays are adjusted to truly radiate properly.

For more complex arrays (shunt-fed, folded unipole, nonlevel ground, self-supporting towers) that are more difficult to model, the existing FS measurement techniques may still be more accurate. The proponents are, therefore, suggesting the change for easy-to-model arrays only.

But when FS measurements are required, they suggest fewer than the current rules require. Five to 10 good points are sufficient; the rest of the points on a radial just verify what is already known, they say.

Proposing rules

Proponents say the field strength measurement requirement should be made optional when an accurate model of the array can be generated. Those who wish to continue using the existing techniques (whether a good model can be generated or not) would be free to do so.

Those arguing against the proposal dis-

pute the accuracy of prediction techniques and question whether they will insure that interference levels do not increase. If the FCC does accept the proposal, it will have to put various limitations on the type of arrays to be modeled and require very good documentation of the sampling system.

The FCC is also looking at how other structures in the vicinity of the array should be factored into the measurements. Dawson suggests that reradiators more than one wavelength away from the array and less than 45 degrees tall have a minimal effect on the far field and could be omitted from the model.

It may be possible to be a little loose with the model because the field variations would be far less than variations caused by propagation changes, such as skywave.

Reply comments in the initial inquiry have been submitted and it remains to be seen whether the commission will take the next step and propose a rule change. It would be quite a departure from the way directional antenna systems have been analyzed for over 50 years.

□□□

Harold Hallikainen is president of Hallikainen and Friends, a manufacturer of transmitter control and telemetry systems. He also teaches electronics at Cuesta College, San Luis Obispo, Calif. He can be reached at 805-541-0200, or on Internet at ap621@cleveland.freenet.edu.

Selecting the Right Voice For Your Station's Local Image

► continued from page 24

somebody who is not heard regularly on-air or in commercials. Your listeners will be conditioned to know when they hear that voice, they're about to learn something fun about your station. Ideally, this same voice is used in your station IDs/drops.

If you can't afford to hire a "big" local voice, consider contracting a national talent; you can fax them copy and have tapes overnighted back to you. Many owners and general managers are uncomfortable about the expense because they feel a DJ can do the job, but this local approach can make promos sound unimportant. As with live liners, the biggest challenge is writing.

Find the best writer on your staff and work with him or her regularly. You may wish to create a small pool of people to examine copy and voice opinions. It may take some time for your copywriter to develop a tough skin, but after a while he will appreciate the assistance.

The right exposure

To prevent overexposure of recorded promos, rotate several different versions or update them daily. Save recorded elements for later use, cataloging them as you go. This will save

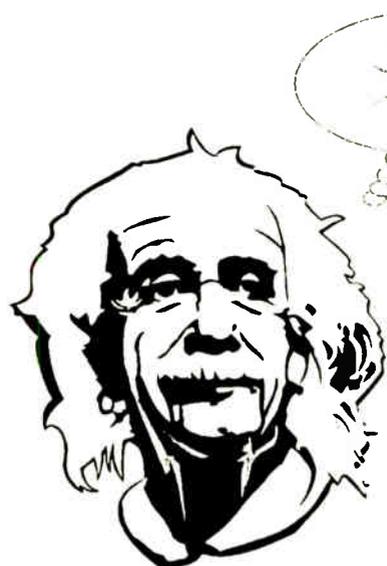
time and money, as stations have a tendency to repeat many of the same events and contests.

It seems amazing that recorded announcements shorter than ten seconds set the stage for much of your identity, but when done properly, these truly make the magic of radio. Your slogan belongs here with great music, sound bite or effect. While individual sound bites might need changing on a regular basis, most of these should air for long periods of time so that people identify them with you.

Reality check—Most of this material is elementary and that's precisely what makes it so important. Even if you're already doing most of the above, try putting yourself to this test: Record two hours of promos/liners/IDs/drops off-air, editing out all music and talk. Listen to this tape without interruption. If you're entertained and emotionally involved with what you hear, take the rest of the day off. If not, plan on working this weekend!

□□□

Mark Lapidus has worked in radio for more than twenty years as a DJ, program director and promotion director in Ohio, West Virginia, North Carolina, Texas and most recently Washington.



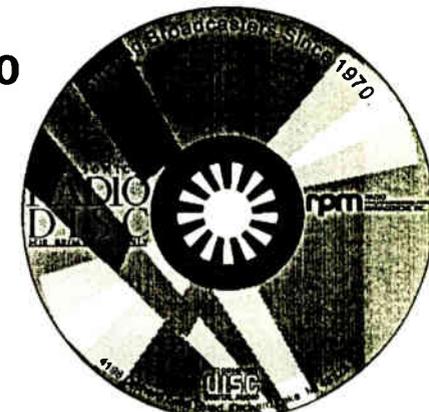
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Switch Placement Requires Planning

by James R. Murphy

MORGANTOWN, W.Va. Nearly all radio stations have a plethora of switches for performing normal, day-to-day functions.

Switches are mounted on panels, housed in mini-boxes stuck to the side of a cabinet or case and a few even end up hanging by their own wiring. These pushbutton farms are often in close proximity to the studio console and are as

apparent that I needed a rack panel two spaces high, with 14 switches.

On top of that, I would have to duplicate the same panel in two other studios. This meant I would need 42 panel cutouts, not to mention the wiring involved, a lot of work.

An easier way

I am a rather lazy person with absolutely no desire to drill and file 42 holes in aluminum. I immediately set out to find an easier way.

A few scratchpad sheets later, I came up with what I call my "function execute" switch. Although there is some circuitry required, there are only two switches—a thumb-wheel and a momentary pushbutton—at each location.

The switchbox can easily be mounted on a one-inch-by-six-inch panel in a console, or in a minibox of similar dimensions. All you need then are the six conductors connected

to a central location housing the actual switching relays, and the system is ready for you to control up to 16 functions.

(By the way, this is an excellent project for the young apprentice engineer or operator, or for anyone wanting to brush

up on digital logic. I include some basic language to assist those not fully grounded in digital electronics.)

As in most designs, there are many ways of accomplishing a given task. The design chosen here is based on cost and availability of parts. For instance, a tri-state buffer could have been used just as easily, but a more common, thus more

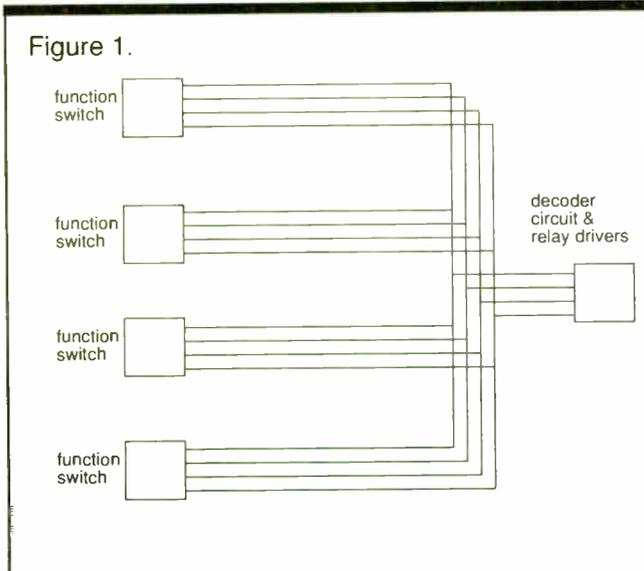
readily available chip was used.

I always try to use parts that are available as "equivalents." My only exception here is the thumbwheel, which is available through most mail order supply houses.

As many as you want

Figure 1 shows the basic flowchart. Although only four switch modules are shown, many more may be paralleled into the central decoder and relay driver. A big

continued on page 30 ▶



attractive as the electric box in Herman Munster's basement.

When I completed a recent studio installation, I began laying out the panel space for the various switches. After much drawing and measuring, it became

Writing a Job Description

▶ continued from page 23

work groups in the station and management. As the general manager, do you want to be notified if the station is off the air at 2:00 a.m. or will notification later that morning during business hours be sufficient?

Another essential item includes reporting requirements. Whose responsibility is it to notify you when the station is off the air? The DJ can tell you that you are off the air but may not have a clue why. Your engineer could tell you why and give you an estimate of the time that will be required to correct the problem. Having these reporting requirements clearly defined in advance can save valuable decision making time during such a critical period.

Do you require weekly and or monthly reports from the department heads. How many positions report to the department head. These requirements should be listed on the department heads' position descriptions. These additional duties compared with the subordinate staff justify higher salaries for the department heads.

Another area that should be specified in the position description is special working conditions. Will you require your sales representatives to use their own vehicles and gas when they are making client calls? Will you compensate them for mileage and/or gas? Do you provide special vehicles for any positions such as 4-wheel drives for the engineer? Will you expect the engineer to pick up other staff members on inclement weather days if they are unable to get to the station with their own transportation?

Do you provide a promotional vehicle

for the DJs to use during personal appearances? Will you expect them to transport promotional gear and sound reinforcement equipment in their own car?

In addition to the basic sections, position descriptions should all be in the same format making management review of them simpler. The person responsible for developing them should follow the same guidelines for developing them. If you do not have position descriptions, you could have each staff member assist by writing his or her daily responsibilities. Your department heads could complete them using the same format.

The final review and approval could be the general manager and/or owner. When the task is complete, the position descriptions should provide a balanced and integrated picture of the organization. They should be reviewed annually and updated, as necessary.

If your station is expanding, it will be much easier to describe a new position. If you are downsizing, position descriptions will be valuable in assessing the work load of other positions and splitting one position's responsibilities among others.

Position descriptions play a vital role in your station from recruiting to daily work to performance evaluation. They provide internal structure that promotes fair compensation and defines expectations. They can be one of your most valuable management tools in running your station.

□ □ □

Sue Jones is a Senior Manager for Computer Data Systems Inc. in Rockville, MD. She can be reached at 703-323-0491.

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Which Switch and Where?

► continued from page 28

advantage to this system is that all functions can be activated from all locations.

The switch assembly is shown in Figure 2. This unit's thumbwheel switch selects a binary address. For example, with the thumbwheel on "0," all outposts of the switch are high, and are inverted by IC1. The analog switch, IC2, is open, so the four data outputs are isolated from the lines.

Placing the thumbwheel switch on "7" would place a binary 7 to the input of IC2. If you are learning binary or BCD logic, a logic probe check at A(1) would be HI, B(2) would be HI, C(4) would be HI, and D(8) would be LO (1 + 2 + 4 + 0

= 7).

The data lines are in the high impedance state until the execute switch (SW2) is pressed momentarily. This puts a LO on the EXECUTE line as well as pin 1 of IC1. Pin 2 goes HI, enabling (closing) the analog switch.

The addresses you have selected on the thumbwheel are now placed on data lines A, B, C and D. This address will remain on as long as you keep the switch pressed.

Incidentally, diode D1 allows for the LO to pass to the EXECUTE line, but prevents other switches from enabling the analog switch on this unit.

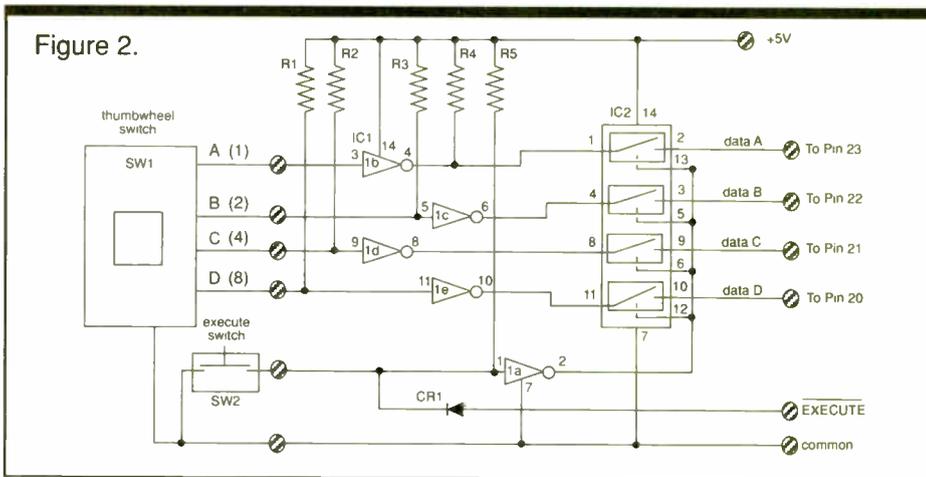
The heart of this unit is the 74154 demultiplexer (shown in Figure 3) which takes a four-bit address and, when enabled at the G2 terminal by the (active LO) EXECUTE line, places any data that might be on G1 to the decoded address 0

0 (Pin 1). This is simply because I wanted to have a not-used channel position. You could easily use output 0 by connecting the proper relay driver assembly.

Because the selected output of IC3 goes LO, and to save some cost, I used a PNP

can mount these boards almost anywhere.

I attached my perf-board vertically beneath a channel module on our console, cut the holes for the two switches and the installation turned out looking



transistor, connected to the high side, as the relay driver. The LO output turns the

"factory."

For the decoder and relay driver, I used a 3.5-inch rack panel with a rather large (3 x 10 x 13) chassis mounted to it to hold the electronics, relays and a small 5 V power supply. I mounted the relays on the same board as the 75154.

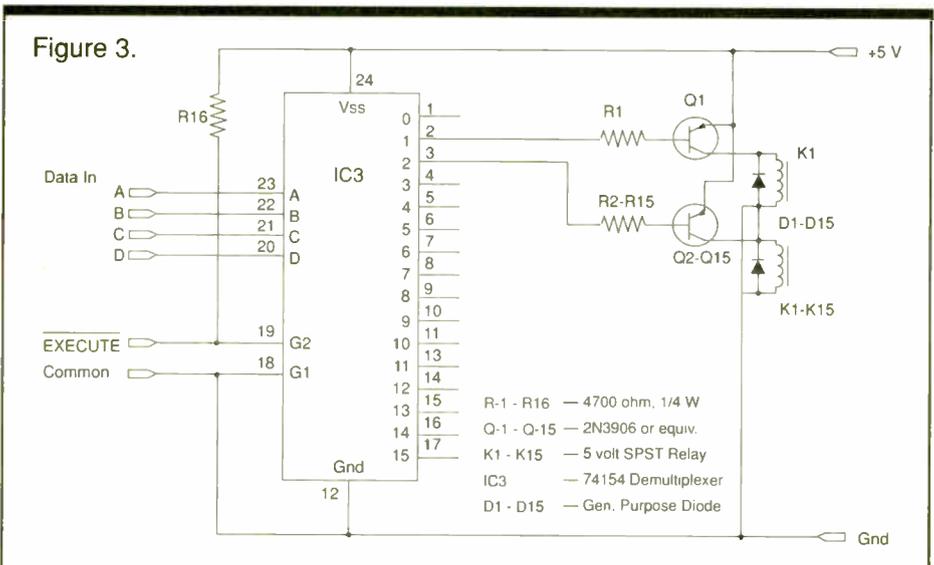
The four data lines, the switch and the common, along with the 30 contacts from the 15 relays, are brought out to terminal strips on the back.

Be sure to have properly-sized wire for the data and control lines. AWG 22 or 24 should work fine, unless the runs are unusually long. If you do have long runs, adjust the 74154 logic to within TTL levels—less than 1 V for LO, above 3.5 V for HI.

With this system, you can start and stop tape recordings from any studio. Satellite channels can be changed, and the console channel starts can be activated. The list can go on and on, from automation commands, to the setting of clocks and placing studios on the air.

□ □ □

James R. Murphy is director of engineering for West Virginia Radio Corp., Morgantown, W.Va. He can be reached at 304-296-0029; or fax: 304-296-3876.



through 15. I have strapped my "data" to this pin at LO, so it always delivers a LO to the selected output address.

Remember, the highest you can count with a four-bit number is 16. If you count zero as a number, the highest number is 15.

I have not connected anything to output

transistor on, pulling the collector to the positive rail of the power supply, energizing the relay.

Construction

I built the switch circuits using small perf-boards, about two inches by three inches, and point-to-point wiring. You

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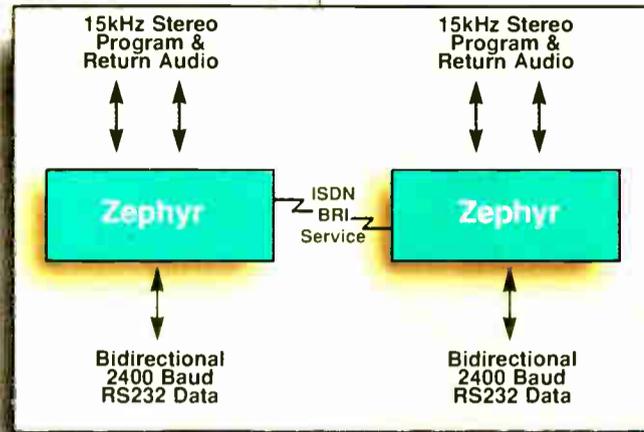
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NPR Picks MUSICAM for Satellite Network

National Public Radio (NPR) announced last month that ISO/MPEG Layer II (MUSICAM) will be the compression system transmitted over its newly redesigned Public Radio Satellite System (PRSS).

NPR's analog C-band satellite program distribution technology, which is currently installed in about 350 non-commercial radio stations in the U.S. and Puerto Rico, has been in place since the late 1970s. NPR has been distributing programming over two transponders on Galaxy IV since last year.

Transponder capacity will be markedly

increased by June 1995, when the compressed digital PRSS is scheduled to be completed. (The conversion is to be done in stages beginning in December 1994).

The new system's main components are to be the ABR700 MUSICAM satellite receiver from ComStream Corp., San Diego, which was specially designed for the NPR project (3,000 units have been ordered), and an IBM-developed automated network feed system, or what NPR calls Satellite Operation Support System (SOSS).

NPR reached the decision to use

MUSICAM after a long evaluation process. It published a call for bids for a digital encoding system in 1990 and replies were received from vendors offering MUSICAM, Dolby's AC-2 and Scientific-Atlanta's SEDAT.

"We promised our affiliates that we would be careful to choose an audio coding system that was equal to or better than our analog signals," said Burnham Morse, NPR's PRSS project director. At the same time, NPR wanted to be able to multiplex significantly more programming per transponder.

A series of subjective listening tests

were organized in NPR's behalf by consultant and author Skip Pizzi. Rather than a double-blind test structure, with each encoding system compared to the other competing systems, NPR opted to compare each system to the existing analog only.

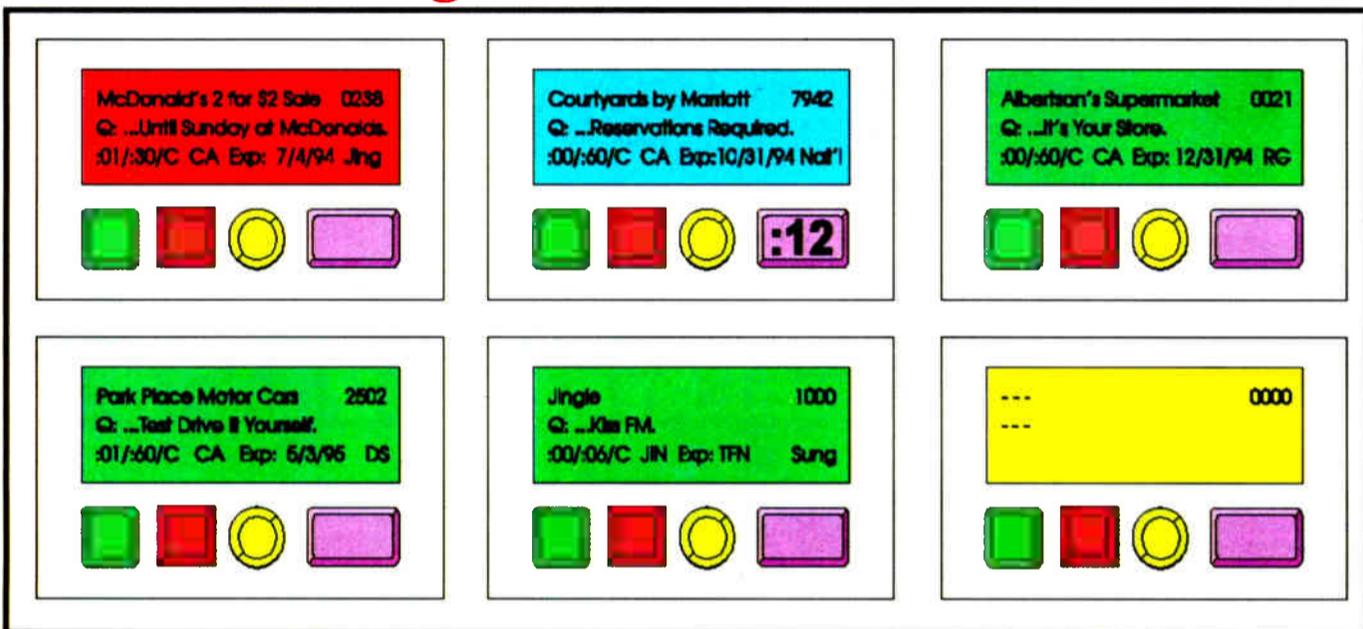
"All the systems offered to us exceeded our expectations and exceeded the sound and the feel of the analog system," Morse said. ComStream's MUSICAM system was chosen for its price and product availability, and not because its audio quality outperformed SEDAT or AC-2, she said.

"Generally speaking, the digital systems beat the analog, but when we went through multiple iterations of the coding, we started getting some problems. It really can start to get pretty bad," said Gordon Carter, chief engineer, WFMT(FM) Chicago, who was on the test panel.

The test group tried to piece together different coding/decoding scenarios, including all the compression passes likely to be used when digital audio radio transmission begins. Scenarios of up to eight compression passes were tested, sometimes with the same compression system and sometimes mixing them.

"It was somewhat program-dependent, but (degradation after eight passes) was

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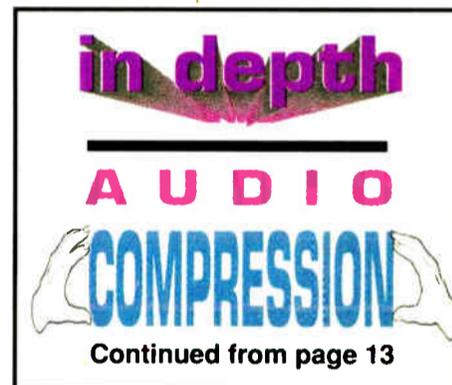
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Continued from page 13

quite severe to the point where the digital systems were unacceptable while the analog was moderately passable," Carter said. "The digital algorithms appeared to be actually chopping holes in the programming."

NPR has been aware and concerned about potential dueling-algorithm artifacts since the tests and advises its affiliates to use compression sparingly, Morse said. Plans for NPR's own studios (which are currently being moved and rebuilt in a new Washington location near Capitol Hill) do not include a compressed automated storage and playback system, she said.

(The IBM SOSS system will handle signal switching only and will not be involved in program playback or any other application requiring compression.)

Whatever dueling algorithm problems may arise at NPR are likely to come from outside productions. NPR keeps several different playback and record devices to accommodate the several tape and disk formats program producers use, Morse said.

If compression algorithm artifacts still prove to be a problem in the future, the ComStream system has been designed to convert to uncompressed AES/EBU digital audio or to analog. "We specified that early on, that any products had to have that option," Morse said.



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Compression Systems Are Gaining a Foothold

Predictions of broadcast technology trends are always problematical and predicting the future of a technology moving as rapidly as data compression is probably foolhardy.

But so far, it is safe to say that a number of audio compression systems have earned a long-term foothold in the U.S. marketplace, including ISO/MPEG Layers I and II (MUSICAM), Dolby's AC-3, Audio Processing Technology's apt-X and Scientific-Atlanta's SEDAT.

Two other systems that are not yet widely used but appear to have growth potential are ISO/MPEG Layer III and AT&T's PAC.

The most interesting marketplace competition will be among the systems that could potentially be marketed as universal algorithms, capable of handling most or all the compression needs in the broadcast chain, right up to the listener once digital audio radio (DAR) service begins.

Already there are those who propose

single-algorithm operation with MUSICAM. But each individual compression system has its high and low points—none can claim to be the best algorithm for all applications.

Some insight into the future of compression can possibly be gleaned from a closer look at the leading compression systems—when and why they were developed, as well as their current level of development.

ISO/MPEG

If broadcasters gravitate toward a single encoding system as a de facto standard for all broadcast operations, the International Standards Organization/Moving Picture Expert Group (ISO/MPEG) standards have the early natural advantage.

ISO/MPEG Layers I, II and III are a combination of technologies developed by several European laboratories (see Figure 1).

Separate development projects through-

out the 1980s resulted in two leading encoding systems, MUSICAM and ASPEC. MUSICAM became the basis for Layers I and II in 1989, after going through an ISO/MPEG process that sought to create a standard that would do for the digital audio world what DOS did for personal computing.

Layer II is the most famous and widely used MPEG system today, with several companies licensed to build it into studio, RF, cable and satellite equipment as well as integrated service data networks (ISDN). It is also proposed for digital audio broadcast transmission and audio-for-video applications. Layer II must operate at 192-256 kilobits per second (kbps) to maintain audio quality.

Layer I is a simplified version of Layer II that operates at about 384 kbps. Philips adopted this bit rate for the Digital Compact Cassette (DCC) system to attain Layer I compatibility. Before MUSICAM was adopted by ISO/MPEG, there was extensive testing between the

two layers and "it seemed almost transparent after blind tests," said Sunil S. Nethisinghe, manager, multimedia audio products, Philips Semiconductors.

Some developers later said an even more versatile standard than Layer II was needed to accommodate all broadcast applications with high audio quality while operating at lower bit rates. Layer III, completed last year, attempts to meet those objectives by combining elements of MUSICAM with ASPEC. It operates at 32-320 kbps, with 192 kbps recommended for compact disc quality.

The matter of which applications Layer III handles better than Layer II is still a matter of evaluation and argument in Europe (see Part I of this report, Feb. 23). But there seems to be general agreement that transitions between Layers II and III are as transparent as between Layers I and II.

California Digital Audio Systems Inc. (CDAS) is recommending conversions from Layer II to III and back to II in its "digital audio Xpress" (daX) broadcast approach, to be discussed during the coming National Association of Broadcasters convention.

CDAS envisions the ISO/MPEG encoding schemes used interchangeably throughout the broadcast chain, eliminating transcoding between other compression systems and nearly all digital-to-audio conversions. If daX catches on, ISO/MPEG could have a worldwide competitive edge.

SEDAT OSI

The idea of retaining audio quality through reduced transcoding is not new. Scientific-Atlanta (SA) has been developing a similar system for its Spectrum Efficient Digital Audio Technology (SEDAT) encoding in recent years.

The SEDAT OSI (open system interconnection) approach calls for a series of

continued on page 36 ►

Squire Answers Critics

NEW YORK Compression system developers and manufacturers may be glad to hear that Herb Squire does not plan to test their systems anymore.

Squire, chief engineer, WQEW(AM)-WQXR-FM New York raised the issue of incompatible digital audio compression systems, or dueling algorithms, to new levels of attention last year by



Herb Squire, chief engineer, WQEW(AM)-WQXR-FM New York

demonstrating how they can result in obnoxious noise and drastically reducing a radio station's audio quality.

"I've proven there is a problem," he said, leaving it up to others to follow his lead by testing possible solutions.

(He was scheduled to deliver his dueling algorithm talk to the Institute of Electrical Engineers' Colloquium on Cascading Audio and Video Compression Systems in London earlier this month, but is not planning another NAB presentation this year.)

Squire is well aware of the criticisms that followed release of his tests results (see Part I of this report in the Feb. 23 issue). He has answers for all of his critics and a few things to say about some of the dueling algorithm solutions proposed so far.

He agrees with critics who say that two or three passes of digital compression is typically the limit at most stations today, but that the number will increase in the

future. Sometimes passes will be added without station engineers even being aware of it.

"Even your source music may have been data reduced in some way before it even gets to your CD," he said. Frank Sinatra sings with several internationally famous vocalists on his current "Duets" album, but was rarely in the same studio with them when it was recorded. Engineers shuttled compressed music between studios over telephone lines for later mixing (RW, Nov. 23, 1993).

Squire also disagreed with those who say the noise produced by his tests was indistinguishable from noise created by multiple analog/digital conversions. In earlier tests, Squire said, he put uncom-

pressed classical music through 10 D/A and A/D conversions and the rise in the noise floor was imperceptible without headphones.

"I would say that any noise produced by the conflict between the algorithms is going to exceed anything that would be created in just the conversion alone," he said.

Squire also criticized vendors who say stations have the responsibility to test compression systems before making final equipment purchases.

"You're playing 'Beat the Clock' with a deadline. You don't have the ability to sit back for a few weeks and do a qualitative analysis," he said. "The way the broadcast industry is today, you're dealing with very minimal (station engineering) staffs and you don't have the luxury to do that kind of thing."

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World Radio History

Compression Algorithms

► continued from page 35

interface chips installed in satellite receivers, digital recorders, digital editors and other equipment, allowing signals to be routed in either compressed SEDAT or AES/EBU digital audio, without conversions to analog. (See Figure 2.)

The OSI approach, however, has been on the drawing board for a long time. SA announced the plan a year and a half ago (RW, Nov. 4, 1992), but has not advanced it very much since then. "We haven't had the technical people available to develop the product," said Jack Fenster, director, broadcast radio product management at SA's Melbourne, Fla., development facility.

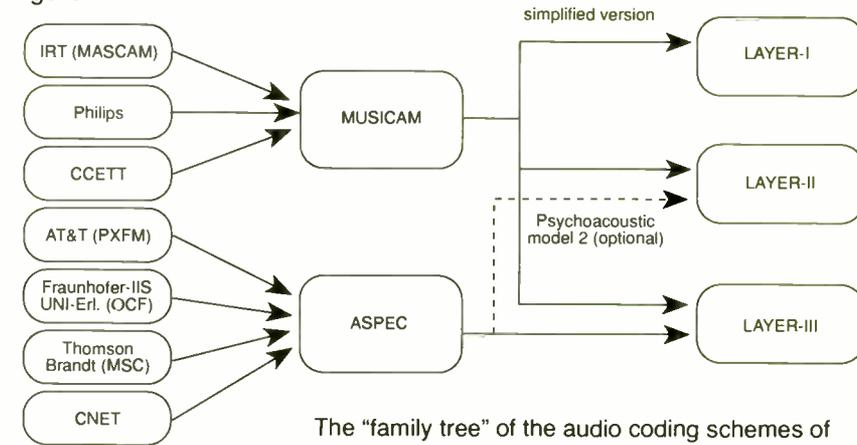
Nevertheless, SEDAT is one of the

receiving ABC Radio, CBS Radio, AP Broadcast Services and other news network feeds.

SA got involved with equipment development for satellite radio networks in the early 1980s when it acquired AdCom, in Melbourne which developed DATS (Digital Audio Transmission System), the world's first digital audio satellite transmission system. DATS delivers FM-quality (15 kHz) mono audio and data channels for news wires and remote control commands.

Radio networks began demanding better quality by 1990. SA responded to a call for bids from ABC Radio by revising DATS with SEDAT, which delivers 20-kHz, 128-kbps audio. "It turned out that MUSICAM was too far away from

Figure 1.



The "family tree" of the audio coding schemes of IS 11172-3. Layer 111 combines the best idea of ASPEC and MUSICAM.

ABC and CBS began SEDAT distribution in September 1991 and other news networks gradually followed their lead.

Since then, SA has been working to create a SEDAT family of compression systems to accommodate a wider range of programming.

The current system, redubbed SEDAT-I, is used mainly as a voice-only system for news and talk distribution. In January

SA began distributing receivers for the more specialized SEDAT-III, a low-bit-rate mono system, developed to support talk programming on ABC and Unistar.

ABC also hired SA to develop SEDAT-IV, a 128-kbps stereo system billed as having CD-quality for distribution over the Satellite Music Network. Production models of SEDAT-IV receivers are

expected to be ready by this summer. (SA has development of an even higher-quality stereo system, SEDAT-II, ordered by Unistar and IDB Broadcast, temporarily on hold.)

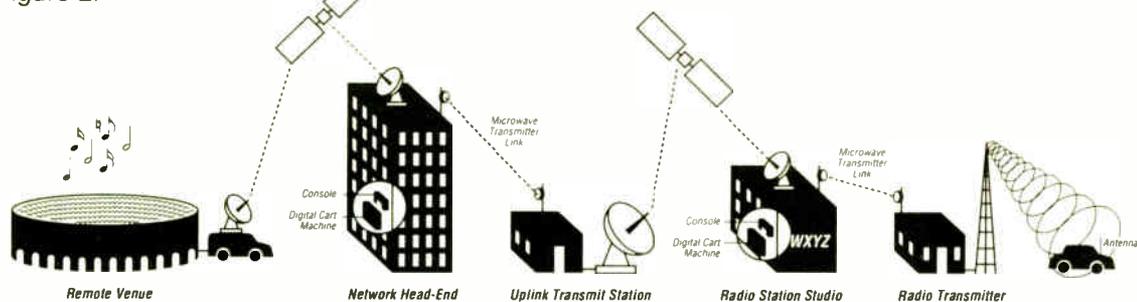
SEDAT's competitive standing with MUSICAM appears to depend on user reaction to its revised algorithms and progress in OSI development. But at least one major SEDAT customer already appears to be a probable defector.

"We are staunch supporters here of MUSICAM," said Tony Masiello, vice president, technical operations, CBS Radio. "Besides our involvement in DAR (CBS is a partner in USA Digital, which is proposing three MUSICAM-based transmission systems), we have developed a digital audio editing product for news, and our compression algorithm of choice is MUSICAM."

Masiello said manufacturers should provide multiple encoding options on their equipment so that each broadcaster can configure facilities to one preferred compression scheme. "If you want to be a SEDAT house, go ahead, but every-

continued on page 38 ►

Figure 2.

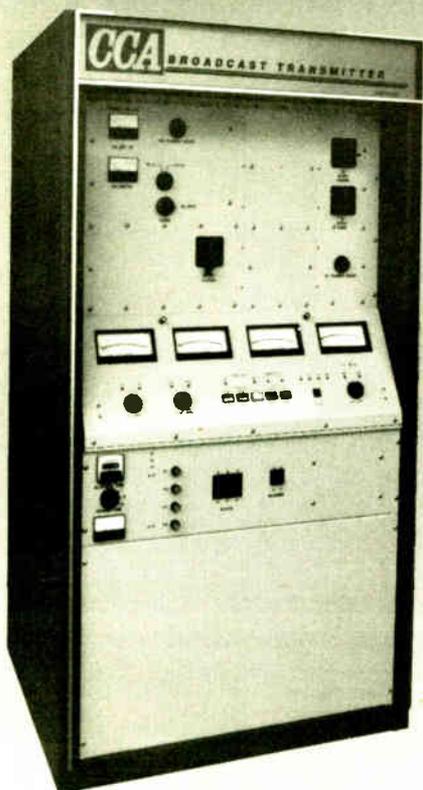


Scientific-Atlanta's vision for SEDAT OSI (open system interconnection)

major U.S. compression systems by virtue of the hundreds of affiliate stations

being ready and ABC wanted something sooner," Fenster said.

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Many Systems Are in Crowded Field

► continued from page 36
thing in the station should be SEDAT," he said.

AC-2 and apt-X

Many believe that no formal or de facto standard will form around ISO/MPEG or any other approach, regardless of technological advancement or new interface approaches.

"I don't know whether every combination the ISO now has in the marketplace will necessarily achieve what we all want to happen, which is excellent sound quality without loss," said Bob Donnelly, general manager, satellite systems, ABC

Radio. "I think it's too early to tell what will happen."

Well-established algorithms, such as Audio Coding (AC)-2 from Dolby Laboratories, San Francisco, and apt-X from Audio Processing Technology (APT), Belfast, Northern Ireland, are licensed to several manufacturers and are already present at many U.S. stations.

A number of audio storage, automation and studio-to-transmitter links (STL) suppliers have installed Dolby AC-2 codecs in their products. "It was designed for high-quality professional, applications for cases where you want to have similar complexity for encoders and

decoders," said Louis Fielder, manager of Dolby's digital audio coding group. AC-2 has 192 kbps codecs featuring 10 millisecond (ms) coding delay (used chiefly in the Dolby DSTL), and a 120 kbps system for other applications.

Dolby began digital audio compression work in the early 1980s to develop a codec for direct broadcast satellite audio transmission. AC-1 never made it on DBS, a media that is still struggling to establish itself over a decade later. But it was the compression system used by the Digital Cable Radio service.

AC-2 was finished in 1986 and is still the most widely used of Dolby's audio

compression systems in the radio industry.

In television, Dolby's audio-for-motion-picture development led to AC-3, which was recently chosen by the FCC's Advisory Committee on Advanced Television Services as the audio compression system for the proposed high definition television standard. "AC-3 was the natural vehicle (for HDTV) because of its five-channel capability that we strongly believe is an important factor in future high-quality audio for pictures," Fielder said.

"AC-3 being taken on as the (HDTV) standard has forced the issue to some degree," says Michael Smyth, head of APT's Los Angeles office. "You can't have both. It's either low coding and you can't do tandem coding, or it's a lot more bits with tandem coding."

At 384 kbps, AC-3 will have well under 100 kilobits per channel, "so the problem of tandem coding will be compounded...Any coding done before that is going to be noticeable to the consumer," Smyth said.

Wide variety

APT's apt-X algorithm, which typically operates at 192 kbps, has been applied to a wide variety of compression applications, similar to AC-2. But Smyth emphasized the practicality of apt-X's short coding delay of under 4 ms at 32 kHz sampling before comparing audio quality.

"The whole telecommunications side is ours for the taking," Smyth said. "G.722

in depth

AUDIO COMPRESSION Part 2

requires that the coding delay is less than 5 ms. MUSICAM's is up to 200 ms. Dolby and MUSICAM are never going to be accepted by telecommunications people."

Smyth's brother, Stephen, developed apt-X in Ireland during the late 1980s. He was working with ISDN-type algorithms, such as the European-developed G.722, for British Telecom while completing his PhD at Queens University in Belfast. As he experimented, he gradually applied wider bandwidths to the algorithms to test their high-fidelity music performance.

The work evolved into apt-X, a G.722 derivative completed in 1989. The algorithm has not changed substantially since then. "That's one of the things our customers like. They know when they get apt-X, there is a history behind it. Four years is a long time in this field," Michael Smyth said. About 75,000 channels worth of apt-X equipment has been sold so far.

Other compression newcomers are bound to appear in the same way, Smyth said, because specific applications are often found that are not adequately addressed by the existing technology: "I don't believe you're going to get fewer algorithms; you'll get more."

Relative newcomers include two major international corporations—AT&T Bell
continued on next page ►

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► continued from previous page

Labs with its Perceptual Audio Coding (PAC), developed for digital audio broadcasting, and Sony Corp.'s Adaptive Transform Acoustic Coding (ATRAC) system, the enabling technology in its MiniDisc (MD) magneto optical format.

But PAC is not yet in circulation in the radio industry or any other communications media. It is the proposed compression system for three of the proposed DAR transmission systems now being tested by the Electronics Industries Association and National Radio Systems

applications is uncertain.

Otherwise, AT&T has not yet explored the feasibility of mingling PAC with other algorithms or developing a CDAS daX-like broadcast chain for PAC, should a PAC-based system be approved.

Nikil Jayant, head of AT&T Bell Labs' signal processing branch, said internal dueling algorithm tests are planned, but that getting the systems ready for EIA/NRSC testing has been AT&T's chief concern so far. (Dueling algorithms are not part of the EIA/NRSC DAR test schedule.)

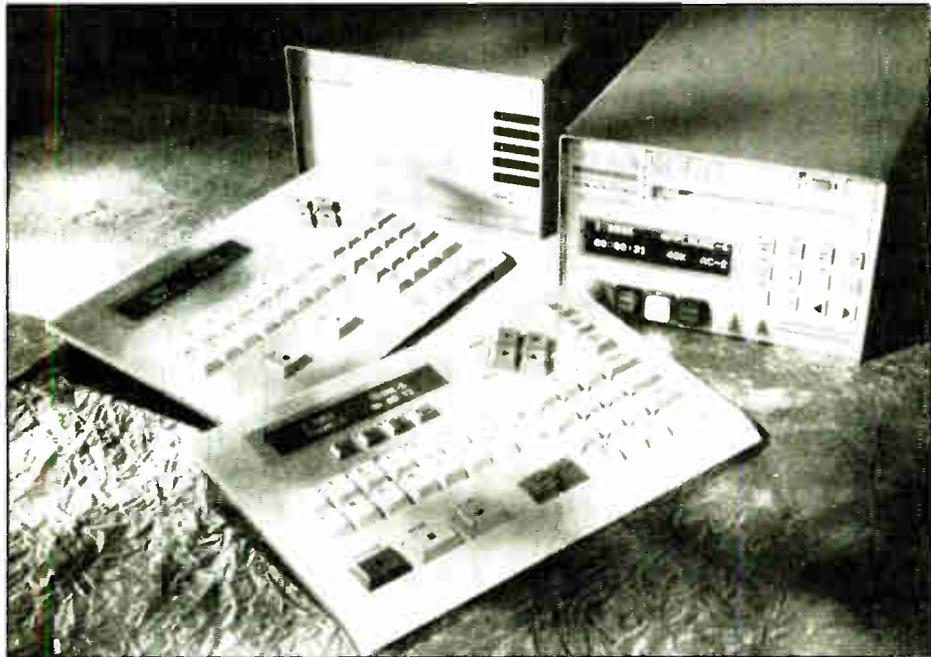
Sony's ATRAC was among the compression algorithms tested during Herb Squire's trials last year, but professional MD equipment has only begun to hit the radio market. There is little real-world experience of ATRAC interacting with

other compression systems other than the Squire tests.

MD's background is comparable to Philips' DCC. Both were originally meant to be consumer formats and eventually redesigned for broadcast applications. In fact, Sony and Philips both hold patents on elements of MD and DCC.

But the two companies parted company when it came to choosing the recording media. "To replace tape with tape did not seem to solve all the problems the consumers were complaining about," said Sony spokesman Paul Fochino.

ATRAC allows for 74 minutes of near-CD-quality on a 2.5-inch disk rather than DCC's conventional audio cassette, an obvious space- and money-saving advantage for stations installing digital audio automation systems.



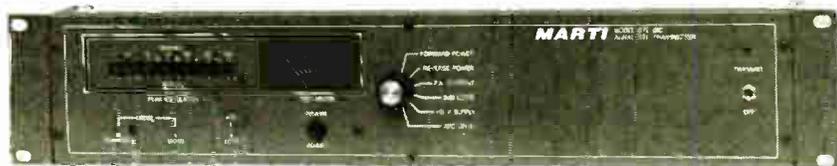
360 Systems' DigiCart/II with optional Dolby AC-2 compression

The PAC algorithm's goal is similar to MPEG/ISO Layer III—CD-quality digital stereo at a low data rate of 128 kbps. AT&T's internal subjective testing rated PAC at 4.5 on the CCIR scale of five. MUSICAM and ASPEC at 128 kbps were rated at 2.5 and just under 3.5 respectively.

Committee: the Amati in-band, on-channel system, NASA/JPL's S-band satellite system and AT&T's own in-band, adjacent-channel system (RW, July 14).

MUSICAM is the only other algorithm being considered for DAR in the U.S. If a MUSICAM system is ultimately chosen by the FCC, PAC's future in other

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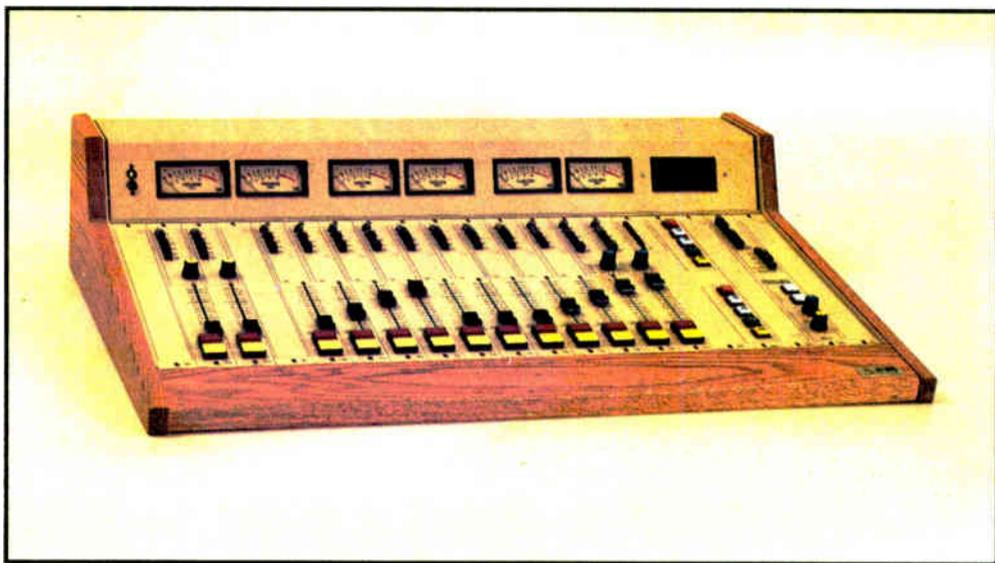
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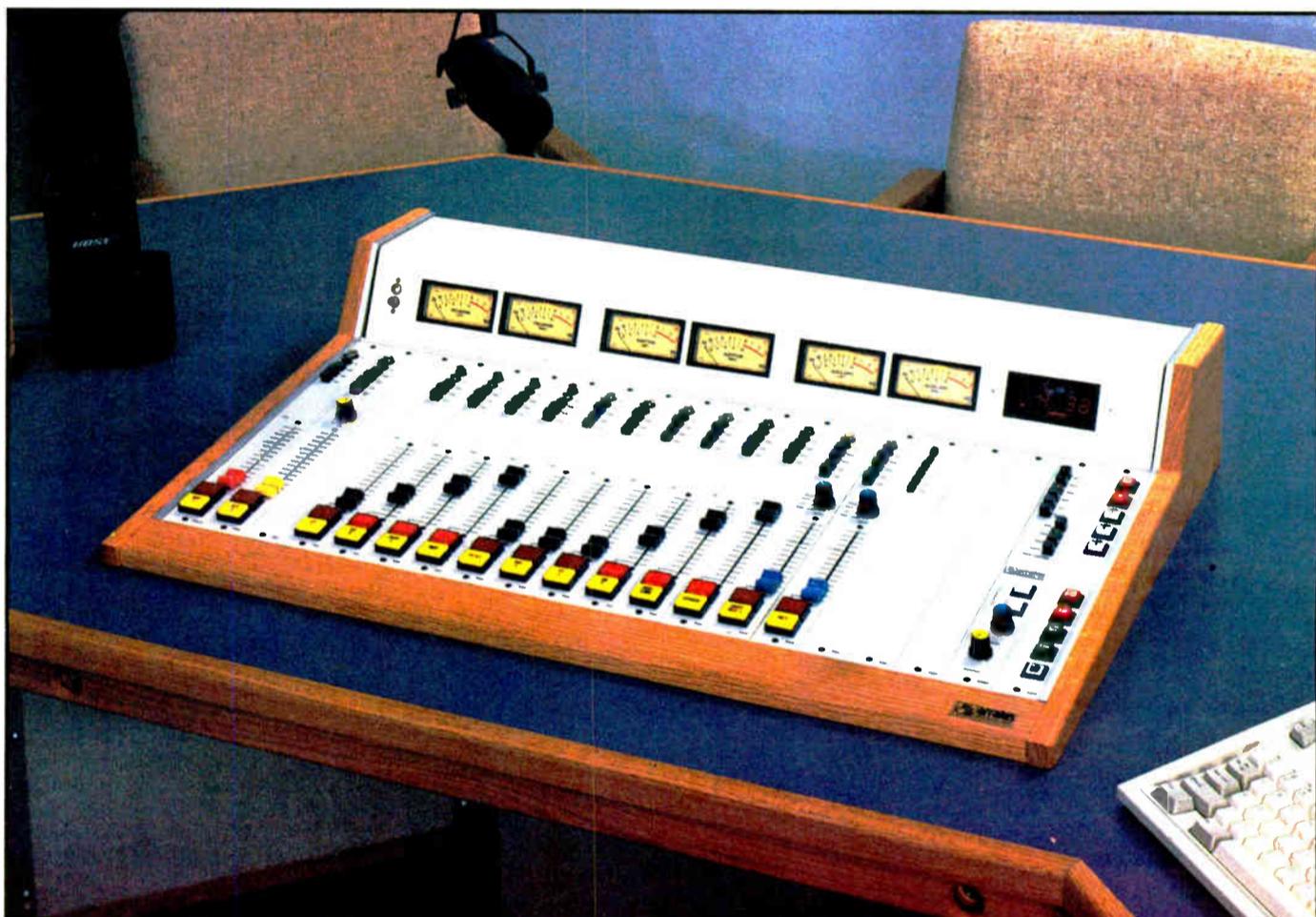
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OFFBEAT RADIO

DGS Provides Rapid ISDN Solutions

by Dee McVicker

SAN FRANCISCO A little over a year ago, when the bomb exploded at New York's World Trade Center, news media all over the country scrambled to cover the story. As in most cities, San Francisco-area TV stations were in a fierce competition to be the quickest to reach the public with complete news of the explosion.

They also wanted to promote their coverage as quickly as possible.

A few hours to go before the evening news, and within just a few hours after the explosion, KGO-TV had distributed a radio spot to 25 area radio stations using a new wired digital service, the Digital Generation Systems (DGS) Network.

It took KGO-TV less than an hour to produce its radio ad at its own studios, and minutes to send it by telephone line via DGS to the radio stations.

Good timing

The DGS Network receivers had been installed at the radio stations just weeks before to handle advertising activity during the Nielsen February sweeps, the peak season for TV station advertising on radio.

"(KGO-TV) had been advertising quite heavily on the local radio stations at the time of the World Center bombing, so when they got the news over the wire, they were able to put together a spot in their studio in about an hour and we broadcast it for them out to all the radio stations," said DGS President Henry Donaldson.

As part of the test market for the DGS Network, Bay area stations were equipped with personal computers for electronically receiving advertising spots from television stations, commercial producers and other advertising services. The cost to radio stations, said Donaldson, included only the incoming telephone line. Computers and all other equipment was provided free of charge by DGS.

"I really do think it is a great idea," said Mark Van Gelder, production director, KSFO(AM)-KYA(FM) San Francisco. "Especially during sweeps weeks, when we run a lot of television commercials and a lot of those are time sensitive."

"I think it's going to replace a lot of services, especially bicycling tapes," said Dave Bramnick, vice president and general manager, KFRC(AM)-KFRC(FM).

After testing the system in the San Francisco market, DGS officially launched its service nationwide in October 1993. During its New York City debut, radio pitchman Tom Bodett, whose Motel 6 radio spots won the 1991 Radio Advertising Bureau's Mercury Gold Award, demonstrated the DGS by sending an audio message from his DGS-equipped production studio in Homer, Alaska, to the DGS receiving computer at the Rainbow Room at Radio City Music Hall.

"Now that it's possible to send spots within hours, DGS has practically moved production studios into radio stations," Bodett said.

Over 500 radio stations now use DGS to bicycle ads electronically, including major-market stations in Baltimore, Philadelphia, New York and Washington.

Most began using the system to narrow the time gap between finished production and on-air broadcast of radio spots, and to improve the radio ad quality.

Advertising agencies and their production houses also benefit from the digital delivery service. Over 60 signed up with DGS in its first two months of national operation.

Like wired services emerging in the digital age, the DGS Network travels along real-time networks, such as IDB and ED-NET, and public digital connect services, such as Switched 56 and ISDN. Radio spots typically originate at advertising

studios and are wired over high-speed lines to DGS's central exchange in San Francisco, and then dispatched to designated radio stations.

Transmit times

The time it takes to transmit spots varies from three minutes to 20 minutes or more, depending on the type of telecommunications link used, Donaldson said. All spots sent through the system are converted to 16-bit digital audio at a sampling rate of 48 kHz for CD stereo quality.

Using high-speed byways, DGS is able

to deliver radio spots faster and in better condition than the more traditional methods used by radio stations and ad agencies, such as dubbing and shipping audio tapes.

"Radio's greatest benefit is its immediacy and its ability to reach and change copy," said Bramnick, who credited DGS with helping improve radio's immediacy and its competitive edge against competing media.

"At the moment, the stations need only put in a regular telephone line," Donaldson said. Spot delivery costs are paid by advertising agencies, and run from \$10 a spot to \$35 a spot.

□□□

Dee McVicker is a free-lance writer specializing in the broadcast industry. She can be reached at 602-545-7363.

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Please make every effort to secure all of the articles yourself. Northern Virginia Community College and **RW** are not in a position to supply readers with back issues.

by Ed Montgomery

Part V

ANNANDALE, Va. Depending on their construction, transistors can exhibit several characteristics. Some are designed to be a switch, where current flows at its maximum or not at all, while others operate in the linear range with current constantly flowing in varying intensities, as in analog amplifiers.

Figure 1 illustrates the bipolar transistor's family of characteristic curves. A small change in base-emitter current results in a very large change in current

In this illustration, collector current (I_C) is displayed on the vertical axis and collector voltage (V_C) on the horizontal axis. The different curves illustrate various conditions of collector current at different collector voltages.

For example, if the base current I_B is increased from 60 microamps at point A to 180 microamps, at point B, there will be a corresponding increase in collector current from 3.25 milliamps to 7.75 milliamps. The 120 microamps change in I_B results in a 4.5 milliamp change in I_C .

The ratio of change of I_B to I_C is known as "Beta," the figure that shows the amplifying capability of the transistor. In this case,

Beta is 37.5.

Circuit designers observe these characteristic curves to gauge how much linear distortion will be introduced when a specific level of signal is amplified.

Figure 2 illustrates many of the characteristics a manufacturer supplies in the device. This information is important when the time comes to replace a failed transistor.

More often than not, the replacement transistor will not have the same identification number as the original. A cross reference guide lists the

number of the replacement device as well as these characteristics.

P_T is the maximum amount of power

Figure 2.

123AP

NPN Si Transistor

P_T	1.2 W
I_C	0.8 A
V_{CBO}	75 V
V_{CEO}	40 V
V_{EBO}	6 V
h_{FE}	200 Min.
f_T	300 MHz

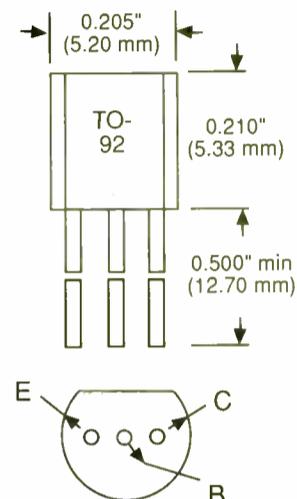
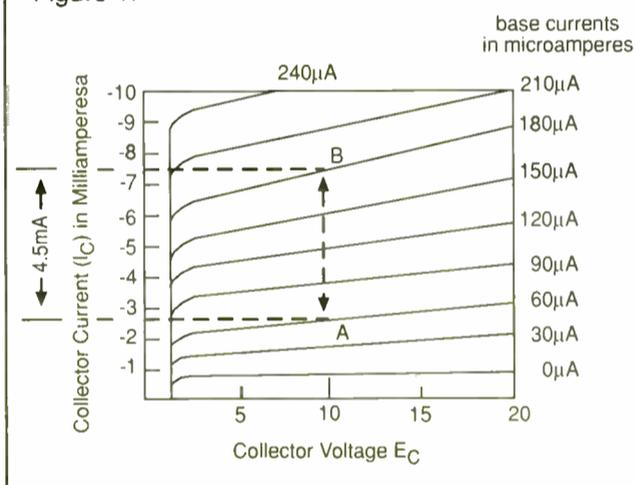


Figure 1.



flowing from the emitter to the collector.

same identification number as the original. A cross reference guide lists the

the transistor can dissipate without being de-stroyed. I_C is the maximum collector current that can be handled. V_{CBO} , V_{CEO} and V_{EBO} are the voltages present between the collector and base; collector and emitter, and emitter and base.

V_{CEO} , for example, is the voltage that will drive the transistor into maximum collector current saturation. Increasing the voltage beyond this point will have no effect on the collector current. These are usually maximum ratings and are helpful when the exact replacement device is no longer available.

h_{FE} is the "Beta" rating for the device and f_T indicates the gain bandwidth of the transistor. Even though bipolar transistors are current controlled, voltage measurements across the junctions are published because it is usually impossible to measure such small currents when the device is in a circuit.

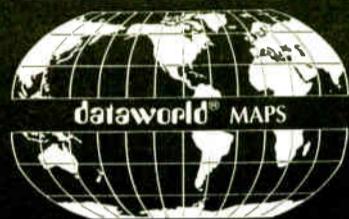
Voltage measurements are easier to come by, but avoid shorting the leads of the transistor together when measuring. Transistors operate at very low currents and voltages. Shorting the leads together could destroy the transistor junction.

Transistor checkers are used to check the viability of the device and measure diodes and field-effect transistors (to be discussed in the next installment). Checkers are designed to connect to a device that is either in or out of the circuit. They measure forward and reverse or leakage currents, a characteristic that can increase as the device ages, ultimately causing it to fail.

You can waste a great deal of time by trying to make a bad or marginal transistor function, even if the checker indicates it is good. When time for troubleshooting is considered in with the cost of repair, you often will find it cheaper to simply replace the transistor.

□ □ □

Ed Montgomery is a communications teacher at Thomas Jefferson High School for Science and Technology. He has taught broadcast engineering at Northern Virginia Community College and worked as a broadcast engineer for several radio stations. He can be reached at 703-750-5090.



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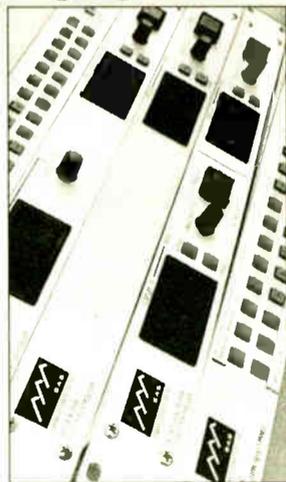
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Alternative RF Networks for Radio

by Thomas Osenkowsky

BROOKFIELD, Conn. An engineer occasionally encounters a strange-looking RF network that looks like a Tee network with extra components.

Figure 1 shows just such a lagging -60 degree Tee network. The shunt leg coil, L3, is used to fine-tune C3 by cancelling some of its capacitive reactance. C3 is usually chosen to have a little more Xc than is required by the network, hence the need for L3.

A vacuum capacitor may be recommended for higher power applications, but they tend to be expensive.

created. You can resonate a nearby station's frequency so that its RF does not enter your transmitter's PA stage and create intermodulation products or affect the accuracy of your modulation monitor.

Notice that I used two components for the input leg of the network. By design, you need +j9.4 ohms, which equals 1.5μH at 1000 kHz. Any variation in the phase shift or load resistance might lower the required inductance to the point where it becomes impossible to adjust the network.

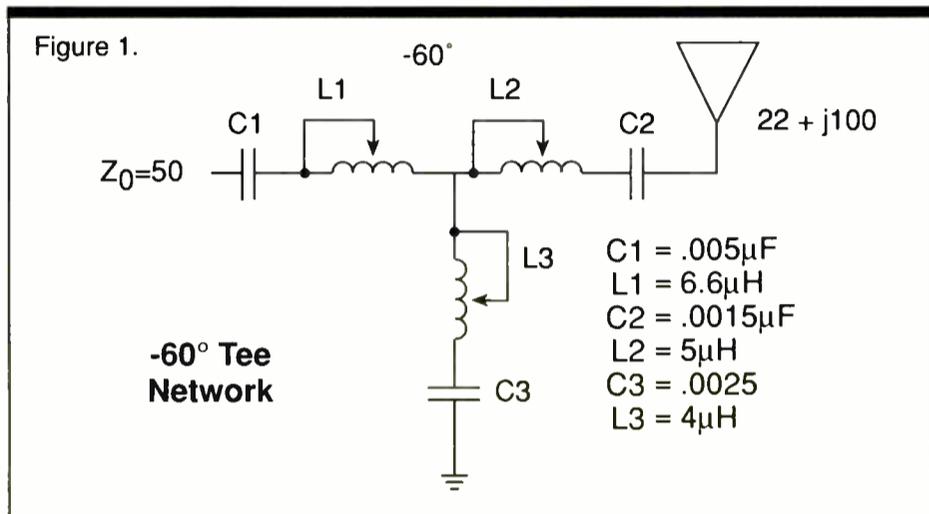
A .005 capacitor to get a little Xc into the picture allows for a better range of

fixed capacitor) because only one unique combination of L and C will do the job.

These equations are algebraic variations

tion voltages. In some cases, however, a parallel component can be very helpful.

In Figure 3 a modified Tee network is used in a three-tower DA. Note the very high drive point impedance. A 50 pF capacitor placed across the base insulator changes the drive point impedance to



Equation 1 can be used to calculate the series resonant frequency of the L3-C3 combination. The -60 degree Tee network requires -j38.3 ohms in the shunt branch. Using a .0025μF capacitor for C3 and a 4μH coil, the resonant frequency (short circuit) is 1584 kHz. If we used a .0015μF capacitor and a 10.8μH coil, resonance is 1251 kHz.

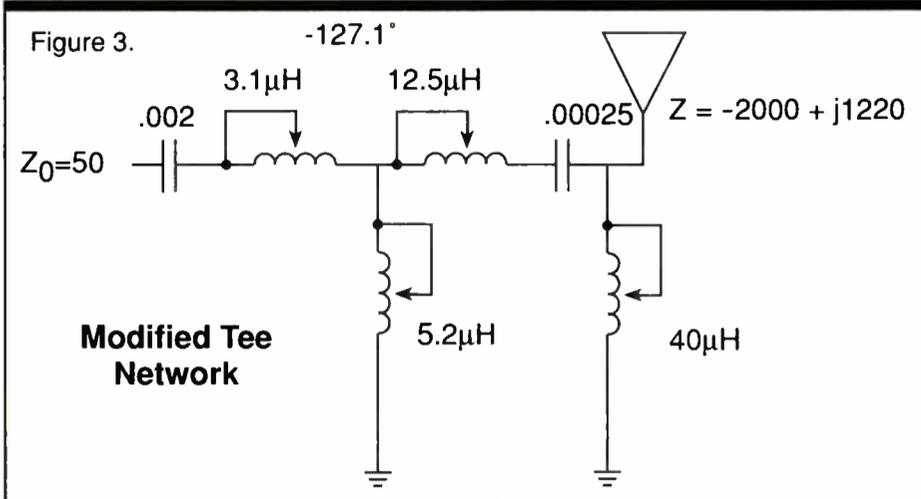
Equation 2 can be used to calculate a combination of C3 and L3 that will resonate a lagging Tee shunt leg above carrier or a leading Tee shunt leg below carrier.

This can be advantageous. If the lagging Tee is resonated at 2 times the carrier, additional second harmonic attenuation is

input-arm adjustment without compromising bandwidth.

Recall the rule of SARL PARC (Series Above Resonance Inductive, Parallel Above Resonance Capacitive). A combination of L1 and C1 produces the required inductive reactance for the input arm. It cancels equal but opposite reactances at the sideband frequencies, provided that the upper sideband is capacitive.

Figure 2 shows such a network for a given impedance sweep. Equation 3 calculates the unique values of L1 and C1. For the shunt branch in Figure 1 and the input branch in Figure 2, you must use a vacuum variable capacitor (or carefully chosen



of the basic reactance formulas. Transmitter output networks often use these principles in their design.

Parallel combinations are not demon-

-2045 -j1204, assuming no mutual coupling in the system. A standard Tee network would be of little value here.

(Thanks to Jerry Westberg of Westberg Consulting for suggesting this scheme.)

Shunting the tower with a 40μH coil converts -2016 + j1220 to -37.2 + j318, which is easily matched to 50 ohms by a Tee network. The phase shift caused by the 40μH coil is -52.13 degrees.

The direction of power flow is the sign that the actual phase shifts are reversed because we are dealing with a negative tower and phase shift.

With a little imagination, some simple manipulation of network arms can produce astounding results.

Equation 1

$$F_r = \frac{1}{2\pi\sqrt{CL}}$$

Equation 2

$$C = \frac{F_0}{2\pi X_3 F_r^2} - \frac{1}{2\pi X_3 F_0}$$

$$L = \frac{1}{4\pi^2 F_r^2 C}$$

Equation 3

$$L = \frac{F_u \cdot |X_u|}{2\pi F_u - F_0}$$

$$C = \frac{1}{4\pi^2 F_0^2 L}$$

X_3 = Absolute shunt arm reactance required by Tee network (ohms)
 F_0 = Carrier frequency (MHz)
 F_r = Desired reject frequency (MHz)
 F_u = Upper sideband frequency (MHz)
 $|X_u|$ = Absolute value of upper sideband reactance (ohms)
 π = 3.141592653589793
 C = capacitance in μF
 L = inductance in μH

strated here because they tend to produce high circulating currents and junc-

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Figure 2.

Input Arm

Tee Network Load Impedance

Freq	Z
990	28 - j12
1000	26 - j9
1010	24 - j6

After -95° Tee Network

Freq	Z
990	48.9 + j7
1000	50 + j0
1010	48.2 - j8

Load VSWR 1.15/1.17

With Modified Input Arm

Freq	Z
990	48.9 - j1
1000	50 + j0
1010	48.2 - j0

Load VSWR 1.03/1.04

Thomas Gary Osenkowsky is an SBE certified senior broadcast engineer and NARTE first-class certified engineer. He can be reached at 5 Beachwood Grove, Brookfield, Conn. 06804.



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DESIGNS THAT MAKE THE DIFFERENCE

Radio's Role on the Superhighway

► continued from page 18

activated shopping service from home and eventually from your car? Or information downloads for news, weather, sports and stock quotations exactly when you want them?

Time Shifting: TV networks already know about this one. And radio stations with hard disk systems are using them to pre-tape and self-automate dayparts, then send their morning man out to sell time. One live person sitting in a booth down the street announcing the time is rapidly becoming an antiquated concept.

DAB: There isn't much to add to a topic that's already been talked to death, except to point out that many of the new technologies that will affect radio have their origin once a signal becomes digitized. It may not happen tomorrow, but it will become a reality as we move into the 21st Century (only a scant half dozen years from now).

Seizing the moment

If all this seems scary, let me borrow a quote from John Abel's Future Summit talk and repeat that when it comes to new technologies: "The limits are measured by our creativity." For starters, radio broadcasters are probably going to be better off if they stop thinking of themselves as providers of a single program in which to sell a limited number of availabilities. The one program

per signal idea is going to have to change, and radio owners are going to have to focus first on their inherent advantages.

Foremost among them are radio's installed base and the ability to transmit a wireless signal. Radio is everywhere. It is said to have a 99 percent penetration rate: contrast that with cable's 63 percent. Radio is in homes, in cars, in our ears, and even, in my case, in the subway. That means that anybody wanting to reach large numbers of people quickly and inexpensively will have to consider the radio signal of tomorrow as an opportunity. The first name for radio was "the wireless."

We might want to revive that moniker as we move into the future too, because one of broadcasting strengths is the ability to go from here to there, without cables. If I want to send my story to RW Editor Luci Cobo these days, I have to hook up my computer to a modem and my modem to a phone and her computer has to be hooked up to each one as well (okay, we use electronic mail, but it's the same principle). What if I was on safari in Kenya (I wish!)? Radio could reach me. But Luci couldn't.

Endless possibilities

The point is, a wireless form of communication provides a crucial link, a connecting access road, if you will, on the info superhighway. Once station

owners start thinking like that, all kinds of possibilities open up. With "digitization," station owners can think of themselves as signal owners and transmission providers. And one signal will multiply

Anybody wanting to reach large numbers of people quickly and inexpensively will have to consider the radio signal of tomorrow as an opportunity.

into several signals transmitted at once. In addition to data signals, these could be narrowcast program signals, each to a different niche market, each with its own advertising. If one commercial cluster every 15 minutes is profitable, five (or more) on each of five signals can be five times as profitable.

The same holds true for "programs on demand." News, weather, traffic and stock quotes on demand can all be sponsored. So can music downloads and over-the-air shopping services. Or revenues can be split among the signal provider (you) and the retailer offering the item for sale.

Additional revenue streams are possible from leasing multiplexed signals for data transmission. And how about deals

with the satellite and cable companies to carry your signal? National news and personalities like Howard Stern and Rush Limbaugh will be in demand even for direct satellite services. Sometimes radio just does it better.

Of course, by now you realize that the important point in all of this is not really an expansion of technology, but an

expansion of the way radio broadcasters think of themselves.

And just as General Sarnoff looked at Marconi's wireless and saw a music box that could provide music to every home, we can look at the explosion of new technology and see radio signals becoming the access lanes to the information superhighway.

In fact, I see a sign for an on-ramp just up beyond that next curve. Care to join me on the six-lane? I think the General would approve.

□□□

Judith Gross is VP/Head Copywriter for MediaScan, an advertising and public relations firm specializing in broadcast and pro-audio technology. She can be reached at 212-929-6108.

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"I should have bought a DCS in the first place."

I thought I'd impress HQ by buying the cheapest hard disk system I could find. After all, they all look the same! Their promises sounded good and I wanted to believe.

I found out promises come cheap. But their system wasn't really cheap—not once you added up the little "extras" it took to do the bare minimum. And it still couldn't do all the things our station really needed.

I found out the hard way, at 3 AM when the system we bought crashed. And in morning drive, when missing spots meant dollars down the drain. When I finally reached customer support, they said they were working on software they thought would fix my problem, but they weren't sure when it would be done. Guess what I told them?

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World Radio History

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GUEST COMMENTARY

Radio Engineers: Leading a Thankless Life

by Jim Wojciechowski

HOUSTON Leaving the radio business, after having worked as a chief engineer for quite a few years at various medium and major market stations, has turned out to be one of the best decisions I ever made. Quite frankly, I've never been happier.

Never in working life, beginning with a factory job at age 16, did I ever feel so completely unappreciated and used.

Remote worries

My last broadcast job afforded me the wonderful opportunity to provide the station ownership with a remote broadcast vehicle (my truck), a service vehicle (my truck), tools, test equipment, insurance and gasoline out of my own pocket.

I was given the honor and privilege of being on-call 24 hours a day, 365 days a year, always available to take care of the smallest problem, from a microphone not working (the "mute" switch depressed) to a PCB fire at the 30-year-old transmitter site.

Weekends were the best. From September to December, Saturdays were dominated by live college football broadcasts. The engineer was always first to arrive and last to leave, which was never considered by the sales department when it scheduled a remote from the local carpet store for me the following morning.

On Friday nights and Monday mornings (up at 4:30 a.m., even if you were up all night repairing the transmitter) there were always remotes. After all, who needs a social life or family or marriage?

During my last tenure as a chief engineer, I had a staff of one: me. This staff designed and built a modern state-of-the-art studio facility, a directional AM transmitter site, an FM transmitter site, a complex RPU system with remote receive sites, coordinated several live sporting events (college and pro) and

dealt with many interference complaints.

This staff appeared before planning commissions, zoning boards and other government agencies on behalf of its employer and wrote several letters and legal papers for various administrative agencies, while trying to take care of the day-to-day operations and repairs at a broadcast station.

The general sales manager plugged the toilet and wanted the chief engineer to take care of it. (He was angry when I refused.)

While doing this at my primary station, I also had to do contract work to make ends meet. This meant being on-call for several stations in the area, a real nightmare during severe weather season, but a necessity because my real income from my primary station was \$3 dollars an hour after subtracting my expenses that were not reimbursed from my salary and dividing that number by the number of hours worked.

Priorities

My performance was not judged by this organization's sales-driven management according to any of the efforts I've described. I was evaluated by how quickly I could get around to repairing a cart machine, or set up the 100-percent flawless remotes the sales department demanded.

In a society that replaced reality with image, time spent away from the studio or out of sight of the sales staff was assumed to be time spent home sleeping (or worse). My job performance was measured by my ability to see to each individual's needs, rather than my work for overall good of the station.

Is it any wonder so many broadcast stations are unable to create a competitive product?

I heard through the grapevine that some considered my job performance inadequate. It hurt. I gave up part of my health

and several good years of my life, wasting precious time in an industry that considers technical skills the equivalent of migrant labor.

Perhaps if I had the right "image" and could sell remote broadcasts, I would have been considered "hard-working" or "creative."

Not too long ago, the Society of Broadcast Engineers expressed concern that the broadcasters have been unable to attract young people to broadcast engineering. The cause of the problem is right under their noses.

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conditions and more respect than most broadcast stations. As long as these attitudes continue, the once great industry of broadcasting is doomed to a future of technical and marketplace obsolescence.

In case you've asked the obvious question: "Why did you put up with it?" I can't say. But I'm currently in therapy.

□ □ □

Jim Wojciechowski was chief engineer at various radio stations for eight years. He recently left the broadcast industry to work for an instrumentation and atmospheric sciences firm.

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Ways to Tackle Splatter Monitoring

by Tony Dinkel

LONG BEACH, Calif. On June 30, 1994, all AM radio stations are faced with a new requirement. They will be required to perform and document an RF emissions proof of performance, covering occupied bandwidth and harmonics.

Those of us who installed National Radio Systems Committee (NRSC)-standard processors on our transmitters before June 1990 got a grace period. That time is almost up.

I have actually been performing this service for both my AM and FM clients for the last several years. There are several ways to accomplish these measurements.

Splatter monitor

The most popular and low-cost approach is to use a "splatter monitor," which is manufactured by Delta Electronics (RW, Feb. 9). It allows you to tune your station's carrier frequency, then tune off from center with various filters to trace the AM signal's spectral content on an analog meter.

Among several of the attractive features of this instrument are: frequency agility, allowing a group owner or consultant to purchase one and have it usable at all of his facilities; the ability to be powered from 12 volts DC for easy use in a vehicle, which is a necessity when following the rule, and a reasonable price.

However, the splatter monitor has its

limitations. It will only tune to 100 kHz offset from the channel to which it is tuned. The required harmonic measurements must be performed with a field intensity meter or general coverage receiver.

Because it uses a demodulator, the splatter monitor detects signals on both sidebands simultaneously. This can be a hindrance if there is an interfering signal on one sideband and not the other.

Also, the splatter monitor does not pro-

In congested areas, some critical areas of sweep may be obscured by the signals of other transmitters.

vide hard copy output. The results must be logged by hand.

My preferred technique is to use a "properly operated and suitable swept-frequency RF spectrum analyzer," as allowed in FCC Rule 73.44(a). My analyzer is a Tektronix model 492, which I find to be perfectly suitable for NRSC compliance studies.

It does not operate from 12 volts DC, which is mandatory. The rules require establishment of a field measurement point. In most of my measurement experiences, that point is not near a 110 VAC outlet. The problem is solved, however, with an Exeltech 500 watt power inverter,

By combining the versatility of the analyzer and the unencumbered availability of an AC power source of excellent quality into my Nissan Pathfinder 4x4, I have created a mobile platform capable of near laboratory grade measurements.

In the field

To perform an NRSC proof, the location for the measurement must be established. For non-directional stations, the rules are easy: 1 kilometer from the antenna. I use

a Sony GPS receiver as a guide in determining this point.

Directional stations are a bit more involved; the conditions at each facility vary. The analyzer must be connected to a suitable test antenna. I use a 108-inch CB whip attached to the rear quarter panel of my vehicle.

At least three separate sets of data are to be taken. The first is a close-in sweep at 5 kHz per division. This resolves points -25 dBc at 10.2 kHz and -35 dBc at 20 kHz.

This measurement requires a 10-minute "peak hold" or "max hold" and 300 Hz resolution bandwidth on the instrument. It is best to watch the display as it builds up. A single burst of noise can ruin a good data run.

The second sweep requires the analyzer be set to 25 kHz per division. In this sweep the "30 kHz to 60 kHz is removed from carrier and must be attenuated at least 5 + 1 dB/kHz below the carrier" and the -65 dBc at 60 to 75 kHz data points. This sweep width allows a good view of the spectral content of the transmitter under test.

However, in congested areas, such as Los Angeles, some critical areas of the sweep may be obscured by the signals of other transmitters. This makes verification

of compliance difficult. The problem also affects the third and final sweep, which is a search for harmonics.

In the case of one station, KFI(AM) Los Angeles on 640 kHz, the second harmonic falls on 1280 kHz, which is an active channel. To verify KFI transmitter compliance, the station on 1280 kHz would have to sign off while the measurement is made.

To date, this has not been done, although a test was conducted in front of the transmitter building with a car radio receiver tuned to 1280 kHz. The station transmitting on that frequency was received without interference—not bad for 1,000 feet from a 50 kW stick, in my opinion.

Observations were taken through the fifth harmonic. There were no responses above the noise floor of the analyzer.

Satisfying requirements

As each sweep is taken, the analyzer's "delta marker" feature is used to verify frequency offset versus dB below carrier of the trace. This is a sort of compliance preview. Each sweep is then frozen using the "save" feature and stored individually in its designated digital memory within the analyzer.

After the individual sweeps have been stored, a trip is made to the client's studio or transmitter building. Each trace is then recalled individually and examined for compliance. The delta marker can be used to mark desired points of interest on the trace. After the markers are in place, each screen is plotted on a Tektronix HD-100 four-color plotter.

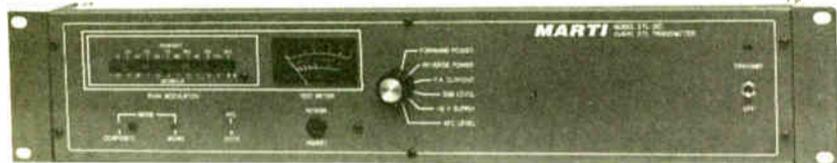
The result is a complete record of each measurement including all instrument settings, satisfying the requirements of Rules 73.44 (a), (b) and (d).

Using a spectrum analyzer to determine NRSC compliance is likely the most sensible and easy approach to the complete task.

□ □ □

Tony Dinkel is a technical consultant in the area of high-performance STL systems and related services. His company, Microwave Frequency Services, Long Beach, Calif., also does RF compliance studies for AM and FM stations. He can be reached at 213-385-0101; fax: 310-425-6299.

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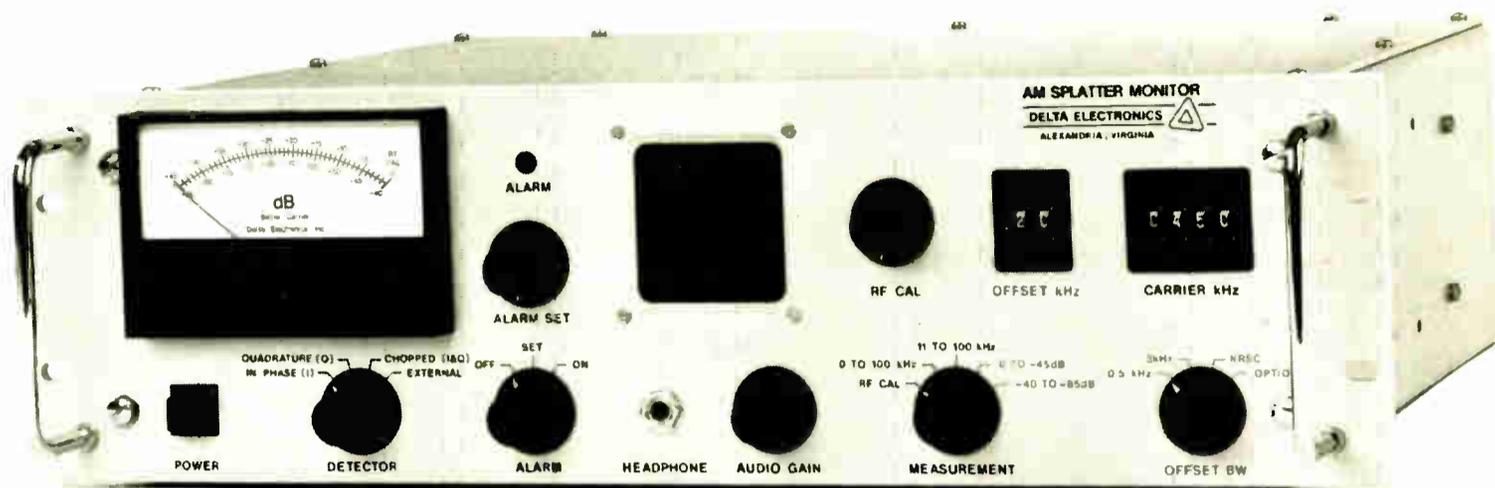
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Model SM-1 AM Splatter Monitor



Features

- Inexpensive means of verifying FCC compliance
- Easy to operate and interpret measured results
- Measurement of I, Q, I+Q (chopped) and external audio signals
- 450 kHz to 1800 kHz phase-locked operation with 10 kHz or optional 9 kHz channel spacing
- Portable operation from external 12 VDC supply and optional active antenna for near field signal monitoring
- Quadrature modulation measurement enables transmitter adjustments for minimum IPM
- External audio input enables evaluation of audio processor's NRSC filter performance
- Optional peak hold circuit
- Optional spectrum analyzer 300 Hz resolution bandwidth model filter assembly
- Front panel speaker and headphone jack permit audible monitoring of interference
- Adjustable alarm output permits remote control monitoring of interference
- Rear panel I and Q outputs and buffered meter output

The Model SM-1 Splatter Monitor provides AM broadcast engineers with a means of accurately and easily measuring off-channel emissions to ensure compliance with the FCC (NRSC-2) emissions standard. Manufactured in response to the recommendations of the National Radio Systems Committee (NRSC) for AM improvement, the instrument provides many of the features of an expensive spectrum analyzer at a significantly reduced price. The Splatter Monitor measures the level of splatter or any other spurious emissions which fall between 11 kHz and 100 kHz away from both sides of the carrier.

The Splatter Monitor provides both fixed and portable operation. While normally installed in an equipment rack and fed with the transmitter or common point RF sample, it also operates in the field from a twelve volt DC source. An optional active antenna then provides the RF sample. This portability is very useful for investigating interference complaints.

DELTA ELECTRONICS



1-800-8-DELTA-8
Telephone 703-354-3350
Fax: 703-354-0216

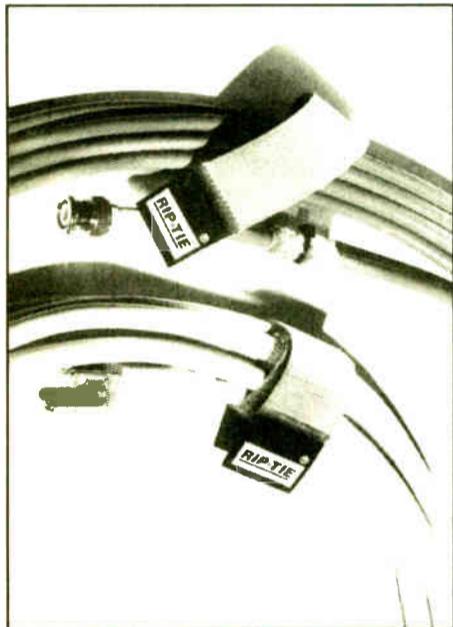
Delta Electronics, Inc.
5730 General Wahsington Drive
Alexandria, VA 22312

WORKBENCH

Cable Ties that Bind

by John Bisset

FALLS CHURCH, Va. Anyone who has done a lot of remotes and has not used Rip-Tie® Velcro cable wraps has missed one of the greatest inventions of all time. They are especially useful after a remote, when cable can be coiled and secured with the Velcro fasteners (as shown in the photo). Rip-Ties have evolved into a studio use—



Seam-Tech's RIP-TIE® cable wraps, shown above, now come in an adhesive-backed version to permit neat routing of cables and wiring under consoles and inside racks.

securing wiring runs under console cabinets or in racks. How often are control

rooms wired neatly with plastic wire ties, only to be cut later when the time comes to install new wiring?

Snaking another wire around the bundle through the cable mount saddle is frustrating and time-consuming, especially if you are working with wide-diameter cables.

Before using Rip-Ties for under-the-console studio wiring, take a look at the even simpler Cable-Catch Velcro cable organizer. One side of the Velcro has an adhesive strip, similar to wire tie saddles, which permits quick and secure mounting to any flat surface. The mating piece has a sewn tab that enables the user to open the organizer with one hand to add or remove wires.

For information on Rip-Ties and a free sample can, circle **Reader Service 82**.

★ ★ ★

From a little north of WSOY, Robin Cross of WNIU(FM) DeKalb, and WNIJ(FM) Rockford, Ill., reports on an interesting way to recycle those anti-static sheets used in clothes dryers. Rubbing them over computer monitor screens will remove dust and reduce future dust buildup due to high voltage inside the monitor.

Robin warns that it is important to use sheets that have been through the dryer. Sheets from right out of the box leave too much residue on the screen. There is enough anti-static compound left in the sheets after coming out of the dryer to keep dust away and not smudge the monitor.

Robin Cross can be reached at 815-753-0088.

★ ★ ★

RW's *From the Trenches* columnist Alan Peterson faxed me a simple, yet very useful tip I have since tried at a couple of satellite

installations with very good results.

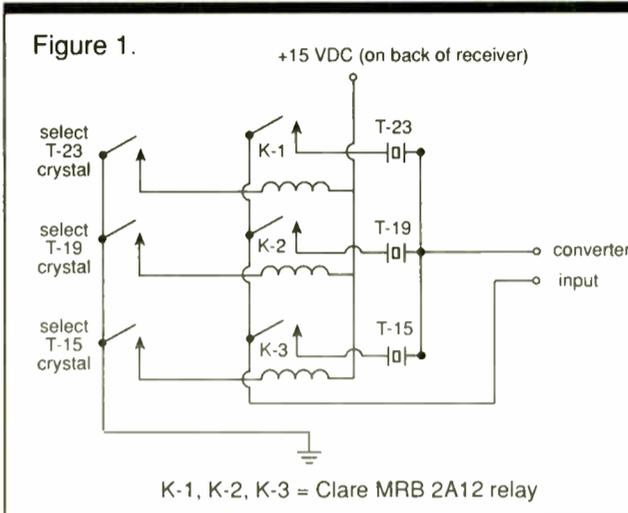
After resetting his satellite dish for what seemed to be the thousandth time, Alan has attached a six-inch length of PVC pipe to the outer edge of the dish which he uses as a "rifle site."

transponders during promos or IDs.

Figure 1 illustrates the plan. Three Clare MRB-2A-12 relays are tied to each of the crystals. In the control room, a three-station latching pushbutton switch selects between the relays for Transponder 23, 19 and 15.

Fifteen volts to power the relays is available on the back of the receiver, with the selected crystal output being fed into the converter input on the receiver.

The relays must be mounted within six inches of the crystals and the converter input. At first, Frank mounted the relays and crystals on the back of the down converter, but when the crystals were switched, the SEDAT cards would lock up and the system could only be reset by



When the dish is properly aimed at the satellite, the pipe is positioned to view a fixed point of reference not directly in the line of signal. For example, the rooftop air conditioner on another building, the light on top of the water tower or any other nearby structure could be used as a fixed point.

If the dish is blown out of line, aim the pipe until you see your point of reference and the signal returns. Alan says this method also works well with theatrical spotlights.

★ ★ ★

Frank Konwinski, chief engineer at WSOY-AM-FM Decatur, Ill., has a scheme for remote switching of crystals in a Scientific-Atlanta DAT-32. WSOY(AM) often has to quickly switch to different

unplugging the power supply.

If you want to get fancy, the relays have an extra pair of contacts that can be wired for status. Frank used the "eyelash"-type pushbutton switches used on many audio consoles. These are the latching switches that display a red flag when one is depressed. The eyelashes cover the red flag when the switch is not selected.

Frank Konwinski can be reached at WSOY, 217-877-5371.

□ □ □

John Bisset is a principal with the contract engineering group Multiphase Consulting. Submissions to Workbench can be sent to his attention, in care of RW, or faxed to 703-764-0751. Published submissions qualify for recertification credit for all SBE certification levels.

Products & Services Showcase

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- Tim Pozar, CE, KKSF-FM, San Francisco.

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- Gary Greth, CE, KLON, Long Beach, CA.

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World Radio History

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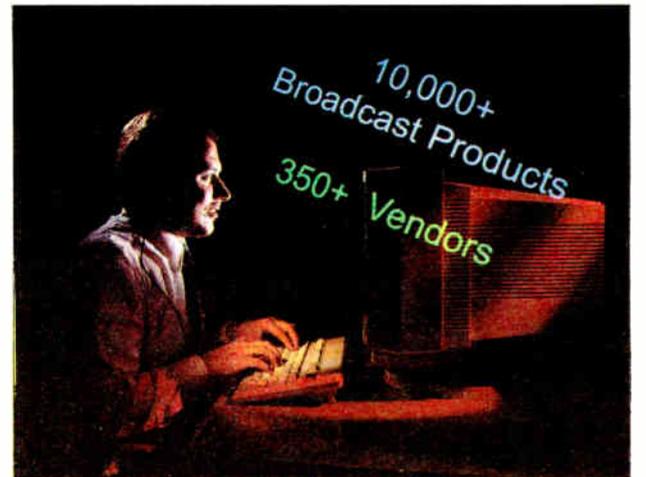
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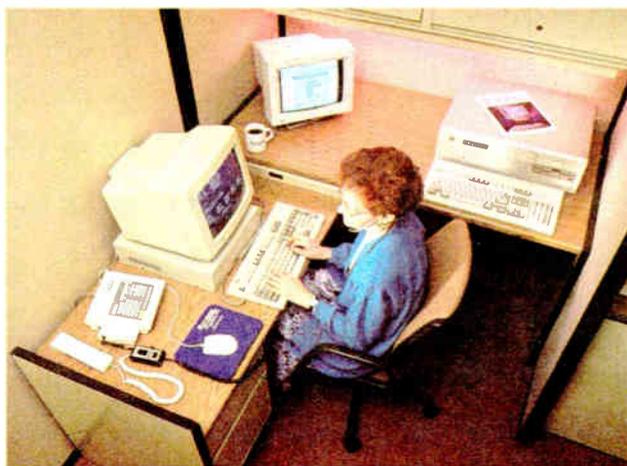
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FEEDLINE

Doing the Uplink/Downlink Math

by W.C. Alexander

Part II of III

DALLAS If you aren't a math whiz or don't care about working through the calculations, you might want to skim through the formulas in this month's column, which deal with satellite transponders and how they work. You will still get a good idea of the factors that influence satellite systems.

A C-band satellite transponder receives the uplink signal in the 6 GHz band, amplifies it, translates in frequency, filters and retransmits the signal back down in the 4 GHz band. A Ku-band transponder receives 14 GHz signals, processes them in the same order and retransmits them in the 12 GHz band.

The measure of how well the uplink path works is called "G/T," defined as:

$$(G/T) = G_a - 10 \log(T_s) \text{ dB/K}$$

where:

- G_a = Antenna gain referenced to LNA input (dBi)
- T_s = System noise temperature referenced to LNA input (K)

The downlink side of the transponder is characterized by saturated EIRP. SFD, the uplink RF flux that is required at the satellite to saturate the transponder, ties the G/T of the uplink and EIRP of the downlink together and defines transponder sensitivity. All these parameters vary according to the geographic location of the earth station with respect to the satellite.

The reason for this is a function of the satellite's antenna aperture and radiation pattern. The G/T and EIRP performance of different satellites are typically called "footprints."

A couple of other parameters of interest are the input (BO_i)/output (BO_o) power transfer and intermodulation response. Both parameters are normally specified in terms of input and output back-off, or as a function of the power reduction in dB with respect to saturation.

Carrier-to-noise ratio (C/N) is used to calculate the overall performance of a satellite system, from uplink through the transponder to the downlink. First calculate space loss:

$$L_s = 185.05 + 10 \log [1 - 0.295 \cos(H) \cos(AL)] + 20 \log f$$

where:

- H = Latitude of earth station
- AL = Difference in longitude for earth station and satellite
- f = Frequency in GHz

With the space loss in hand for both uplink and downlink, the overall satellite link can now be calculated. Calculate uplink C/N by:

$$(C/N_o)_u = EIRP_u - L_u + (G/T)_s + 228.6$$

or

$$(C/N_o)_u = S - A + (G/T)_s + 228.6$$

and

$$S = SFD - BO_i$$

where:

- S = Flux density (dBW/m^2)
- L_u = Uplink space loss (dB)
- $EIRP_u$ = Uplink EIRP (dBW)
- $(G/T)_s$ = Satellite G/T (dB/K)
- $A_i = 21.5 = 20 \log f$ (GHz) (dBm^2)
- SFD = Saturation flux density (dBW/m^2)
- BO_i = Transponder input back-off (dB)

Now compute the downlink side:

$$(C/N_o)_d = EIRP_d - L_d + (G/T)_{e,s} + 228.6$$

and

$$EIRP_d = EIRP_s - BO_o$$

where:

- $EIRP_d$ = Downlink EIRP (dBW)
- $EIRP_s$ = Saturated EIRP (dBW)
- L_d = Downlink space loss (dB)
- $(G/T)_{e,s}$ = Earth station G/T (dB/K)
- BO_o = Transponder output back-off (dB)

Now compute the total carrier-to-noise density ratio of the system:

$$(C/N_o)_t = [(C/N_o)_u^{-1} + (C/N_o)_d^{-1}]^{-1}$$

In the Ku-band, rain is the primary limiting factor in propagation. Raindrops interact with electromagnetic waves by causing absorption, scattering and depolarization.

The attenuation level is determined by the intensity of the rainfall and the path length exposed to rain. There is much more attenuation, for example, from a one-inch-per-hour rainfall produced from a cloud base at 20,000 feet than the same amount of rain from a 1,000-foot cloud base.

Rainfall rates for various parts of the country have been studied by NASA and other agencies. Maps showing rainfall in various regions are included in the "NASA Propagation Effects Handbook for Satellite Systems Design" (ORI TR 1679).

Rain attenuation is calculated in two steps. First determine the rain rate in millimeters

per hour as a function of statistical probability. Then calculate the actual rain attenuation associated with the rain rate which exceeds that probability. Those of us without precision rain rate measurement equipment and ceilimeters, can refer to the aforementioned NASA publication.

Add the probable rain attenuation to the satellite link as a margin to allow for the specified availability under conditions of heavy rainfall. At the same time, be prepared for periods of complete attenuation during rain fade.

In addition to causing attenuation, thermal radiation from raindrops increases the earth station antenna noise temperature. In other words, not only is the signal attenuated, the noise level is increased as well, causing a "double-whammy" to the link's C/N_o .

Finally, an AM processor that combines technical excellence with format flexibility, ease of operation, and bottom line results.

The Cutting Edge Unity AM is a complete, multi-band AM processor designed to make your station stand out on the dial. While Frank Foti uses the same processing sections as his Unity 2000i FM processor, he has specially tailored the Unity AM to suit AM's unique characteristics.

Processing includes a selectable Broadband AGC, selectable Phase Rotator, adjustable low-frequency Bass Enhancer, four-band Processor/Leveler, four-band multiple time constant Limiter, and final Limiter. The use of feed-forward processing allows the Unity AM to process more consistently at all levels. The result is a more open, realistic sound with greater perceived loudness.

Frank has provided presets for a number of formats and programming requirements, including Talk and News, Country, CHR, and more. These are just starting points for your processing adjustments, as there are fifty user memory locations that can be compared by merely pushing a button.

The Unity AM's user menus are logically arranged to be learned in minutes. The easy-to-interpret set-up metering in the Processing Display allows you to see the activity of all processing functions so that you can determine the overall effect of any changes you make.

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Exhibitor Directory

The 1994 Exhibitor Directory is a listing of information provided by exhibitors who responded to an RW NAB questionnaire. Past and potential NAB exhibitors were asked about new and established products scheduled to be shown at NAB this year. Questionnaires returned by the deadline are included here. TBD for booth number means a booth assignment had not yet been made.

COMPANY **BOOTH #**

360 Systems **5420**
Introducing: The DigiCart/TC, a random access digital audio hard disk recorder designed for SMPTE time code synch applications between video and audio.
Also: The DigiCart II digital audio recorder and the A16/B audio routing switcher.
Contact: Doug Leighton, Marketing Manager
18740 Oxnard Street
Tarzana, Calif. 91356
818-342-3127

3M **16605**
On display: The 908 analog recording master tape for Nagra recorders, featuring 75 dB signal-to-noise ratio, and line of recording media.



A-Ware Software **5120**
On display: MusicMaster scheduling and music maintenance system, which interfaces with almost any automation and traffic system. Also Closeline, a school and business closing management system.
Contact: Joe Knapp
A-Ware Software, Inc.
22600 Arcadian Avenue
Waukesha, WI 53186
414-521-2890

Acoustic Systems **12807**
On display: Modular broadcast/recording enclosures including the BB/Econoline and BB/Proline series of voice-over booths.

AEQ **2300**
On display: The Management of Audio Systems (MAR) digital audio workstation and storage device. Company line of studio gear, including power amplifiers, audio monitors, consoles, portable mixers and telephone hybrids.
Contact: Gerard Vargas
AEQ
2211 South 48th Street, Suite H
Tempe, AZ 85282-1008
602-431-0334

AIR corp Systems **3926**
Introducing: AIR cart.mo digital cartridge machine. A digital replacement for analog cart machines. Featuring non-compressed audio at a 48 kHz sampling rate. AIR cart.mo uses removable 3.5 inch Magneto-Optical discs.

Akai **4602**
On display: The DR4d self-contained four-track hard disk recorder and DD1000i re-writeable magneto optical recorder, both now utilized in broadcast and radio production environments. Other products will include the S-Series of digital samplers.

AKG/Orban/dbx **2806**
Introducing: The Orban DSE 7000 digital audio workstation and the Optimod-FM 8200 digital processor. AKG's new C3000 microphone, designed for radio announcers, also will be in the booth.
Contact: Amy Herndon
1525 Alvarado St.
San Leandro, CA 94577
510-351-3500

Altronic Research **2700**
Introducing: The model 67150 150 kW medium wave, air-cooled dummy load, processor-based calorimetry system for air or water systems, and the Model 6700 and 0700 series of dummy loads.
Contact: Doug Starkey
P.O. Box 249
Yellville, AR 72687
501-449-4093

Andrew Corp. **15674**
On display: The MR-050 Series DryLine Dehydrators, SD-002 Series Static Dessicators, IEC connectors for HELIAX, VALUFLEX HELIAX jumper cable assemblies, and 3M Cold Shrink weather-proofing kits.
Contact: Bobbi Rick
10500 W. 153rd St.
Orlando Park, IL 60462
800-255-1479

ASACA **16619**
On display: Audio analyzers, switchers, magneto optical recorder and other audio equipment.

Aphex Systems **3924**
Introducing: Expander Gate Model 622, featuring Logic-Assisted Gate circuitry. Four-channel Logic-Assisted Gate Model 105, featuring VCA 1001 for pristine audio quality and high-speed performance. Easyrider four-channel compressor Model 106.
Also: Audiophile AirChain, including the Compellor Model 320, aural exciter type C2 with Big Bottom Model 104, Dominator II Model 720 and Digidoder. Full line of professional audio processing equipment.
Contact: Chrissy McDaniels, Sales Coord.
11068 Randall St.
Sun Valley, CA 91352
818-767-2929

Arrakis Systems **2412**
Introducing: MixStar consoles, including the 22,000 20- and 30-input modular consoles; the 1,200-5S compact, five-input console; 1,200-10-S 10-input console; and the 1,200-TRT four-channel turret for news/talk operation. Deskstar furniture line.
Also: DigiLink digital audio system. TrakStar digital audio editor. 12,000 Series consoles.
Contact: David Burns
214 South 19th St.
Richmond, IN 47374
317-935-7087

ATI **13603-13604**
Introducing: The Nanoamp Series of low-cost utility amplifiers, which includes expandable mixers, microphone, and line amps. Also: The MicroAmp and Encore Series of amplifiers.
Contact: Ed Mullin
328 W. Maple Avenue
Horsham, PA 19044
215-443-0330

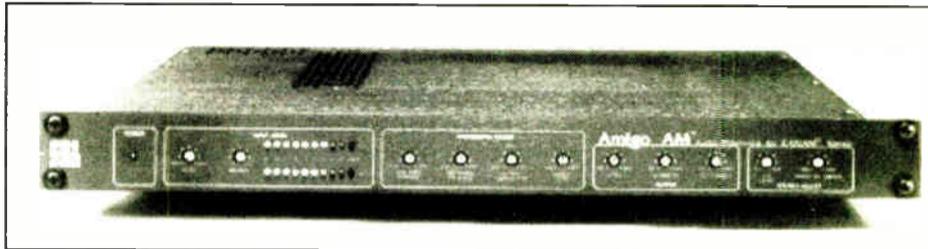
ASC Audio Video Corp. **19753**
Introducing: The Virtual Recorder, a digital random access replacement for VTRs, in combination with commercial spot insertion systems and audio workstations.

Audi-Cord Corp. **3926**
On display: Full line of DL Series NAB cartridge machines, available in either mono or stereo configurations. Dual recorder reproducer for simultaneous recording or cartridge copying.
Contact: Andy Rector
1845 W. Hovey Ave.
Normal, IL 61761
309-452-9461

Audio Accessories **13041-13042**
The company will show its audio panels, jacks, patch panels and cords.

Audio Precision **3402**
Introducing: An improved bit-rate digital encoder/decoder testing software.
Also: The Systems One, System One Plus DSP, and Portable One Plus.
Contact: Tom Minter
P.O. Box 2209
Beaverton, OR 97075-3070
800-231-7350

Auditronics **2302**
Introducing: The Destiny 2000 on-air management console for use with hard disk storage.
Also: The Airmaster 90 on-air console, 210 Series, and 800 series.
Contact: Murray Shields
3750 Old Getwell Rd.
Memphis, TN 38118
901-362-1350



CRL's Amigo AM

Audio Services **4506**
Introducing: The DK Audio MSD-550 Master Stereo Display.
Also: The Fostex PD-2 portable DAT, and TASCAM DA-88.

APT **4306**
Introducing: The Pro-link, which combines an ISDN terminal adapter with six channel I-MUX.
Also: The DSM100 digital audio transceiver, ACE 100 Series of PC and Macintosh expansion cards, and X-console.
Contact: Steve Cheung
Edgewater Road
Belfast BT3 9JQ
Northern Ireland
0232-371110

Audiopak Inc. **4018**
On display: NAB standard continuous-loop audio carts, including A-2, AA-3 and AA-4 for the recording and broadcast of spots, jingles, announcements and music. Lubricated audio tape for use in all types of endless loop cartridges and cassettes, including Formulas 605, 613 and 614.
Contact: Gordon Stafford
P.O. Box 3100
Winchester, VA 22604
703-667-8125

Audio Developments **16125/16225**
Introducing: The ADO62 and AD145 location and edit mixers. AD081 Flexi Link Systems and ADO150 Series 19-inch 1U studio rack equipment.

Autogram Corp. **4520-2**
On display: MM-8A and MM-12A low-cost 8 slide pot audio console. PM 1032, part of the Pacemaker Series of 6, 8, 10 and 16 slide pot consoles. R/TV-20 top-of-the-line slide pot audio console.
Contact: Ernest T. Ankele Jr.
1500 Capital Ave.
Plano, TX 75074
800-327-6901

AVCOM **11607**
Introducing: The BNG-1#00A broadband noise generator that can be used with spectrum analyzers.
Also: The GAE-1575 GPS antenna extension.
Contact: Charles Odom
500 Southlake Blvd.
Richmond, VA 23236
804-794-2500



BASYS Automation Systems **19247**
Introducing: The NetStation for Windows, a PC-based newsroom system workstation.
Also: The D-Cart digital audio record, edit and playback system.
Contact: Kristin Schleiter
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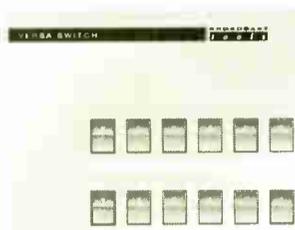
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FAX 716 765 9330

READER SERVICE NO. 47

NEW! Composite Audio DA and Switcher!



APPLICATIONS

- Switching Between Composite STL's
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- Feed Up to 3 Transmitters with Identical Audio
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- Non-Intrusive Composite Testing/Monitoring

FEATURES

- 2 Input Switcher
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918-437-3333 Fax 918-438-7322

READER SERVICE NO. 16



CD100 • X Compact Disc Adapter-Amplifier

Matches any consumer compact disc player or cassette deck to broadcast console input. Only \$99.00 FOB factory or from any broadcast dealer.

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Phone 209-298-6838 FAX 209-298-8270

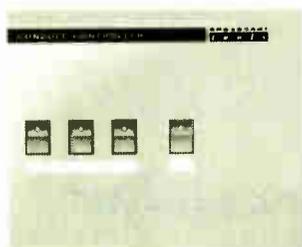
Turntable Parts/Felts
Russco, Collins TT-200, Sparta

READER SERVICE NO. 161

Realize the full potential of your MACKIE CR-1604

The Broadcast Tools Console Controller II allows users of a Mackie CR-1604 or virtually any MI type console to utilize many broadcast features at an incredibly low price.

- Turn mic & line inputs On/Off locally or remotely
- Switch between AIR signal and program audio
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- Activate ON-AIR light
- Start a Skimmer tape or cassette



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AUDIO
BROADCAST
GROUP

READER SERVICE NO. 52

Belar 2508
Introducing: A new digital FM stereo monitor analyzer.
Also: The Wizard modulation monitor and company's established line of products.
Contact: David Hirsch
119 Lancaster Avenue, P.O. Box 76
Devon, PA 19333-0076
610-687-5550

Benchmark Media Systems 11059
On display: The Jr. Audio Director Plus, an eight-input, two-output monitoring device; RGM-10 remote gain and metering control, AudioWorld Interface, MDA-101PA microphone preamp, DA-102M and DA-111 and DA-112 stereo distribution amplifiers.
Contact: Rory Rall
5925 Court Street Road
Syracuse, N.Y. 13206-1707
315-437-6300

BEXT 2414
Introducing: The SF Series of solid state MOSFET FM amplifiers from 100 to 1000 watts, and the LEX 25 programmable FM exciter.
Also: The line of FM amplifiers and STLs.
Contact: Dennis Pieri
739 Fifth Avenue
San Diego, CA 92101
619-239-8462

beyerdynamic Inc. 11315
Introducing: DT 190 sportscaster headset/microphone combo. DT 150 monitoring headphone. MC 834 large diaphragm condenser microphone for on-air voice work. MEM 86 set shotgun microphone system. MCE 50 Series miniature clip-on microphones. M424 control room talk-back microphone. VHF and UHF wireless microphone systems. NE 700 TE2 two-channel diversity receiver.

Broadcast Programming 1424-1425
Introducing: Digital AC Christian format on CD; Chartbreakers, monthly CD service; DigitaLease, package of digital automation equipment, researched formats and all necessary CDs to allow a station to become digital in one step at one price.

Bradley Broadcast 4002
On display: The Telos Zephyr digital transceiver that uses ISDN lines, and the Telos One-x-Six Talk Show System, a digital hybrid six-line phone console system. Other products will include Digidesign's Session 8 digital studio and the Audioarts line of broadcast mixing consoles.

Broadcast Electronics 3424
Introducing: The FM-3C 3 kW solid state FM transmitter, the D.A. Box digital audio storage system and the AV-100 networked digital audio storage system.
Also: The FM-1C 1 kW solid state FM transmitter; FM-30B 30 kW FM transmitter; AM-5 5 kW AM transmitter; RBDS; MT-90 12-channel console; AT-90 12-channel console; AV-100 digital audio storage system; CORE automation system; Sentry automation system and VMC-16 voice remote control system.
Contact: Kim Winking
4100 N. 24th St.
Quincy, IL 62301
217-224-9600

Broadcast Marketing International 19328-19329
New products to be displayed are: Kobold ENG 200 compact lighting system and Noriyuki time code equipment.

Broadcast Supply Worldwide 4820
On display: The Arrakis DigiLink and TrakStar systems as well as the KORG and DigiDesign digital workstations.
Contact: Tim Schwiager
7012 27th Street West
Tacoma, WA 98466
800-426-8434

Burk Technology 4818
Introducing: Software options for the ARC 16 transmitter remote control system.
Also: The LX-1 six-input stereo selector.
Contact: Phil Halter
7 Lomar Drive
Pepperell, MA 01463
508-433-8877

Cablewave Systems Inc. 15753
Introducing: Cablewave broadcast antenna pattern computer software for pattern viewing with database of product information. N and 7/16 DIN series cable connectors with improved water blocking design.
Also: Flexwell air and foam coaxial cables. Cablewave BU series of side-mount and top-mount broadcast antennas. Rigid line coaxial cables. CP-1000 and HP-1000 FM antennas.

California Amplifier 15383-5
Contact: Tom Ellsworth
460 Calle San Pablo
Camarillo, CA 93012
805-987-9000

Capitol/OGM Production Music 12905
On display: A full line of production music for contemporary markets including the new Archives line.

CBSI 1624
Introducing: Broadcast accounting and traffic department software including Design Financial reports, Custom Reports and PowerPlus. Also: The Classic and Elite Traffic and Billing systems, as well as the InterAcct. software.

CCA 4220
On display: The full line of AM, FM and shortwave broadcast transmitters as well as company's 60 watt FM exciter.
Contact: Steve McElroy
360 Bohannon Road
P.O. Box 426
Fairburn, GA 30213
404-964-3530

Central Tower 1906
On display: Antenna support towers, guyed towers and welded sections.

Clark Wire & Cable 19537-8
Introducing: Clark 1300 Series audio snakes. Hannay cable reels.
Also: Bulk audio and video cable and connectors. Remote composite cables, patchbays and terminated reels. OEM custom terminated cable assemblies and harnesses.
Contact: Julie Clark
151 S. Pflugsten Rd., #B
Deerfield, IL 60062
708-272-9889

Clear-Com Intercom Systems 18015
On display: AMS-1022 stereo audio monitor. Wired and wireless two, four, eight and 12 channel partyline intercom systems. Pro-40 lightweight headset product line. Matrix Plus II digital 100x100 central matrix intercom system.

CRL 3015
On display: The DAA-50 digital audio analyzer, a digital audio interface tool for analysis and decoding of AES/EBU and consumer digital audio signals. Other products include RBDS-SC-100 generator and the Real Time Event Sequencer.

Coaxial Dynamics Inc. 5116
Contact: John R. Ittel
15210 Industrial Pkwy.
Cleveland, OH 44135
216-267-2233

Cole Wire and Cable 10759 & 10859
On display: Cable and wire for audio and video. High voltage transmitter cable.

Comark 16113
On display: IOX TV transmitter lines, IOT and the S Series transmitters.

Communications Data Services 4019
On display: Data and computer applications for radio and GIS industries.

Comtech 13402-13403
Introducing: The EC8 microprocessor control system with optional IBM compatible software for control of the company's line of satellite antenna systems.

How to tame transmitter power problems.

WHR Series STABILINE® Voltage Regulators for AC power systems up to 660 volts.

Transmitters placed in remote, unattended locations such as mountain tops and wilderness areas depend on long utility power lines for service. Unfortunately, the lines often produce poor voltage regulation and other damaging power aberrations. Poor regulation can reduce power tube life by as much as 70% and the performance of associated equipment is similarly affected.

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Cost-effective WHR Series STABILINE® Voltage Regulators are the preferred choice of broadcasters worldwide for use with transmitters, receiving stations, studios and mobile production vehicles. These high power voltage regulators maintain constant voltage to your sensitive equipment even when the power line input voltage and system load vary widely.

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- Hold output voltage within ±1%
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- Designed for UL and CSA approvals

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- Tropicalization
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- High energy transient suppression
- Input voltage range alarm contacts



For Catalog WHR692 and to learn how WHR Series STABILINE® Voltage Regulators can be the solution to your power problems, write, fax or phone Ted Gladis at

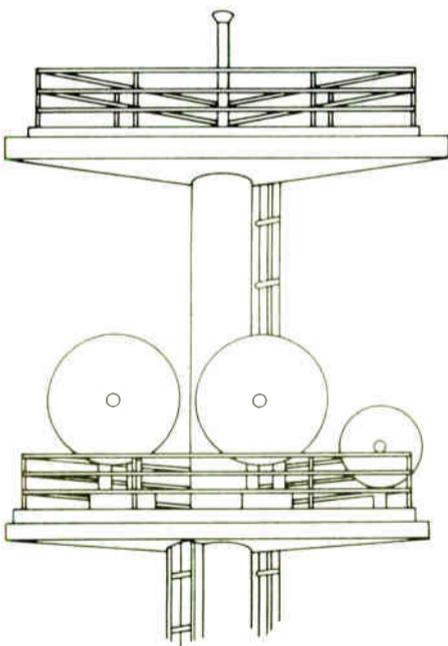
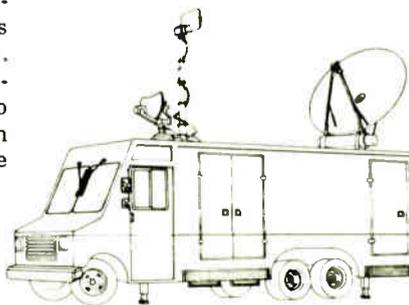
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— Ron Crockett, SHOOK ELECTRONICS



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— Steve McElroy, CCA ELECTRONICS



3-phase, 500 kVA WHR Series Voltage Regulator

Products & Services Showcase

For more information on the products shown below, circle the appropriate Reader Service No. (s) on the enclosed Subscription/Reader Service card or contact the advertiser directly.

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READER SERVICE NO. 158

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STAT-CAT

BOOTH 3704

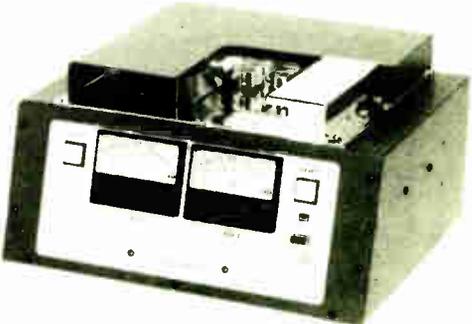
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READER SERVICE NO. 142

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Toll Free: 1-800-638-0977
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READER SERVICE NO. 124

Introducing (ta-da)
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 It's an 8 input to 2 output ON LINE or monitoring device.

\$550



The new Benchmark Jr. Audio Director Plus™ brings more to the party! It brings more control and selection features, and a stereo headphone amplifier, along with the performance and value that are traditionally a Benchmark for the industry.

In a half wide, 1RU high chassis, the Jr. Plus has two input switch banks which allow left and right outputs to select between eight sources. Additional switches provide a Mono Mix, with adjustable gain reduction of 3 to 6 dB, and a Right Channel Polarity reversal. LEDs indicate switch action. Inputs may be passively mixed ahead of the input amp by depressing two or more buttons.

Installation is "instant" with a No-Mod™ Rack Mount adapter and plugable Euro-Style barrier strips.

Benchmark
 the measure of excellence

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READER SERVICE NO. 188

Finally!
An affordable routing switcher.

- 6 balanced stereo inputs/outputs
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- Status display on front panel switches
- Audio connections via wire captive terminal strips



Applications

- Console input expander
- Studio switcher
- Source equipment input/output selection
- Composite/SCA audio switching
- Remote control studio and EBS operation

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GPS MASTER CLOCK/TIME CODE GENERATOR
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Locked to the Atomic Clock in the Global Positioning Satellite System, you can have time, date and time code within nanoseconds of UTC, anywhere in the world!!

ES-185 **\$2495.00**



STANDARD FEATURES INCLUDE:

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OPTIONAL FEATURES INCLUDE:

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- Video Sync-Generator

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READER SERVICE NO. 116

Comrex 12206
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 Also: Established lines including 7.5 kHz digital audio codecs.
 Contact: Lynn Distler
 65 Nonset Path
 Acton, MA 01720

Connectronics 13628
 On display: Line of audio and video cables including JB9600 Easy-Wired TT Patchbays and XB range of modular patchbays.



Crown's CM-312

Comstream 4000
 Introducing: A desktop version of its ABR75B satellite digital audio receiver that is suited for business music applications.
 Also: The ABR 200 and ABR75/75B integrated receivers.

Cortana 3704
 On display: Stati-Cat lightning prevention system.
 Contact: David Stockmar
 P.O. Box 2548
 Farmington, NM 87499
 505-325-5336

Crown International Inc. 4400-3
 Introducing: CM-312 head-worn microphone.
 Also: Line of Crown microphones and amplifiers for broadcast purposes.
 Contact: Bob Herrold
 1718 W. Mishawaka Rd.
 Elkhart, IN 46517
 219-294-8000

CTE International Srl
 Contact: Enrico Antoniazzi, Comm. Dept. Mgr.
 Via R. Sevardi, 7
 42010 Mancasale
 Reggio Emilia, Italy
 39-522-516660

Cutting Edge Technologies 5200
 Introducing: New Unity Remote Software, Unity AM processor and will demonstrate the Unity 2000i FM processor. The new VIP-voice processor also will be shown as will the Dividend Composite Filter.
 Contact: Danielle Cline
 2101 Superior Avenue
 Cleveland, OH 44114
 216-241-3343



Dalet 3803
 Introducing: Ednews news editing software. Traffic scheduling system.
 Also: Cart replacement, satellite automation, non-destructive audio editing and walk-away music automation digital audio systems.

Dataworld Inc. 1918
 Introducing: Customized maps, including international.
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 Contact: Jack Neff
 4827 Rugby Ave., Ste. 200
 Bethesda, MD 20814
 301-652-8822

Dawn Satellite Inc. 17779
 Contact: Rose Prete
 1190 S. Lapeer Rd., Ste. 100
 Oxford, MI 48371
 313-969-0010

DB Elettronica TBD
 On display: TD4/16 and RD4/16 16-bit digital decoders. Vivaldi digital stereo coder. PE 21 FM exciter for new analog and digital audio processors. PM 100/PM 250 FM exciter. KN 500/KN 1000 FM solid state amplifier. DCV Series STL translator.

Delta Electronics TBD
 On display: The Delta Splatter Monitor, as well as the ASE-2 AM stereo exciter, ASM-1 AM stereo monitor, OIB-1, OIB-3, and CPB-1,1A impedance bridges, RG-4 receiver/generator, TCA RF ammeters, 6730E, 6740B transfer switches, AAM-1 analog antenna monitor and PRH-1 high power pulse reflectometer.
 Contact: Joseph S. Novak
 Delta Electronics
 5730 General Washington Dr.
 Alexandria, VA 22312
 703-354-3350

Denon America 4303-4
 Contact: Michael Stelts
 222 New Rd.
 Parsippany, NJ 07054
 201-882-7460

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 Introducing: Beta Cam SP metal particle tapes.
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 Teaneck, NJ 07666
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Dielectric Communications 15719
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 Contact: Jay S. Martin
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 207-655-4555

Dolby Laboratories Inc. 1620
 Introducing: Four-channel DSTL® digital aural STL system. AC-3 digital audio coding. DP521 codec for AC-3 coding. DP501 codec for AC-2 coding.
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 Contact: Kevinn Tam
 100 Potrero Ave.
 San Francisco, CA 94103
 415-558-0200

Dorough Electronics 18815
 On display: Audio Level Meters. Stereo Signal Test Model 1200.

Econco 2210
 On display: Rebuilt power tubes and klystrons for radio and TV transmitters.
 Contact: Debbie Baker
 1318 Commerce Ave.
 Woodland, CA 95776
 800-532-6626

Continental 3418
 On display: Full line of broadcast transmitters and other RF equipment. New product information was not available at presstime.
 Contact: Steve Claterbaugh
 P.O. Box 270879
 Dallas, TX 75227
 214-381-4949

Corporate Computer Systems (CCS) 4826
 Introducing: The CDQ2001 MUSICAM codec, an enhanced version of the CDQ2000, with 18 bit A/D converter.
 Also: The CDQ1000, CDQ2000 and the PACE MUSICAM digital audio editor.
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 Holmdel, N.J. 07733
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Contact: Monty Smith
P.O. Box 84583
Seattle, WA 98124
800-323-2972

ENCO Systems Inc. 5121-5122
On display: DAD486x digital audio delivery system.
Contact: Larry Lamoray
1866 Craigshire Dr.
St. Louis, MO 63146
314-453-0060

Eventide Inc. 4809-10
Introducing: H3000-D/SX Studio Dynamic Ultra-Harmonizer. H3000-D/SE Studio Enhanced Dynamic Ultra-Harmonizer with new 3D speaker-based spatial imaging effects.
Also: DSP4000 Ultra-Harmonizer. VR240 digital broadcast logger. BD980 broadcast delay.
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Hudson, NY 12534
518-828-1690

ESE 12808-12809
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Also: master clock systems, clocks and timers. Time code products. Audio and video distribution amplifiers. Audio level indicators and interfaces.
Contact: Brian Way
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310-322-2136

Elenos SRL 1024
On display: SF series amplifiers based on MOSFET solid state technology. Range of radio broadcasting products including FM power amplifiers, exciters, radio links, filters combiners, aeriels, remote control RF diagnostics.

f.g

FM Systems 19528
Introducing: ALM 771 audio level master.
Also: AVM audio volume meter. AMM audio modulation meter.

Faraday Technology Ltd. 19123-19124
On display: Video filters. Video delay lines. Cable Clone for testing integrity of serial digital signals.

Fidelipac Corp. 1920
On display: Air Marshal digital hard disk system. MX E Series console. Dynamax SRC digital audio sample rate converter.
Contact: Bob McNeill
97 Foster Rd.
Moorestown, NJ 08057
609-235-3900

Focal Press 13404-13405
On display: Books about broadcasting.

Fostex 19185
Contact: David Oren
15431 Blackburn Ave.
Norwalk, CA 90650
310-921-1112

FRESH/The Music Library 2000
On display: TBA

Garner Industries 13622-13623
Introducing: Model CF 750 Type II/IIA extended range degausser.
Also: Line of tape erasers for all formats.

Gentner Communications Corp. 2612
Introducing: G2500 and G3200 telephone Superhybrids. TC-101 telephone interface. ET-100 Personal Teleconferencer.
Also: Line of telephone interface products including couplers, hybrids, call directors and audio bandwidth extenders. VRC-2000 remote control system. Audio routing and distribution products. On-air audio processing equipment. Teleconferencing products and services. Assistive Listening System for ADA compliance in public buildings.
Contact: Elaine Jones
1825 Research Way
Salt Lake City, UT 84119
801-975-7200

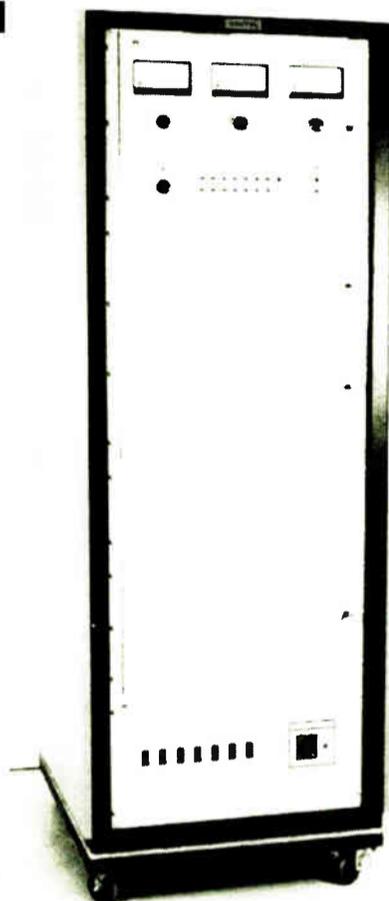
Gorman Redlich Mfg. Co. 4812
On display: Off-site EBS monitor. Models CM and CMR digital antenna monitor. Model CEB EBS encoder-decoder.
Contact: James T. Gorman
257 W. Union St.
Athens, OH 45701
614-593-3150

Graham-Patten Systems Inc. 11551
On display: D/ESAM® 800 and D/ESAM 400 digital edit suite audio mixers.

h,i,j

Halland Broadcast Services Inc. 3700
Introducing: Halland's Country Hits CD music library. The Nineties AC/CHR library update.
Also: The Seventies AC/Gold CD library. Rock 'n' Roll Graffiti Oldies library. The Eighties Plus AC/CHR library.
Contact: Steve Steinberg
1289 East Alosta Ave.
Glendora, CA 91740
818-963-6300

Hallikainen & Friends 1712
Introducing: DRC200 transmitter control system software update. Election Central software.
Also: DRC190 transmitter control system. TEL 171 digital telemetry adaptor. ITO178 board and software for controlling a Moseley TRC-15A with a TEL 171. TVA series of audio mixers.
Contact: Harold Hallikainen
141 Suburban Road, Building E4
San Luis Obispo, CA 93401-7590



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Nautel Maine Inc.
201 Target Industrial Circle
Bangor, Maine 04401 U.S.A.



Harris Allied 2218
 Introducing: Harris Quest 1 FM transmitter. AIRcart digital cart machine. Audisk. Cylind S-Band spread spectrum modems. ENCO DAD486x digital audio delivery system. Gentner telephone hybrids. Mini Disc recorders/players. nVision digital interface products. Orban DSE-7000. RE America digital audio codecs.
 Also: Harris Platinum Series® PT 10FM transmitter. Digit™ digital FM exciter. Harris DX 10 and DX 100 digital solid state MW transmitters. Harris AMS-G1 C-QUAM® stereo exciter. Harris HT 10FM and HT 35FM FM transmitters. Audio-Metrics CD-10 CD cart player. Tascam DA-88. Roland DM-80. Auditorics consoles. RE America RDS/RBDS equipment. Harris Allied radio studio systems.
 Contact: Martha Rapp
 3200 Wisnann Lane
 P.O. Box 4290
 Quincy, IL 62305-4290
 217-222-8200

Henry Engineering 3700
 Introducing: Fast Trac II voice-over audio workstation. Stereoswitch three-input stereo line switcher.
 Also: Matchbox. Telephone Information System. USDA. Twinmatch. Micromixer. Logiconverter. MixMinus-Plus. Superelay.
 Contact: Hank Landsberg
 503 Key Vista Drive
 Sierra Madre, CA 91024
 818-355-3656

HHB Communications 1403
 Introducing: New recording media product and an addition to the company's CEDAR range of audio restoration products, among other new products.
 Also: The PORTADAT range of portable DAT recorders, featuring 4-head, 4-motor transports derived from DDS technology. The advanced media products range of HHB DAT tape, and the CEDAR DC-1 de-clicker, the CR-1 de-crackler, featuring buzz removal and distortion reduction as well as the CEDAR II production system. The HHB CDR Indexer, and the ATC range of studio control monitors and the Coles line of mics.

Holiday Industries Inc. 3920
 On display: RF and MW instrumentation and EMF meters.
 Contact: Michael Leighton
 14825 Martin Dr.
 Eden Prairie, MN 55344
 612-934-4920

IDB Broadcast 5226 & 5227
 On display: Information on company's 15 kHz Switched 56 Digital Sports Interconnect Transmission services. Also 3D2 - direct digital audio, high quality audio transmissions for recording studios.

Inovonics 2306 - 2308
 Introducing: Operational RBDS display.
 Also: Line of audio recording, signal processing and instrumentation equipment for broadcast, including the Model 530 FM modulation monitor, "Sentinel" all-mode diagnostic receiver, and "David" FM processor/stereo coder.
 Contact: Jim Wood
 1305 Fair Ave.
 Santa Cruz, CA 95060
 408-458-0552

Intraplex Inc. 5118
 Introducing: The PT 350 and PR 350 are program audio transmitter and receiver modules that transmit in 16-bit linear uncompressed format. The Intralink STL+ is a fully integrated STL package for transmitting high quality, uncompressed linear stereo audio over T1 lines.
 Also: Line of high speed digital communications equipment.

International E-Z Up 5212-5213
 On display: World's Fastest Shelter free-standing canopy. Instant Shelter canopy.

International Tapetronics Corp. 1218
 Introducing: A series of enhancements to company's DigiCenter digital audio management system, including DigiCenter-EDITOR, an integrated multitrack waveform production editor operating on a workstation; DigiCenter-NEWS, a networked array of workstations offering collection, editing and management of both audio and text information for news applications; DigiCenter-PLUS, expanded networking capabilities for background file transfers, backups and maintenance, and the DigiCenter-LITE, a low-cost entry level system in a computer tower hardware platform.
 Also: The DigiCenter audio management system; digital program repeater, a solid state, full bandwidth mono recorder and reproducer; audio routing switcher with adjustable input levels, mono/stereo switching, various remote controls and RS 232/422 control; ITC Cart II cartridge machine, as well as the Delta and Series 99 cart machines and the ESL V, and Series 1 and 2 cart machines. ITC will offer remanufactured versions of all varieties of its cart machine line.
 Contact: Charlie Bates
 2425 South Main St.
 Bloomington, IL 61704
 309-828-1381

ITELCO S.p.A. 19414
 Introducing: New FM exciter-transceiver with output power from 100 W to 250 W. MOSFET amplifier, automatic power control built-in switched power supply and plug-in construction.

JBL Professional 15713
 introducing: MPA series amplifiers. SR6670A power amplifiers.
 Also: 4400A series studio monitors. Models 4206 and 4208 studio monitors.

J.N.S. Electronics Inc. 2306 - 2308
 On display: Digital audio program transmission equipment, including the D-Mux 500 series, a stereo or mono audio multiplexing systems using 16-bit technology for multiple 15 kHz, 7.5 kHz, or 3 kHz audio feeds, and the RFL-700 Series 1.5 to 2.3 GHz digital microwave link for D-Mux. Modular rack frames, including the 8000 Series "the Frame" modules for audio and video amplification and distribution, monitoring, switching, audio test, RF demodulation, off-air reception and program changeover functions. Audio routing systems, including the 8300 Series stereo to 100 X 1 and the 9000 Series, mono/stereo to over 100 X 100.
 Contact: John Leonard
 P.O. Box 325000
 San Jose, CA 95125
 408-729-3838

Jampro Antennas Inc. 1915
 Introducing: JCPD flat panel circularly polarized antenna. JADP cavity backed panel antenna. JIDC inter-digital combiner. JIDF inter-digital filter.
 Also: Penetrator series of FM antennas.
 Contact: Marlene D. Young
 6340 Sky Creek Dr.
 Sacramento, CA 95828
 916-383-1177

Jefferson Pilot Data Services Inc. 13811
 On display: JDS 2000/1000 broadcast management system that interfaces with traffic, billing, accounts and sales; BIAS, on-line integrated traffic sales, management and general accounting system; SALESLINE, sales management linking sales to traffic and accounting, and PC SESAMI, a PC-based avail system that provides proposals and research information.

k,l

Kintron Laboratories, Inc. 4824
 On display: AM/MW antenna matching networks. HF open wire transmission line switch. HF balun. HF open wire feedline. HF feedthrough panel. AM/MW multiplexed antenna systems and tuning units. Air-cooled dummy loads. AM/MW directional antenna phasing system. Open frame and vacuum RF contractors. Rigid transmission line. RF patch panels. Equipment racks. Isocouplers. Fixed and variable inductors. Meter jacks and plugs. Coaxial cable clamps. Static drain chokes. Lighting chokes.
 Contact: Tom King
 P.O. Box 845
 Bristol, TN 37621-0845
 615-878-3141

Klark Teknik 2412
 Introducing: DN3600 programmable graphic equalizer, a digitally controlled analog unit includes two special function keys that allow user to alternate between an EQ curve, relative fader position for channel A or B, or a combination.

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Korg Las Vegas Hilton—BSW 4820
 Introducing: Version 4 software for the SoundLink digital audio workstation & EDL Auto conform software.

Logitek Electronic Systems Inc. 3215
 Introducing: Super-VU precision bargraph audio meter with simultaneous display of loudness and peak levels with selectable functions including peak and maximum hold phase density and sum display; Crossfire II four-channel automated mixer, local or remote control levels and crossfades as well as RS 232/422 computer port; Serial Sound SS-SRC sample rate converter that accepts AES/EBU or S/PDIF data at ±50 percent of output sample rate.
 Also: On-air modular console with frame sizes that hold 6, 12 or 22 mixers. Mixer modules feature DCA faders. Optional RS-232 control.
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 Houston, TX 77057
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Introducing: Klark Teknik DN3600 stereo programmable graphic equalizer; DDA QII console, a true LCR (left, center, right) unit with choice of eight mono, stereo or four true LCR outputs. Also: Klark Teknik's 300 Series graphic and parametric equalizers. 400 Series parametric equalizers. 500 Series compressors and gates. 700 Series digital delays. 800 Series crossovers. DDA's QMR, PROFILE and INTERFACE consoles. MIDAS' XL3-16 broadcast remote console.

Marti Electronics 3918-3919
Introducing: STL-15C frequency agile composite STL link, now available in export frequencies from 150 MHz to 480 MHz. Also: STL-10 SCPS STL systems available from 150 MHz to 960 MHz. Systems for remote broadcast, the RPT-30, RPT-15 and RPT-2. Contact: Dan Rau 1501 N. Main St., P.O. Box 661 Cleburne, TX 76033 817-645-9163

Maxell Corp. of America 1661
On display: Professional audio and video products, including audio cassettes, R-DAT cassettes and reel-to-reel products. Product line includes 3/4-inch digital audio tape, optical disks and CD and CD-R.

McCurdy Radio Industries Ltd. 13111
On display: DCS 3000 DSP serial digital intercom system, using advanced technology to meet demanding local and network broadcast requirements. MICROCOMPACT digital intercom system for small mobile units and studios. M/2000 automation system. McCart digital audio storage and multi-channel playback system. UMD-32 tri-color 32-character under monitor display units. ATS-100 stereo audio test set. ATS 2656 stereo audio monitor with integral 6x1 switcher. UIO-80 universal interface unit for serial/parallel machine control interface. 9000 Series audio and video distribution amplifiers and accessories. Contact: Dan Kupiec 108 Carnforth Rd. Toronto, Ontario M4A 2L4 800-267-8800

Media Touch Systems Inc. 1006
Introducing: Media Touch digital audio editing program. Pick 'N Play studio control software package. "Auto-Record" workstation. Also: OpLOG live assist/automation control system. MediaDISK digital audio system. Contact: Jim Waterman 50 Northwestern Dr., Unit 11 Salem, NH 03079 603-893-5104

Modulation Sciences Inc. 11102-11104
Introducing: Software upgrade for Model RDS-1 RDS/RBDS encoder; RDS/RBDS data receiver. Also: RDS/RBDS coder, FM ModMinder, Modulation Monitor/analyzer, StereoMaxx spatial image enlarger, CP-803 composite processor, Sidekick audio and data subcarrier generators, DSCA-1 data SCA receiver, composite D/A, wired STL. Contact: Arthur Constantine 12A World's Fair Drive Somerset, NJ 08873 908-302-3090

Moseley Associates Inc. 2824
Introducing: The StarLink 9000, all-digital modular system for simplex/full duplex transmissions, including 13 Personality Modules. Two new options for the DSP 6000: ISO/MPEG source codec and built-in AES/EBU rate converter. Optional programmable intelligent coprocessor module and interfaces for VM 700A video analyser, satellite controllers and video/audio switchers for the MRC 2. Also: The MRC 2 transmitter control system, the MRC 1620 transmitter control system, the RPL 4000 remote pickup link system, the DSP 6000 digital audio codec for RF and T1 applications. Contact: Jamal Hamdani 111 Castilian Dr. Santa Barbara, CA 93117 805-968-9621

MYAT Inc. 4619-21
On display: Adjustable quarter wave stub second harmonic filter and line of rigid coaxial transmission line products and components. Contact: Robert Hilsdorf P.O. Box 425 380 Chestnut St. Norwood, NJ 07648 201-767-5380

Nady Systems Inc. 11327
Introducing: 950 GS UHF wireless microphone system, a wireless receiver, rack-mount true diversity frequency synthesis unit with selectable channels arranged in groups for easy access. Also: Line of established company wireless mic systems.

NAGRA Lysis 1213
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Nautel Maine Inc. 1912
Introducing: NE50 Digital FM Exciter uses direct digital synthesis (DDS) to generate the modulated FM carrier. NE50 accepts composite, mono and SCA inputs using a/d technique designed for ultra low-noise and distortion. Also: Company's full range of AMPFET Series AM and FM solid state transmitters. Contact: Jorgen Jensen 201 Target Industrial Cir. Bangor, ME 04401 902-823-2233

Nemal Electronics Inc. 13619
On display: Composite audio/video cables. Audio snake cables. Custom audio/video interface panels. Audio/video cable and patch cords. RF connectors and adaptors.

Neotek Corp. 2226-2227
On display: Esprit Series console system for broadcast production, offering eight aux busses and mix-minus from every input module. Mono/stereo configuration. Information will be available on company's line of consoles for multitrack recording, broadcast production and editing.

NPR Satellite Services 4807-8
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Neumann/Sennheiser 12136
Contact: Albert C. Zang, Jr. 6 Vista Dr. Old Lyme, CT 06371 203-424-9190

Neutrik USA 3906
Intro: NanoCon three-pole sub-miniature connector. Models NC3FX and NC3MX solderless/ screwless insulation displacement connectors. Model NJ*FD-V vertical 1/4" jack. Contact: James E. Cowan 195 Lehigh Ave. Lakewood, NJ 08701 908-901-9488

NVISION Inc. 20081
Introducing: NV1050 Four-channel Sample Rate Converter, accepts AES/EBU signal, sample rates 32-50 kHz. NV1055 Four-channel Digital Audio Mix/Minus and Routing Module. NV1060 Digital Audio Delay Compensator Module, provides up to 20 video fields (330 mS) of delay. Optional BNC/1-volt Digital I/O interfaces for NV1000, NV3064 and NV3512. Also: NV1000 modular terminal hardware. NV2000 digital audio transmission systems. NV3512 expandable digital routing switchers. NV3064 compact digital routing switchers. NV4448 sample rate converter. NV 5500/5200/5100 sync generators.

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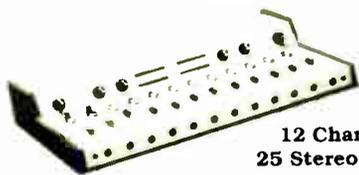
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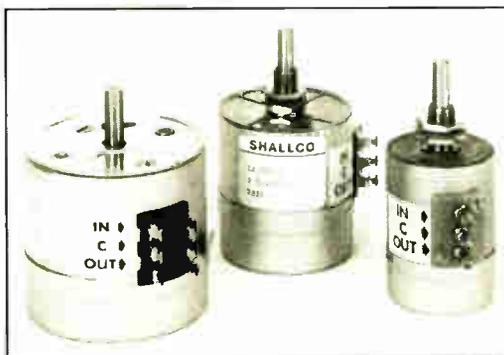


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Hollywood, CA 90028
800-828-6664

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Also: Omni-5000 5000 W AM broadcast transmitter.
Contact: John Solt
113 Dickerson Rd.
North Wales, PA 19454
215-699-2400

Otari Corp. 1209
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Contact: Deborah Bryce
378 Vintage Park Dr.
Foster City, CA 94404
415-341-5900

Pacific Recorders & Engineering 13047-9
Introducing: ADX Basic, streamlined version of company's ADX workstation.
On Display: ADX Digital Workstation. Turnkey broadcast systems. Studio furniture. Consoles. Peripherals.
Contact: Jim Miller
2070 Las Palmas Dr.
Carlsbad, CA 92009
619-348-3911

PanAmSat 15171
On display: Satellite transmission services.

Penny & Giles 4527
Introducing: MM16 MIDI Management System, real-time control for production/post-production applications. VCA16 Audio Control Module.
Also: PGF 8000 and 3000 Series linear faders. Analog and digital T bars. E-belt digital controllers.

Potomac Instruments 2310
Introducing: AA-51A automatic audio analyzer, compatible with test software on NAB CDs.
Also: AG-51 audio generator. FIM-41 AM field meter. FIM-71 VHF field meter. FIM-72A UHF field meter. 1900 antenna monitor. RC-164 remote control. 1500-PC remote control. SD-31 synthesizer detector. SMR-II AM monitor receiver. 1700 Series remote control interface products, including the 175-TLM tower light monitor.
Contact: David G. Harry
932 Philadelphia Ave.
Silver Spring, MD 20910
301-589-2662

Pristine Systems Inc. 3800
On display: Pristine digital control system for digital radio programming; uses Pioneer 6- and 18-slot CD players and Tascam DAT machines for music and Dolby AC-2 digital hard disk audio for commercials, promos, voicetracks, liners, etc. Music Plus music scheduling software.
Contact: Boyce Williams
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Professional Sound Corp. 5124-5
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Promusic Inc. 13148-9
On display: Promusic production music library of over 1,000 CDs, with an average of 15 new releases per month. The Match production music library. Digifects and Sound Ideas SFX library. The Big Whoosh, containing over 250 production elements.

Prophet Systems Inc. 5222
Introducing: CD and hard drive automation module & copy editing module for Wizard for Windows.
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Contact: Kevin Lockhart
111 W. Third St.
Ogallala, NE 69153
800-658-4403

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QEI Corp. 4218
Introducing: Digital remote pickup system. Digital transmitter-to-studio link. 675-B FM exciter.
Also: CAT-LINK digital STL/TSL featuring Q-MAX 16-bit digital discrete audio card and digital composite system cards. AUTOMOD closed-loop automatic gain control for FM. Solid state and single-tube FM transmitters at 10 W-30 kW.
Contact: Jeff R. Detweiler
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Williamstown, NJ 08094
800-334-9154

Radio Express TBD
Introducing: TM Century's HitDisc E, weekly compilation of new breakers in European hits and alternative music.
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Radio Design Labs 5406-7
Introducing: Additions to the "Stick-On" line of products, including ST-OSC2A and ST-OSC2B audio oscillators, ST-SX4 audio switcher and ST-RG-1 ramp generator with remote control.
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Contact: Jerry Clements
P.O. Box 1286
Carpinteria, CA 93014
805-684-5415

Radio Systems Inc. 3012
Introducing: DDS digital audio delivery system for on-air delivery, built on a multi-user operating sys.
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Contact: Daniel Braverman
601 Heron Dr.
Bridgeport, NJ 08014
609-467-8000

RE America 3801-2
Introducing: RE 4500 ETSI digital video codec. RE 660 MUSICAM encoder. RE 661 MUSICAM decoder. RE 532 RDS/RBDS encoder.
Also: RE 533 slim-profile RDS/RBDS encoder. RE 8720 tie line encoder. RE 8739 tie line decoder.
Contact: Andrew Bosworth
31029 Center Ridge Road
Westlake, OH 44145
216-871-7617

Register Data Systems 4508
Introducing: Windows-based traffic and billing system. Hard disk-based live-assist and music automation.
Also: Phantom digital audio automation system. PC-based traffic and billing software packages.
Contact: Brad Harrison
P.O. Box 980
Perry, GA 31069
800-521-5222 or 912-987-2501

Radio Computing Services Inc. 5202
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213-685-5141, ext. 338

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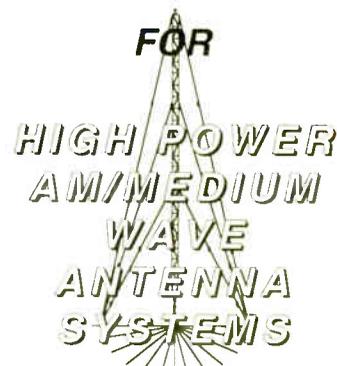
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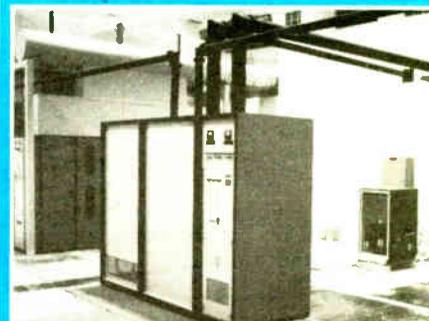
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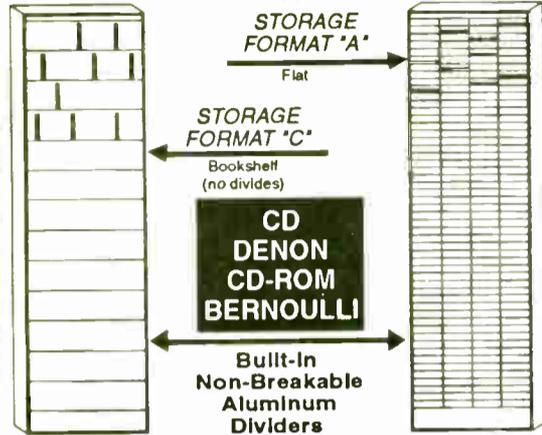
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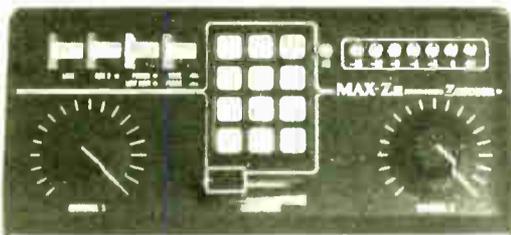


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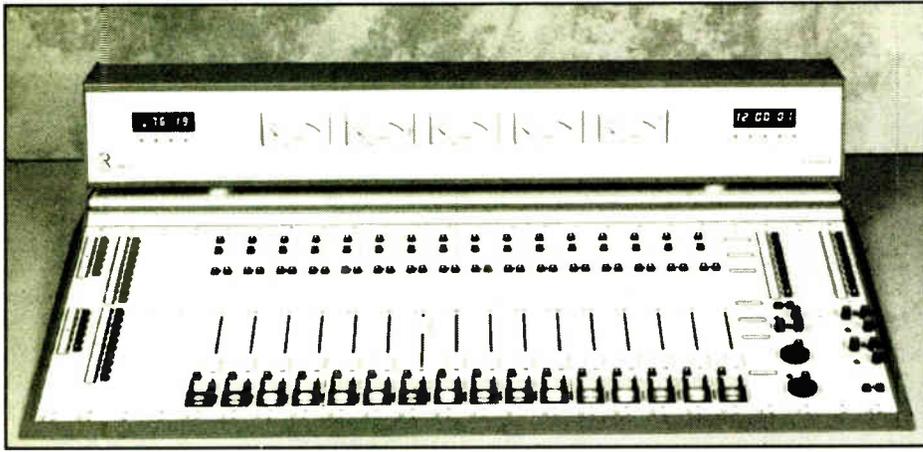
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Perma-Power S-102 amp w/S1420 batt pack, mobile/portable PA unit, 12 W out, excel cond, \$100. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

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Dynaco stereo 120 solid state, rack mt \$229. Dynaco stereo 70 tube amp all new tubes! Dynaco PAT 4 preamps \$59. W Gunn 619-320-0728.

Jampro JMPC-10 10 bay circular FM antenna on 107.1, new cond, stored inside, \$9500/BO. B Zellmer, 303-353-6522.

Want to Buy

WANTED:
 Pultec EQ's; Fairchild, Teletronix, dbx, UREI, Sontec Limiters. Neumann, Telefunken, AKG and RCA mics. MacIntosh or Marantz Gear; Lang, Neve and API gear. Misc old tubes and guitars.

DAN ALEXANDER AUDIO
 1340 Mission Street
 San Francisco, CA 94103
 (415) 252-7102
 FAX: (415) 252-7524

RCA/Dielectric BCF-6B antenna, 6 bay tuned to 90.5, \$4000, (6) radomes, \$1500. A Clawson, WFFF, 1715 Michigan St, Sturgeon Bay WI 54235. 414-743-7443.

Windcharger 200, 100', on ground, BO. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

ERI FMH-10AC 10 bay antenna, CP tuned to 105.5, \$19,500. M Wodlinger, WIXI, 3337 Tamiami Trail N, Naples FL 33940. 813-262-1000.

Phelps Dodge CFM-3, 3 bays, tuned to 98.3 MHz, gd cond w/heaters, \$1500. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

ANTENNAS/TOWERS/CABLES

Want to Sell

Phelps Dodge CFM-LP3 3 bay FM on 92.1 MHz, removed 12/93, \$2500/BO; Cablewave HCC158-50J, 1-5/8" air coax, approx 260', \$800/BO. G Reinheimer, WYYD, POB 4108, Lynchburg VA 24502. 804-237-4700.

Andrew EW63A waveguide w/ends, (2) new rolls, 75' & 140' in boxes, BO/trade. M Kestler, KAWZ, 241 Main Ave W, Twin Falls ID 83303. 208-733-3133.

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Designed and built for your frequency. Choose from 1 to 12 bays and five power levels. Financing available. Call Jimmie Joynt at S.W.R. **214-335-3425**

Andrews various 3" & 1 5/8" connectors, 100' of 3 1/8" Andrews line, (2) RF chokes Continental 814B + manual, BO; Continental ERI Rototiller tuned to 97.7, 3 bay, 1 5/8" lead, 1.5588 gain, BO/trade. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

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Andrew 5" air coax 500' on I-80 in Iowa, connectors incl, \$10000. R Henry, WPIO, 505 Josephine St, Titusville FL 32796. 407-267-3000.

MC1 61104 3 1/8" motorized coax switch, never arced, great shape, \$1000. C Hudak, WBZZ, 1715 Grandview Ave, Pittsburgh PA 15211. 412-381-8100.

Towers (5) 380', 24" & 30" face, complete w/lights, some addtl hardware, on ground, ready to ship. J McClish, WCRJ, POB 92251, Austin TX 78709. 800-856-5670.

Jampro 3-bay high gain antenna at 102.1, \$1500. E Seeger, WMXT, 2704 S Iby St, Florence SC 28505. 803-661-5000.

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 Bloomington, IL 61704

ERI 2CPLFM 2-bay w/radomes tuned to 91.5 MHz, \$2000. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

Eventide digital delay, excl cond electronically, scratch on top cover when removed from equip rack. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

ERI 37CP5 5-bay FM antenna, tuned to 93.7 MHz, recently rebuilt, \$1500; Myat 3" rigid transmission line, 20' lengths, incl bullets, hangers, some elbows avail, 320' avail, \$150/section. C Hudak, WBZZ, 1715 Grandview Ave, Pittsburgh PA 15211. 412-381-8100.

Sine Systems Stereo Watchdog, rides stereo balance, phase flip, subs loss of left or right chnl, \$425/BO. D Evans, KALW, 2576 Harrison, San Francisco CA 94110. 415-695-5740.

ERI G5CPM tuned to 96.7, 180' Andrew HJ5-50 7/8" line. A Clawson, WFFF, 1715 Michigan St, Sturgeon Bay WI 54235. 414-743-7443.

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4 or more bay antenna tuned to 90.1 MHz needed for educational FM upgrade. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

UREI 537 33 band graphic equalizers (3), gd cond, will sell separate or together, \$250/ea or 3/\$600. Jeff, 703-297-1188.

3-bay antenna tuned to 90.7 MHz, no radomes. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055. 405-658-2556.

Wanted: used towers, beacons and side lights. Phone (901) 286-8100; FAX (901) 286-5600.

AUDIO PRODUCTION

Want to Sell

Demeter 4 ch rack mt tube direct box NEW \$795. W Gunn 619-320-0728.

Digidesign Audiomedia I digital recdg & editing system, analog in & out, stereo w/Audiomedia Vol 2 software & deck I 4-trk automated mix software, manuals. J O'Leary, 1717 Euclid St NW, Washington DC 20009. 202-332-8377.

Eventide BD-941 bdct delay line w/3.6 or 12 second delay, \$850. R Chambers, 916-257-2121.

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1305-F Seminole Trail Charlottesville VA 22901

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Marantz PMD-500 motorized stereo cassette deck	NEW	\$ 419
Valley 610 Stereo Compressor/Limiter	Rebuilt	\$ 395
Marti VHF RPU Package (RTP-30/CR-10)	Rebuilt	\$ 1,995
Harris AM-90 AM MOD Monitor (current model)	NEW	\$ 995
Harris CC-II Mono RP Cart Machine - Closeout -	Rebuilt	\$ 395
Otari MTR-10 Reel to Reel	Rebuilt	\$ 2,995

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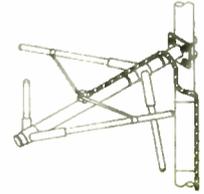
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AUDIO PRODUCTION...WTS

Ashly SG35E 4-chnl noise gates (4), \$225/ea. J Anderson, Regent Univ, 1000 Centerville Tpke, Vir Bch VA 23464. 804-523-7417.

Pultec HLF-3C filter, \$125. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

Valley 400 mic processor, like new cond, \$400 plus shpg; Ashley PQ-26 stereo parametric six band EQ, excel cond, \$425 plus shpg; BBE 442 audio enhancer, excel cond, \$150 plus shpg. S Herring, Matt-Mark Audio Prod, 4709 N Cleveland, Kansas City MO 64117. 816-452-7260.

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Micro-Trak 7216 stereo audio DA, 2 in 12 out in 1-3/4" rack mount, individual output controls for ea output (4), \$150 ea. S West, KMXR, 1 Gaslight Sq, Corpus Christi TX 78404. 512-886-6153.

ADC 96 & 144 Pr TT patchbays, excel cond, 1 rack space, 3 rows of 48, top 2 rows normalled, \$149, 96 is 2 row normalled, \$129 (you remove old wiring) or we totally refurbish w/new front panel, ready to install, \$199-229. TT cords up to 10 per bay at \$9 ea, reg \$13.95, also 1/4" bays. Audio Village, 619-320-0728, or Fax 619-320-2454.

dbx 180A type I NR (3), \$35 ea; dbx 224X type II NR (2), \$25 ea; CRL CC300A composite controller, \$35; CRL SMC 600A stereo mod controller, \$30. M Everhart, KXYQ, 111 SW 5th #1550, Portland OR 97204. 503-226-6731.

Want to Buy

Audio level control equipment. J Mitchell, CVPI, POB 1046, Alexander City AL 35010. 205-234-0426.

Fairchild 600 conac or 602 Conex high freq limiters. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

AUTOMATION EQUIPMENT

Want to Sell

Smartcaster 8K mono, will interface w/satellite, (2) 60 MEG hard drives, \$3900. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

SMC MSP-1 automation system, complete w/(4) Otari ARS-1000, (3) 350RSB Carousels, SMC 712 dual cart player, universal interface, all in 3 matching SMC custom deluxe racks, manuals, in operation, \$6000/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

Schafer Series 7000 w/(4) Audiofiles, (2) R-R, (3) racks, unknown cond, gd for parts, BO. G Reinmeimer, WYYD, POB 4108, Lynchburg VA 24502. 804-237-4700.

Harris 9001 automation w/(2) Otari ARS-1000, (2) IGM 24 Go-Carts, (2) single play ITC cart decks; also second system for spares or standby w/Brain, switcher, pwr supply, terminal, keyboard & manuals, \$4000/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

IGM-SW automation cntrlr, IGM update w/4 Go-Cart 24 interfaces, manuals & software, \$1800. E Duellman, WONT/WQTC, Box 1385, Manitowoc WI 54221. 414-682-0351.

SMC 452 bi-directional, stereo Carousels, \$800 ea. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Scully automated system, useful for non-commercial AM/FM, BO. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

Format Sentry FS12 C, 48 tray IGM Instacart, (4) ITC R-R plybcks, 1000 SL Tandy computer, DMP Tandy printer, DRS uninterruptible power supply, Spotmaster R/P machine with 25Hz tone alert & (2) 6' racks to mount, excellent condition, will sacrifice for what is owed on equipment, will consider selling all or part of equip. A Terry, 703-647-8493.

SMC DP-2 complete system. D Barron, KWJM, 113 N Main, Farmerville LA 71341. 318-368-3094.

SMC automation system, w/SPP 3060 stepper, AS-10 switcher, time clock, (2) 700 Series single play cart decks, (3) Carousels w/(3) RAC-50 random access controllers, (4) Scully 270 tape decks w/outboard tone sensors, all in (4) matching racks, \$1200. B Williams, KOOL 106.1, 918-455-9522.

Sentry Systems cntrlr/interface w/16 Pioneer PD TM3 CD plyrs, XT computer, complete AC CD library & Computer Concepts DCS, all under 1 yr old, \$26K or sep. M Rollings, Rollings Comm, POB 882, Chesterfield MO 63006. 314-458-5595.

Want to Buy

Complete studio w/(2) R-R, (2) cassette, (2) CDs, mics, console, automation equipment, etc, must be in good condition, missionary station, \$3000 plus donation receipt for the difference. K Leatherwood, Believers Bdctg, POB 1776, Terrell TX 75160. 214-524-1956.

Conex 25 Hz tone gen. Howard, KDAP, Douglas AZ 85609. 602-364-3484.

Time announce carts. D Tabor, WLCK, Box 158, Scottsville KY 42164. 502-237-3149.

CART MACHINES

Want to Sell

Harris triple deck stereo cart machine, totally recon, looks/operates like new w/all connectors, \$900. G Jones, SW Mediacast, 110 Sierra Rd, Kerrville TX 78028. 210-367-4587.

Audi-Cord DL Series (3) stereo play only, \$3500 ea, DL/RS R/P, \$900. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Audi-Cord DL series stereo R/PB, \$700/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

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ITC PD2 mono PR cart deck, mint cond, \$700. E Finley, Genesis 2000 Std, 4101 W Union Hills Dr, Glendale AZ 85308. 602-978-8092.

Rapid Q mono cart player, \$95. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

BE 5300C tripledeck, stereo, PB, mint less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Spotmaster 500 R/P (2), 1 excellent condition, \$500; 1 good condition, \$300 both mono, lever type, \$700/both. K Stevens, In House Audio, 5354 Cortez Ct, Mobile AL 36609. 203-666-4232.



Great Prices on original equipment tape heads for ITC, BF, Fidelipac, Otari, Tascam & others!

Sparta 300 P mono cart mach w/1 kHz cue PB, home made rcd electronics, \$150/BO. R Perrine, Imagination Indust, 2475 State Rd Ste 22, Cuyahoga Falls OH 44223.

Fidelipac/Dynamex CTR-12 stereo-play w/all tones, never used on air, \$850. D Igou, KCHL, 8435 Twister Oaks, Garden Ridge TX 78266. 210-651-9049.

Want to Buy

ITC PD-II, need one R/P unit, one PB for simple newsroom operation, nothing fancy, no junk. A Sutton, WBCU, POB 70, Union SC 29379. 803-427-2411.

ITC Delta stereo P/B machines. D Irwin, KSOL, 55 Green St, #200, San Francisco CA 94111. 415-616-5768.

ITC, BE, Fidelipac cart machines: single, triple, mono, stereo, play & record/play. Call M O'Drobink @ 619-758-0888.

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Tascam 34B 4 trk R-R, all manuals, cables, roll-around stand, very little use, excel, \$650. A Selk, Selk Prod, 1391 Normandy Dr #1, Atlanta GA 30306. 404-876-8894.

Otari MX 5050, \$1800. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Telex 235 3:1 cassette duplicator, like new, \$650 plus shpg. S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9258.

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Uher 4200 Report Monitor, R-R stereo 1/2 trk portable, 3 hds, 4 speeds, new in box, \$500. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Tascam 32 1/4" 2 trk, excel cond, low hrs, \$500. R Maycock, RMC Consulting, 10245 Haledon Ave., Downey, CA 90241. 310-861-7624

Otari ARS-1000 (2), mint condition, Best Offer. J Kesler, WOBZ, POB 220, Livingston KY 40445. 606-843-9999.

Otari ARS 1000 (2) gd cond, w/25 Hz, \$400/ea. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

EMPLOYMENT

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

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Agree experience isn't only years, tapes? Hire Janet 502-895-5888. FT announcing, programming aspirations. Computer literate, in radio since 1980 PT announcing, mktg exper, serious only.

Radio dynamo seeks news job at medium mkt station, call for tape. M Kunkle, 814-226-9259 or 412-744-3270.

Agree exper isn't only yrs, tapes? FT announcing, programming aspirations, computer literate, in radio since 1980 P/T announcing, mktg exper, serious only. Janet, 502-895-5888.

Custom Voice IDs, spots, breakers, promos, etc, 25 yr pro of Boston, NYC, Philly & DC. Write: JLC, Box 2733, Spring PA 19609.

Inside sales coordinator, 4 yrs exper, proven trk rcd, generate new business, past accounts, coordinate/schedule outside reps. Mark, Orange Co NY. 914-344-1118.

Creative air personality, producer & copy-writer seeks music intensive country station in midwest, 12 yrs exper. Tom, 319-568-2198.

Proven travel program personality writes, performs, produces ratings thru roof show, can handle callins, British accent. Phil, 408-866-8542.

Creative, fun radio is only a call away! Dedicated, exper air personality, recent morning gig w/prod skills, will relocate, AC/CHR/Oldies. Kevin, 609-863-1991.

Hands on Engineer with over 30 years of AM/FM/TV, MF/HF/UHF background, desires position with International SW bdctg facility, FCC Gen SBE Cert, IEEE, AE Degree. Lou, 904-383-8457.

Can do it all, experienced xmtr, studio & digital automation engineer seeking contract maintenance engineering work in north central Texas, FCC licensed/EET/certified. Dave, 214-410-1717.

Broadcast engineer with high power RF experience, instructor in training & safety skills, seeks career opportunity. Ed C, 207-732-5185.

Ready to go to work for your station, young prod man w/multi-media exper, willing to relocate, recent graduate. Brad, 405-329-5632.

20 year vet in radio announcing & some part time sales, seeks full time announcing in AR, OK, MO, KS, TX. Call after 5PM, 501-337-5249.

Arizona only, chief engineer, exper all phases of high pwr AM & FM, 20 yrs exper incl Top 50/100 mkts, dry warm climate, chief, group chief or contract. Send replies to: Radio World, POB 1214, Falls Church VA 22041. Attn: Box 94-01-26-01 RW.

Classic rock/holic looking for FT pos, on-air & prod, intemed at #1 classic rock station in nation, willing to relocate, temperate or mountlns. Eric, 405-329-1664.

Radio pro for htra, programming, mgmt, versatile. Roger, 615-235-6889.

Country music library comes with me, exper GM, PD & DJ in country music radio, I know country music. David, 407-981-0104.

Mama's Dead radio talk host David F Diamond is ready for new, major market. 901-761-5577.

Prod co seeking paid radio, TV narration assignments. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

Over 20 yrs exper in radio mgnt news & engineering, mostly in small or med mkts, seeks mgnt news or engineering pos in MO, AR or West TN. Bill, 816-461-5834.

Soon-to-be bdctg grad w/on-air, prod & sales exper seeks FT pos in May, great skills & desire. Shawn, 812-886-9729.

Combo Chief Engineer, announcer, sales, production, Tampa Bay area or other good coastal Florida location. Bill, 813-844-3823.

Research specialist seeking paid assignments. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

12 yr eng/prog/prod looking for exciting new pos in radio, exper at KITS, Live 105 in SF & KFAL classical in LA, will relocate. Bruce, 415-388-9005.

CE, NBN, FCC/Radar, CET, ISGCT cert seeks FT/PT pos or temp work TV/radio station, references avail upon request. M Rakoff, 114-41 Queens Blvd, Forest Hills NY 11375.

Exper Afro-Caribbean Christian broadcaster seeks announcer/prod or PD position with serious minded religious station in AK or SE region. Carlos, 305-674-1249.

Experienced jock, CHR background in NY market, great voice, quick wit, excellent board & production skills, will relocate, air check avail. Jim, 201-768-3709.

Former Christian grp GM avail, hands-on style, applications, acquisitions, engrg, sales, more. T Sauceman, 39297 Hwy 74, Gonzales LA. 504-647-8907.

Small mkt PD/announcer/news available, 8 years experience, top sound, dependable, hardworking, avai immed, will relocate. S Elliott, 904-757-6397.

If you master analog music tapes for radio stations & need more assistance, I have exper/equip. R Bass, 4100 O'Hare, Mesquite TX 75150-4454.

HELP WANTED

Community radio, Cape Cod, Mass seeks general manager with heavy emphasis on development skills. Three years broadcast management experience, familiarity with all aspects of radio, proven fundraising experience. Salary: \$25,000 with health insurance & incentives.

Apply by March 1, 1994 to:
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WOMR, POB 975,
 Provincetown MA 02657.
 Call Mitch: 508-487-2619
 for info packet.

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 1125 W Boone Ave., Nampa, ID 83651
BBS 1-208-467-4110

HELP WANTED

Coastal Southeast noncommercial FM in Progressive Format threatens to appear. Morning & afternoon slots open. Looking for low-key, high-knowledge sound. Send resume & tape to: DJ Search, 181 Edgemont Ave., Elmwood, CT 06110-1005

Ass't Engineer

KVOO in Tulsa OK needs a FT ass't engineer. Exper in AM directional & FM w/subcarriers helpful. Detailed studio maint exper a must & knowledge of digital computers. Old stable company w/great benefits. Part of Midwest chain. EOE. Send resume to: Larry White, KVOO, POB 52548, Tulsa OK 74152. No calls please!

Senior RF Engineer

Outstanding opportunity for motivated and highly qualified senior engineer. EE and PE desirable. Will perform and supervise FCC application and field engineering services. Broad theoretical and hands on skills in radio and TV transmitting facilities, cellular, microwave and land mobile systems. Excellent verbal and written communications essential. Willing to travel in US and abroad.

Marketing

Individual with strong engineering marketing background to develop and support business in the wireless communications area. Background from cellular, paging, broadcasting or related fields. Excellent writing and presentation skills essential. Active participation in project planning and implementation. Strong creative role in new products and services. Willing to travel. International experience and Spanish language capability desirable.

Resume to: HR, LBA Box 8026, Greenville, NC 27835

ABOUT OUR EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$60/column inch. Payment must accompany insert, use your MasterCard or VISA; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

POSITIONS WANTED: Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 2 issues of Radio World. Contact information will be provided, but if a blind box number is required, there is a \$10 fee which must be paid with the listing (there will be no invoicing). Responses will be forwarded to the listee, unopened.

Mail to: **BROADCAST EQUIPMENT EXCHANGE**
 PO Box 1214, Falls Church, VA 22041
 Attn: Simone Mullins

To **ADVERTISE:** call 800-336-3045

CASSETTES/R-R...WTS

Ampex 440 (4) wrkg mono machines, many spare parts, \$300/ea. D Kannes, KTAR/KKLT, 301 W Osborn Rd, Phoenix AZ 85013. 602-274-6200.

Otari MX 5050 MK III 2 trk, stereo, excel cond, \$1050; MCI JH 110A 2 trk 7.5-15-30 ips console mt, \$750; Scully 280-1 FT MT, \$350. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

Ampex AG440/350, several units, PB only, great for parts, BO; ITC 770 stereo PG, gd cond, \$650. R LaFore, WSHH, 1459 Crane Ave, Pittsburgh PA 15220. 412-531-9500.

Dictaphone 5600 logging reel machines & controller (2), BO. R LaFore, WSHH, 1459 Crane Ave, Pittsburgh PA 15220. 412-531-9500.

Scully 280 1/2 trk stereo w/motion sensing, in roll-around console, having trouble getting sufficient erase current to erase head, otherwise works fine, \$900. R Stopher, 3600 Kiki Ct, Louisville KY 40219. 502-969-1942.

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Fax (415) 341-7200

Otari Corp.
378 Vintage Pk. Dr.
Foster City, CA 94404

Ampex MM1200 8 trk remote, \$4500; Otari MTR10-2C stereo, \$3500; MCI Sony JH110B in console, \$1595; MCI Sony JH110A in console, gd cond \$1095; MCI JH110B mono, \$595; Ampex AG350 stereo, excel cond, \$495. J Price, 214-321-6576.

Akai GX 40000 1/4 trk, 3 head R-R (2), \$75 ea; Akai GX 9 3 motor 3 head cassette deck, \$50; Toshiba PC G30 2 motor 2 head cassette deck, \$30. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

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Revox A77 MK1 original A77 case w/speakers, 10" reel adaptors, 3 3/4" - 7 1/2" quarter trk, almost new, \$395/BO. D Bisbee, 685 S Roys, Columbus OH 43204. 614-279-6163.

Metrotech 525P R/R PB deck, stores w/2 preamps, \$300/BO. R Perrine, Imagination Indust, 2475 State Rd Ste 22, Cuyahoga Falls OH 44223.

Tascam 32-2, 7-15 ips, excellent condition, \$550/BO; Ampex ATR100 4 speed 1/4" with extra cards & alignment tapes, \$4000. Z Nicall, Semendria Studio, 6404 Hollywood Blvd #410, Hollywood CA 90028. 213-464-2145.

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Scully '100' recorders, record/play amplifiers, 8, 16, 24 track heads. Sequoia Electronics, 4646 Houndshaven Way, San Jose CA 95111. 408-363-1646.

Otari Mark II-IV 1/2" 4-track, multi-track, mint, less than 50 hours, Best Offer. R Kaufman, Pams Productions, POB 462247 Garland TX 75046. 214-271-7625, after 3PM CDT.

16 track 2" \$3450, MCI JH110C-8 \$2800, 110C-8 play only \$500, ATR800 mono or Tascam 7300 or 2502 \$600 ea, MCI Locator III \$1195, Tascam 52 2 trk \$1200, Ampex AG350 excel \$50/ch. W Gunn 619-320-0728.

Otari 5050 MK III-8 track, heads excellent, \$2450. Wayne Gunn 619-320-0728.

Recordex 6 cassette rewriter \$100; Tascam 40-4 4 trk 10" in flight case w/free dbx \$750; MRL new short test tapes \$39 for 1/4" to \$199 for 2". W Gunn 619-320-0728.

Want to Buy

Sony TCD-5M stereo cassette recorder in bad to fair condition for parts/salvage. J O'Leary, 1717 Euclid St NW, Washington DC 20009. 202-332-8377.

Any model splice finder-eraser, in working cond. B Sims, KVSF, 1311 Calue Nava, Santa Fe NM 97505. 505-982-2666.

Tascam 58 1/2" 8 trk wanted to buy or trade for Otari 5050 MK III-8 or...? Wayne Gunn 619-320-0728.

Ampex tube recorders and mixers. W Gunn, 619-320-0728.

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

Spotmaster TP-60B tape timers from cart tape winders (TP-1A or TP-1B). Mel Crosby, 408-363-1646.

CD PLAYERS

Want to Sell

Denon DN-950FA in excel cond, \$750. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

Audlometrics AMCD5-1000A multi-disk (100) CD players w/RS232 control interface (2) avail, new optics, \$1000 ea. J Stromquist, WNCB, 2828 Piedmont Ave, Duluth MN 55811. 218-722-3017.

Technics SL-P1200 (3) CD plyrs, all wrkg cond, \$800/ea. C Hudak, WBZZ, 1715 Grandview Ave, Pittsburgh PA 15211. 412-381-8100.

Denon DN-950FA CD cart machines (2), need some work, \$600/BO. C Pace, Evangel College, 417-865-2811 ext 7364.

Studer A-727 (2), bdct quality, 5 yrs old, well maintained w/manual, \$450 ea/\$800 both. M Meyer, WWCK, 3217 Lapeer Rd, Flint MI 48503. 810-744-1570.

Denon 950FA, like new, \$975. R Nelson, KKRW, 10333 Richmond, Houston TX 77042. 713-780-0937.

COMPUTERS

Want to Sell

Tandy 6000HD w/at least 1 floppy drive. Mel Crosby, 408-363-1646, FAX 408-363-0957.

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Want to Sell

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Tascam M 208 8 chnl, 4 buss mixer, like new, \$500. R Maycock, RMC Consulting, 10245 Haledon Ave., Downey, CA 90241. 310 861-7624

Teac 15, 24 in mixing board, \$2500. HL Sewell, Oakridge Music, 2001 Elton Rd, Haltom City TX 76117. 817-838-8001.

Ramko DC-8 mixer, needs work w/some parts, \$150. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

LPB S12 5 pot 10 input stereo, excel cond, very clean, \$1295; LPB S13C 8 pot 24 input stereo in excel cond, gd clean working order, \$1895. J Travis, WCJK, POB 506, Bath NY 14810. 607-776-4151.

Gates Dualux II, refurb, new paint, \$1500. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

BE 450, \$1500. R May, KULF, 306 E Main, Brenham TX 77833. 409-836-9411.

Arrakle 500 SC excl cond, 8 chnl stereo, will trade for studio or on air processing, \$1750. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

Soundcraft Spirit 163 mixing console, \$1550; Quantum 12A mixing console, \$1300 complete; Fostex 2050 line mixer, \$100. R Streicher, Pacific A/V Enter, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

Dynamax stereo 8 chnl for air or production, like new cond, \$3200/BO. Terri, GMN Inc, Box 2205, Cincinnati OH 45201. 606-572-9446.

Audionics 110-A 4-trk & 2-trk mixing console, 18 inputs, EQ modules, pwr sply, extra modules, manual, \$1200. D Kannes, KTAR/KKLT, 301 W Osborn Rd, Phoenix AZ 85013. 602-274-6200.

Shure FP-31 3-chnl mono mixer/case, used, gd cond, \$350. Raider Prod, 215-889-9565.

Altec 352-A 5 chnl mixer amp, \$125; Ampex MX-10 6 chnl stereo tube mixer, \$125. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

BE 5M150 Series used as prod brd, gd cond w/manual, \$250. K Paul, WKXD, 259 S Willow, Cookeville TN 38501. 615-526-6860.

Radio Shack disco mixer, 3 mic, 2 line, 2 TT inputs, \$50. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Want to Buy

BE 5M-5250A or 4M50A for simple newsroom operation, no junk. A Sutton, WBCU, POB 70, Union SC 29379. 803-427-2411.

LPB Signature series 10 or 12 chnl. J Frew, WYXC, 1410 Hwy 411 NE, Cartersville GA 30120. 404-382-1270.

Sparta Electronics A-20B, trying to rebuild console, need schematic, service info & parts source, will pay postage. T Wheeler, County Electronics, RR1 Box 215, Carlock IL 61725. 309-376-7721.

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UREI 811 Time Align studio monitor speakers, excel cond, \$800/pr. Z Nicall, Semendria Studio, 6404 Hollywood Blvd #410, Hollywood CA 90028. 213-646-2145.

Sansui SE88 10 band stereo EQ, \$30; Sansui RA1000 stereo reverb w/built in mic-line mixing, \$30. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Solar Black 102-450 50 yds by 72" speaker, grill cloth, \$300/BO + shpg; McCauly 6284 12" 16 ohm (2) speakers, new, \$150/pr + shpg; Yamaha R1000 digital reverb, works, gd cond, \$100/BO + shpg. F Stadler, Fred Stadler Prod, 3912 Liberty, Westmont IL 60559. 708-960-4545.

Want to Buy

dbx 902 (2), 903 (4), & 905 (2), not frame, just modules. R Streicher, Pacific A/V Enter, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

Roland DEP5 needed. S Russell, 60410 Klett Dr, Decatur MI 49045. 616-782-9258.

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UREI BL-40 Modulimiter, SN 632, \$195. R Chambers, 916-257-2121.

Optimod 8100A/ST studio chassis only, gd cond, \$400. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

Orban 414A dual chnl stereo compressor/limiter, \$425/BO; Aphex 700 studio dominator multi-band audio processor, \$600/BO. D Evans, KALW, 2576 Harrison, San Francisco CA 94110. 415-695-5740.

Optimod 8100A, \$4100. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

Optimod 8000A (2), one works, one doesn't, \$1900/both. R Henry, WPIO, 505 Josephine St, Titusville FL 32796. 407-267-3000.

CBS Labs Audimax III (2), \$100/ea or \$175/both. C Binder, WZOS-FM, 38 E Bridge St, Oswego NY 13126. 315-342-9600.

Orban Optimod 8000 in great cond, \$2000. D Barron, KWJM, 113 N Main, Farmerville LA 71341. 318-368-3094.

CRL AGC400 & PMC 450, \$50. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

Inovonics 1176 LN, gd cond; Inovonics 222, gd cond. D Barron, KWJM, 113 N Main, Farmerville LA 71341. 318-368-3094.

Altec 1591-A compressor, \$175; Fairchild 67K dynamic de-esser, \$75; Fairchild 663 compressor, \$75. D Lundy, Lundy Tape Duplicators, Cumberland Gap Pkwy, Heidrick KY 40949. 606-546-6650.

Want to Buy

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Volumax 4000A, UREI LA-4, needed. Tom Scher, 716-634-2545 M-4PM EST.

CBS Volumax 411 service/opertion manuals, will pay cost of reproduction & mailing or will buy outright. GP Brefini, GPs Mobile Jukebox, 12 Bailey St, Foxboro MA 02035. 508-543-4213.

CBS Labs Audimax wrkg or not, stereo or mono, also manual or copy for same. T Carroll, 212-967-4800, 9-7 EST.

Optimod 8000A for educ FM upgrade. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

Fairchild 670 or 660 tube compressor/limiter, Teletronics LA-2A tube compressor/limiter or UREI LA-3A solid state compressor/limiter, call after 3PM CST. 214-271-7625.

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MICROPHONES

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AKG C34 stereo mic w/remote, cable, Suspend mount, windscreen & carrying case, \$1450; (2) AKG 414B ULS matched pr, \$1600; (2) Nakamichi CM300 w/2 capsules & case, \$600. J Burke, Reels on Wheels, 2824 Sherwin, Chicago IL 60645. 312-338-1977.

RCA 77DX-44BX, chrome, excel cond, BO over \$800 for ea. RF Burns, RF Studios, 1326 High Meadow Dr, Garland TX 75040. 214-271-4386.

Electro Voice RE27ND's (2), new, still in case, \$425 ea/\$800 both. W Harris, WNPC, POB 189, Newport TX 37821. 615-623-8743.

AKG C422EB in excellent condition, \$1850; AKG D-140 dynamic cardioid mic, \$225/pair; HME System 82 diversity wireless mic system, complete, \$425. R Streicher, Pacific AV Entertainment, 545 Cloverleaf Way, Monrovia CA 91016. 818-359-8012.

HME-WM 252 wireless w/S58 mic, \$195. J Price, 214-321-6576.

Audio Technica 811 bidirectional mic, \$100; Gitzo 14' fishpole/internally wired with AT microphone mount, used, good condition, \$80. Raider Prod, 215-889-9565.

Audio Technica 813 mics, \$150 ea. R Suraci, Fine Art Prod, 67 Maple St, Newburgh NY 12550. 914-561-5866.

EV RE10 dynamic cardioid mics (10), \$85/ea. J Anderson, Regent Univ, 1000 Centerville Tpk, Vir Bch VA 23464. 804-523-7417.

Manley Labs CR3A, new, \$795 w/shockmount, windscreen & case, no risk trial in your studio. Also have used mics & everything else. Get our catalog! Liberal trade policy too. Audio Village, 619-320-0728.

Want to Buy

Three studio mics, prefer RE-20's w/mounts for educ FM upgrade. KC Hill, AECC, POB 2061, Bristol TN 37621. 615-878-6279.

Need supplier of custom made microphone flags. HA Bridge, KCUL, Box 1326, Marshall TX 75671. 903-935-1410.

Neumanns, AKG, RCA, EV, Sennheiser etc, any cond, for parts, also wireless mics. J Price, 214-321-6576.

RCA 77DXs/44BXs ribbon, chrome/TV grey, good condition, BO. R Kaufman, Pams Productions, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

Neumann U87s, KM84s, AKG 451s, EV RE20s, Sennheiser 421s. W Gunn 619-320-0728.

77-DX's, 44-BX's, WE KU-3A's On-Air lights, recording lights & audition lights. Top price paid. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131, FAX: 615-292-3434.

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Choke 15 hy 5 kV 400 mA, not swinging, will trade an MC-60 amp & C-8 audio compensator by McIntosh, amp has bad output xfmr. Fred, 6922 Furness Ave, Oxon Hill MD 20745. 301-567-2012 (eves).

360 Systems AM161B, 16x16 digital patchbay w/XLR Elco breakout box, \$800. W Sarokin, Sarokin Films, 23 Rutland St, Mt Kisco NY 10549. 914-666-0233.

Peerless 458116-20 input transformers, 600 ohm input, 60 K ohm output (8), 8 pin octal base, \$15/ea. S Lawson, KAK Products, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Triad A-10-J input transformer (2), 150/600 ohm input, 60K ohm output, \$40/pr. S Lawson, KAK Products, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

Altec 1579A equalized transistor amp for magnetic phono pickup, octal 8 pin base, \$25. S Lawson, KAK Products, 928 Hyland Dr, Santa Rosa CA 95404. 707-528-4055.

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TRW adjust amp loads, 300 W rated, 8 ohms, \$50/pair. R Glen, WJGR, 1718 Shannadoah Rd, Wimauma FL 33598. 813-634-1940.

Magnatek 223-3212, Jefferson Electric dry transformers (2), input 240 V Delta, out 208 V WYE, \$700 each plus shipping. D Morgan, KJYE, 1360 E Sherwood Dr, Grand Jct CO 81501. 303-241-9230.

IBM Quietwriter 14 new ribbons, part #1299790, \$20/all; Apple Mac 825 kB internal drives, 3.5" floppy disc (3), \$10 ea. P Russell, Bowdoin College, Sills Hall, Brunswick ME 04011. 207-725-3066.

Want to Buy

Cutting lathes, Neumann, Westrex, Gramplan, tube amps, 16" tables/arms, 45/78 records. K Gutzke, Custom Recording, 7134 15th Ave S, Minneapolis MN 55423. 612-866-6183.

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

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

MONITORS

Want to Sell

Belar FM RF amp currently tuned to 107.1, \$400/BO. R Wynne, KFLS, POB 1450, Klamath Falls OR 97601. 503-882-4656.

Gorman Redlich EBS encode/decoder, hardly used with manual, money order/certified check, \$250 plus shpg. B Dickerson, WEAG, 1421 S Water St, Starke FL. 904-964-5001.

Belar AMM-2 AM mod mon, \$250. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

Gates GTMM-88S stereo capable mod mon, tuned to 99.3 MHz, \$75. B Williams, KOOL 106.1, 918-455-9522.

Want to Buy

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McMartin or Belar 67 kHz SCA mod mon. J Pearce, WKRS, 3250 Belvidere Rd, Waukegan IL 60085. 708-336-7900.

Phase monitor at least 5 twr positions. George, WNQM/WWCR, 1300 WWCR Ave, Nashville TN 37218. 615-255-1300.

McMartin (buy & sell) any model. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886 or fax 402-493-6821.

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Marti STL-10 stereo (2) xmtrs (2) rcvrs on 950.375 & 950.625, type approved under new rules, \$3000/both. J Gallagher, WBEC, 211 Jason St, Pittsfield MA 01201. 413-499-3333.

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TFT STL units (2) receivers, (2) transmitters, on pair on 450.98 & other on 450.01, both work great. Jeff, 703-297-1188.

QEI Cat Link, needs repair, not in service, \$6000/BO. D Fielder, WVLT, 638 Landis Ave, Vineland NJ. 609-692-8888.

Moseley MRC-1600 telco boards, \$40. S Swanson, KBNL, Box 440029, Laredo TX 78044. 210-724-9211.

MCI RSU-10 STL rcvr switcher, automatically selects backup rcvr if main rcvr fails, \$25; GE Master II VHF mobile 2-way radios, 100 W RF out or 170.150, \$100 ea. M Everhart, KXYQ, 111 SW 5th #11550, Portland OR 97204. 503-226-6731.

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BE synchronous booster reference generator, \$1000/BO; Moseley TPR-2 transfer panel for (2) Moseley TBL or STL receivers, \$500; Moseley TPT-2 transfer panel for (2) Moseley TRL or STL transmitters, \$500; Moseley PCL 606/C 950 composite STL system, \$6500. D Irwin, KSOL, 55 Green St, #200, San Francisco CA 94111. 415-616-5768.

Moseley TRC 15 AW remote control in very good condition, \$425. E Duellman, WOMT/WQTC, Box 1385, Manitowoc WI 54221. 414-682-0351.

Moseley MRC1600 (2) studio units, transmitter unit, telco & subcarrier cards included, \$2000. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

Marti RMC-15 16-chnl digital remote cntrl, excl cond w/manuals, \$450. D Igou, KCHL, 8435 Twister Oaks, Garden Ridge TX 78266. 210-651-9049.

Gentner SPH-3A telephone interface system, excel cond w/manual, \$325. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Want to Buy

TFT 8300 receiver unit. P Lotsof, KAVV, Box 18899, Tucson AZ 85731. 602-290-9797.

Harris 9161 remote control, mainframe, CEPs, electr memory modules & high speed comm modules. B Lockhart, KXXY, 101 NE 28th, Oklahoma City OK 73105. 405-528-5543.

Mark 4' grid dish. M Grubbs, NTI, POB 1047, Luling TX 78648. 210-875-2555.

STL, transmitter, receiver, antenna etc for missionary station in Africa, must be in excellent condition, \$1000 plus donation receipt for the difference. K Leatherwood, Believers Broadcasting, POB 1776, Terrell TX 75160. 214-524-1956.

Moseley 505 rcvr & xmtr, pref on 946.00 Mhz, open. C Cooper, WHLC, POB 1889, Highlands NC 28741. 704-526-1045.

Giant Boom Box, good condition, with A/C, trailer...contact Chris Mac, 207-774-4561. Portland Radio, 420 Westem Ave., South Portland, Maine 04106.

SATELLITE EQUIPMENT

Want to Sell

Scientific Atlanta 15 kHz DATS cards (2), \$750 ea or \$1500/both. S Tefft, WWSC, 217 Dix Ave, Glens Falls NY 12801. 518-793-4444.

Universal SCPC-100 audio receiver, front panel tuning, 50 channel memory, receiver C & Ku band, new, \$425 plus shipping. D Littleton, WAZF, POB 47, Yazoo City MS 39194. 601-746-2372.

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Adcom 7550 excl cond, BO or trade. B Hill, KACK FM, 106 S Jefferson, Mt Pleasant TX 75455. 903-577-9730.

Wegener 1601-50 mainframe, 1624, 1645, 1646, 1683-08, 1606-01, 1605-03 cards, BO. R LaFore, WSHH, 1459 Crane Ave, Pittsburgh PA 15220. 412-531-9500.

Scientific Atlanta 10' sat dish, excel cond, complete, \$1000. J Alsip, KSCQ, Box 1351, SiLoer City NM 88062. 505-538-3390.

Scientific Atlanta AD7450 SCPC rcvr w/new block down converter, rcvr is 1 yr old w/manual, \$1500 plus shpg. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055. 405-658-2556.

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1 kW AM FT in South-Central Virginia single-station town, fully equipped w/3 yr old Nautel xmtr, \$50,000 cash/BO, real estate for lease or sale. G Jones, WODI, 1230 Radio Rd, Brookneal VA 24528. 804-376-5534.

Two stations, AM & FM, good cash flow, gd equip, gd locations, gd weather, wom out owner/operator. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn Box#: 94-03-01RW.

Central West Virginia 25 kW FM, 1 kW AM combo, \$300,000, cash sale. Jim 304-765-7373.

FT AM 1000 W nite, rebuilt from ground up in '92/93, 70 miles N of Houston, presently oldies/talk/rush. BO. J Standefer, KYLR, 1018 12th, Huntsville TX 77340. 409-293-1400.

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Want to Buy

Educational non-profit organization seeks dark or troubled FM or AM station. 800-357-4226.

STEREO GENERATORS

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Moseley SCG-3T, stereo generator, gd cond, \$350. D Heinen, KRSE, POB 127, Yakima WA 98907. 509-248-1390.

Harris MS-15R stereo gen w/extender card for repairs, alignment, \$125. M Everhart, KXYQ, 111 SW 5th #11550, Portland OR 97204. 503-226-6731.

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Radio sales training tapes, 16 VHS tapes covering 30 topics, excellent, \$2500. R Trumbo, KNLF, 800-397-4146.

AOR prod facility deleting classic library, all on 7" reels, \$300. D Pulwers, Dave's Price Audio, 310 N Howard St #103, Alexandria VA 22304. 703-751-9346.

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Ampex 407 mastering tape, 10.5" reels, 1/4" x 3600', new in box, \$10/reel, \$90/box of 10; 3M/Scotch #20 1/2" x 1000', 2.5 mil uncoated white paper on 7" reel, \$4/reel, \$3/reel/quantity. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

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Reels, 10.5" & boxes (30), \$35; 5" reels & boxes, new (125), \$45. L Houck, Rollin Recog, 210 Allgelt, San Antonio TX 78201. 210-736-5483.

Pams Jingles ref tapes, 1951-1976/BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

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TAX DEDUCTIBLE

Want to Sell

New non-comm has its CP, need all types of studio equip, CD & cart machines, consoles, TTs, EBS, mics, etc 501(c)3. J Wong, KOOP-FM, POB 49340, Austin TX 78765. 512-472-5667.

Christian mission needs studio equip, stereo gen, exciter, 175' twr, 600' 1 5/8" or 3" coax for FM, will pay shpg & PU. L Harper, Western Indian Ministries, POB F, Window Rock AZ 86515. 505-371-5587.

Non-profit 501C-3 needs console, cart machines, R/R, SCA rcvrs & automation equip. J Hayes, CVM, 1101 NW 43 Pl, Des Moines IA 50313. 515-244-2848.

Campus radio station needs cart machines, R & R/P, amps, cassette/reel decks & low pwr RF equip, prefer FM. E Welch, Toccoa Falls College, POB 800836, Toccoa Falls GA 30598. 706-886-6831 X5269.

Ed radio 501C-3 needs studio, prod equip, lw pwr xmtrs, shpg & receipt provided. Dr Newcomb, 216-693-4125 or 216-548-2053.

Church wants to bdct services, need any equip you can part with, will pay transportation cost & or shpg, will provide a tax deduction letter. S Mongeau, Emmanuel Baptist Church, 14 Mammoth Rd, Hooksett NH 03106. 603-627-3585.

Peerless Panorama TV camera dolly, Mole/Rich port mic boom, equip must go to a 501 (C) (3) organization, fed tax exempt. K Van Prooyen Sr, Sight Seer Inc, Grand Rapids MI 49505. 616-363-8838.

TEST EQUIPMENT

Want to Sell

Potomac Instruments AT-51 audio test set, complete w/IX-51 transformers, cables, books, mint cond, \$5000. J Seaman, 301-540-2089.

Nicolet Scientific 4A computing spectrum analyzer, \$100. B Dickerson, WEAG, 1421 S Water St, Starke FL. 904-964-5001.

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Potomac AA51, distortion analyzer, new in carton w/book, \$1500; Hewlett-Packard HP-334A, gd cond, \$500. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

Hewlett-Packard audio oscillator in gd cond, works fine, large older oscillator, \$50 plus shpg. D Morgan, KJYE, 1360 E Sherwood Dr, Grand Jct CO 81501. 303-241-9230.

HP 33A dist analyzer w/manual, \$595; Waveform 520-A RMS/DBM sensitive volt meter -60 dB to +50 dB, \$100; Ithaco 4302 dual 24 dB/octave hi-lo-pass filter 1/10 to 1 MHz, \$295. J Price 214-321-6576.

Tektronix 529, mod 188D waveform monitor, multi-standard version w/PAL frame selector, excel cond, \$525; Tektronix 520A NTSC vectorscope, measures amplitude & phase of color video signal, excel cond w/manual, \$1495; Tektronix 454A portable 150 MHz dual trace oscilloscope, calibrated sweep delay, excel cond w/manual, \$495. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

BIRD 3128 wattmeter alarm/RF power monitor, up to 10 kW, 450 kHz to 2300 MHz, mint cond w/manual, \$350. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

HP 334A 5 Hz to 600 Hz, auto nulling, 0.1% distortion, AM detector covers 550 kHz to 65 MHz, excellent condition w/manual, \$795; Bruel & Kjaer 2033 high res FFT sound & vibration analyzer, 0-20 kHz, 11 baseband ranges, amplitude of 40 dB, 80 dB & linear, excel cond w/manual, \$3995. R Sumner, CAVU Corp, 3322 Applegate Ct, Annandale VA 22003. 703-968-8894.

Technics SL-1290 MK2 (2), \$275 ea. G Dunn, No Cal News, 5383 Willow Lake Ct, Byron CA 94514. 510-516-0299.

Leader LSG-17 100 kHz to 450 MHz signal generator, excellent condition, \$85/BO; B & K 520 transistor checker/test in circuit or out with leads, \$125/BO. R Glenn, WJGR, 1718 Shannadoah Rd, Wimauma FL 33598. 813-634-1940.

BIRD 3171 high speed wattmeter RF monitoring system with out line section, \$50; Tektronix 7603 oscilloscope main-frame & power supply, \$50. M Hendrickson, Hedberg Broadcasting, POB 249, Blue Earth MN 56013. 507-526-4044.

Want to Buy

Pink & white noise gen, battery operated preferred. M Cohen, Acoustic Consulting, POB 80145, Lincoln NE 68501. 402-476-8427.

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AEL 1978 25K 25,000 W FM xmtr, very clean in excellent condition, \$13,000; QEI Q30000 1989 30,000 W QEI 30000 FM xmtr in excellent condition, \$28,500; CSI 3 kW in excellent condition, \$12,900. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

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Harris MS-15 exciter, just removed from service & in excel cond, \$2500. C Murray, KMGE. 503-484-9400.

RCA BTF-5B 5 kW FM on 92.1 MHz, removed 12/93, no exciter, \$3500/BO. G Reinmeimer, WYYD, POB 4108, Lynchburg VA 24502. 804-237-4700.

ITA FM-15000B, 15000 W power amp, 1000 W in, 10000-15000 W out, Best Offer. A Weiner, WHVW, 507 Violet Ave, Hyde Park NY 12538. 914-471-9500.

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Harris BC500H 1110 kHz 500 W, 250 W, can go to 1 kW as is, \$1500. C Porter, WCAZ, POB 498, Carthage IL 62321. 217-357-3128.

RCA BTA-5T tuned to 620 kHz, used as main '63 to '80, used as standby '80 to '93, gd cond, \$5000. D Kannes, KTAR/KKLT, 301 W Osborn Rd, Phoenix AZ 85013. 602-274-6200.

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Energy Onix 5.5 kW 3 yrs old, on air for 3 yrs w/no problems, upgraded to 50 kW, \$12500 or w/QEI exciter, \$15K. E Seeger, WMXT, 2704 S Irby St, Florence SC 28505. 803-661-5000.

Collins 830F-1A 250 W w/spare tubes & manual, recently removed from svc, \$1500 plus shpg. K Austin, KFXI, 1101 Hwy 81 N, Marlow OK 73055. 405-658-2556.

Harris MW1A tuned to 1340, excel cond, \$7000. J Alsip, KSCQ, Box 1351, Siloer City NM 88062. 505-538-3390.

McMartin BA-1K, excl cond, tuned to 1450 kHz, kept in AC's room. R Vega, WOCN, 305-759-7280.

Gates BC-2T 1 kW AM tuned to 1470, spare tubes, gd cond. D Barron, KWJM, 113 N Main, Farmerville LA 71341. 318-368-3094.

Harris MW-1A solid state 1 kW AM, excellent condition, on air 1410 kHz, spares, \$8500. 816-628-5959.

LPB 100P tuned to 1460, 100 W or less, like new in excl cond, \$3000. R Swan, WROY/WROL, 101 N Church, Carmel IL 62621. 618-382-4161.

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CSI 10 or 20 kW or 25 kW. R Michaels, KQFX, POB 7762, Amarillo TX 79114. 806-355-1044.

Best 20 W translator. A Clawson, WFFF, 1715 Michigan St, Sturgeon Bay WI 54235. 414-743-7443.

Harris BC5H audio driver for BC5H. G Patschke, KIJN, Box 458, Farwell TX 79325. 806-481-3318.

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CCA 3000 D (3) or similar CCA FM xmtr, prefer snl phase, open. C Cooper, WHLC, POB 1889, Highlands NC 28741. 704-526-1045.

Nautel 1 kW AM xmtr. J Frew, WYXC, 1410 Hwy 411 NE, Cartersville GA 30120. 404-382-1270.

5 kW FM with exciter in excellent cond, on 93.0, missionary station in Africa, \$5000 plus donation receipt for difference. K Leatherwood, Believers Bldg, POB 1776, Terrell TX 75160. 214-524-1956.

McMartin AM/FM transmitter, any model, exciter or stereo modules. Goodrich Enterprises, 11435 Manderson, Omaha NE 68164. 402-493-1886.

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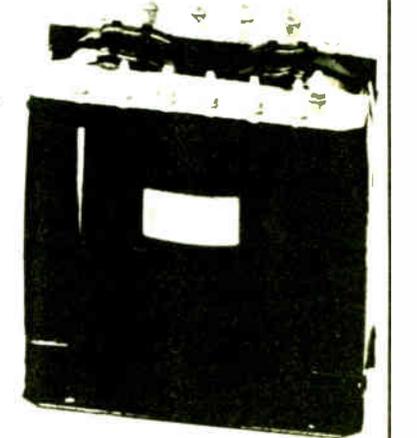
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Doug Gossett, their engineer, said some really great stuff about it, but we didn't want to get technical. Let's just say the specs are definitely superior.

However, Andy Montgomery, one-third of the KIX-106 morning team, said some really good stuff too... "Our entire studio is designed around the Auditronics 800. You might say that the 800 and, of course, Debbie are at the center of everything (Debbie's my wife, so I had to say that). It's reliable and it's sturdy. Have you ever spilled a cup of coffee or a soda on your console and everything shuts down? I don't recommend it, but so far this hasn't been a problem for the 800. It's so versatile. It does everything I need and it always works. That sure makes my job a lot easier. Debbie, Cap'n Pat, the 800 and I make a good team!"

"It's hectic on our morning show and we get lots of phone calls, especially Debbie. This new telephone mix minus system makes them so much easier to handle."

"There are always the three of us on the air in the morning, but it's not unusual to have 5 or 6 people in the studio and on the air at the same time ... plus the music, the commercials and the phone calls. And we still haven't begun to max out the console. It's so reliable that I don't think Doug has had to make even a minor adjustment or anything since we started using it."

If you want to find out what Doug and other users had to say about the Auditronics 800 console, call your favorite Auditronics dealer or Auditronics today.

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