Published twice a month

Radio World

Buyers Guide
Program Audio
Processing
See pages 25-35

Vol 10 No 12 | June 15, 1986 | $2.00 Per Copy

EEPA Eyes US RFR Policies

Supports FCC Preemption

by Edward Wytkind

Washington DC ... Human exposure to radio frequency radiation (RFR) and RFR regulatory matters were among the key topics covered at the third annual Electromagnetic Energy Policy Alliance (EEPA) symposium in Washington, DC held 13-15 May.

A majority of conference attendees rallied behind current efforts, led by the NAB and the EEPA, urging the FCC to preempt all nonfederal RFR standards that could inhibit the operation of federally authorized broadcast facilities.

The heavy lobbying for federal preemption has been fueled in part by the increasing number of cases around the US in which local or state governments have adopted, or are considering adoption of, RFR regulations. Such activity has taken place in Massachusetts, New Jersey, New York, California, Texas, Oregon, Washington and other states.

"There was definitely a broad consensus (among attendees) that the federal government needs to take a lead role in standard-setting by adopting a national preemptive standard," said EEPA President Barry Umansky, who is also NAB deputy general counsel.

Among other issues discussed at the three-day event were poor public perception regarding RFR exposure and current industry activity in attempting to substantiate information on unverified biological effects of short- and long-term exposure to (nonionizing) microwave and RF radiation.

In addition to covering regulatory matters, sessions also explored current bioeffects research, medical/legal matters, public issues and press perspectives.

Robert Watkins, a radiation scientist for the Massachusetts Department of Public Health, discussed the rationale for the state's recent adoption of an occupational RFR exposure standard. He also discussed the state's public exposure standards, which were adopted in 1983.

On 23 December 1985, Massachusetts' new state worker exposure regulations, based on the 1982 American National Standards Institute (ANSI) limit, went into effect. However, broadcasters were granted a six-month waiver (until 1 May 1986) to begin compliance with the new standards.

The Massachusetts case has been under scrutiny from the NAB because of what some officials have called "burdensome and duplicative" requirements mandated by the nonfederal regulation.

Referring to the Massachusetts public standard, which is 1/5 of ANSI's limit, Watkins explained that, due to so many "uncertainties" in the regulatory environment, the only way to relieve the public's fear is to "promulgate a regulation—this gives the public something to rely on."

According to Watkins, without a state-level standard, the potential exists for the adoption of several local ordinances that may be "overly restrictive." He added that the state standards will "supersede" all local regulations.

Watkin's comments regarding the adoption of a federal standard were generally in concurrence with most comments issued in the past year from nonfederal government officials, who say that until the federal government adopts an "absolute" national RFR standard, the policing of exposure violations should be retained on the local or state level as a means for ensuring public and worker safety.

Environmental Protection Agency (EPA) Director of the Analysis and Support Division David Janes presented an overview of the costs of compliance to the ANSI standard for radio and television broadcasters.

According to Janes, compliance will cost the industry about $137 million, with the greatest costs incurred by FM stations. He explained, however, that the cost to the industry will only be $69 million after "tax adjustments."

Janes added that the EPA will soon issue four recor[illegible]FR levels—

(con[illegible]11)

Radio '86 Targets Engineers

by David Hughes

Washington DC ... Even though NAB plans to "double" the number of engineering sessions at its "Radio '86" show, to be held 10-13 September, some equipment manufacturers doubt whether the event will draw a strong showing of engineers.

Still referring to the event as "jointly sponsored" with the NRBA (which recently merged with the NAB) at a 19 May press conference, NAB President Eddie Fritts said Radio '86 will feature 12 engineering sessions, up from 6 sessions at Radio '85, along with an expanded exhibit hall.

The greater emphasis on engineering, which includes the addition of engineering representatives on the show's steering committee, comes after criticism from Radio '85 exhibitors that not enough engineers and technical personnel attended the show.

Some exhibitors say they have decided to bypass Radio '86, slated for New Orleans, in favor of the first annual SBE National Convention in St. Louis 14-16 October.

NAB optimistic

Despite the absence of some previous exhibitors at Radio '86, NAB officials say the show is shaping up to be substantially larger than Radio '85.

At press time in late May, NAB had sold about 13,500 of 25,000 available square feet of exhibit space to 71 firms.

NAB Radio Board Chairman John Dille, co-chairman of the 1986 show, said the NAB was confident it would exceed the number of firms (112) which exhibited at Radio '85, held in Dallas.

The exhibitors are signing up, NAB said, despite a hike in exhibitors fees, which have been increased $1 per square foot to $13 for NAB members. Rates for nonmembers jumped $2 to $18 per square foot.

Some exhibitors criticized the NAB's rates, claiming that floor space fees at the SBE convention are between $4.75 and $5.25 per square foot.

As of mid-May, SBE had lined up 82 exhibitors, representing a total sale of 184 10'×10' booths (many exhibitors buy more than one booth). According to Sam Caputa, who is handling SBE show ex-

(continued on page 10)

BULK RATE
US POSTAGE
PAID IN
RIVERDALE MD
PERMIT NO 5679

Radio World Newspaper
PO Box 1214
Falls Church VA 22041
USA

Regulatory News

NCE-FM/TV-6 Heating Up Again

by Edward Wytkind

Washington DC ... Public broadcast interest groups have urged the FCC to adopt a policy statement placing restrictions on the granting of future TV-6 channel assignments in an action that may signal another round in the 20-year noncommercial, educational (NCE) FM/TV-6 interference controversy.

> *"Both sides, however, emphasized that the compromise was offered only as a 'short-term accommodation.'"*

The interference problem stems from the adjacency of TV-6 and 20 NCE-FM channels (88.1-91.9 MHz) in the frequency spectrum. The issue was apparently resolved last summer when the FCC adopted an industry compromise filed jointly by NCE-FM and TV-6 interest groups.

The FCC's current rules (47 CFR 73.525) on TV-6 interference impose limitations on the future allocation of NCE-FMs, but not on future TV-6 allotments, according to Corporation for Public Broadcasting (CPB) Deputy Director of Policy Planning Edward Coltman.

"We hope to head off the proliferation of channel 6s that would, in turn, inhibit the future growth of public radio," Coltman said.

However, FCC Engineering Policy Branch Chief John Wong explained that the the Commission adopted the 1985 industry com[illegible]host in its en[illegible]terference rule [illegible]e allocation of [illegible]ted as a result

[illegible]mitations (on [illegible]e don't now."

[illegible]it petition, NCE-FM [illegible]t out of the six un[illegible]ssignments in the US (Junction City, KS; Silver City, NM; Casper, WY; Ely, NV; Billings, MT and Kingdom, AZ), "in all cases, alternative television channels are available."

An increase in channel 6 assignments would "limit the service of dozens of existing and potential public radio stations, particularly those seeking to serve the Native American population residing on reservations in the Southwest, whose needs are served by virtually no other broadcast service," the petition added.

In addition, according to the petition, if CPs were granted on the unused TV-6 channels, 27 NCE-FMs would be inhibited due to projected interference problems.

NCE-FM parties also criticized the FCC's so-called "newcomer" policy, which they said forces the newest licensee to "bear responsibility for any interference that may result from its operation."

Not the only approach

Greg DePriest, VP of TV-6 proponent Maximum Service Telecasters (MST), said limiting channel 6 allocations "may be one approach," but "it's not the only approach."

Another approach, he added, "would be for NCE-FMs to relocate to commercial frequencies."

Referring to the "Native American population" case cited in the petition, DePriest argued that "it's a non-problem out there ... there are no foreseeable problems in that area."

With no immediate action planned, he added that TV-6 interests plan to file comments after the FCC rules on the petition.

The joint compromise, which was adopted as a rule last summer by the FCC, was the result of a series of meetings early last year between the two sides.

In addition to lifting an application freeze, which had been imposed in December 1984, the new rule contains provisions addressing grandfathering rights, refined interference models, poor SNRs and population considerations for determining the number of TV-6 viewers experiencing interference.

The rule also grants NCE-FMs power level allowances for efforts to co-locate with a TV-6 or to remedy interference by utilizing consumer receiver filters or some other means.

Short-term solution

Both sides, however, emphasized that the compromise was offered only as a "short-term accommodation" to the interference problem. They urged the Commission to mandate the development of TV receiver quality, which is perceived as the root of the problem.

To date, the FCC has only observed the industry's development of receivers that can differentiate more selectively between the two signals. Plans for further action have not been revealed.

For more information on the petition, contact Michael Lewis at the FCC: 202-632-9660 or Edward Coltman at the CPB: 202-955-5218.

Featured this issue

FCC Clips

Mexican Agreement

To date there has been no word of any progress on the long-awaited agreement with Mexico that would allow more than 300 US daytimers on Mexican clear channels to add nighttime hours, and would permit many other daytimers to increase their post-sunset authorizations.

FCC Mass Media Bureau Chief James McKinney had hoped to have the final agreement penned in mid-April; the preliminary agreement was signed in August 1985. Delays were caused by the September earthquake that destroyed many of the Mexican communications authority's offices.

However, some broadcast industry sources now speculate that the additional delay in the bilateral agreement could be related to recent US government criticism of the Mexican government, including allegations of corruption surrounding the handling of an investigation involving the death of a US Drug Enforcement Agency operative working in Mexico.

However, at press time, the US and Mexico were working to improve relations.

For more information on the progress of the agreement, contact John Wong at the FCC: 202-632-9660.

Amateur Test Waiting Period

The FCC has denied a petition filed by the American Radio Relay League (ARRL) requesting that the Commission reinstate a 30-day retest waiting period for amateur operator licenses that it recently deleted.

The ARRL, according to the FCC, argued that a mandatory waiting period was essential to preserving examination integrity.

However the Commission maintained that the waiting period "unduly limited" the flexibility of the volunteer examiner coordinators (VECs) who administer the tests.

The FCC added that the VECs have "many alternatives to assure retest integrity," including imposing their own waiting periods and using differing sets of questions.

FCC docket number is PR 85-21. Contact John Borkowski at the FCC at 202-632-4964.

Station Totals

The latest station totals, issued by the FCC in April, indicate that there were 10,025 licensed radio stations in the US.

FM stations outnumbered AM stations 5,131 to 4,894. The figures indicated that of the FM total, 3,893 were commercial stations and 1,238 were noncommercial operations.

For more information, contact the FCC's news media information office at 202-254-7674.

Circle Reader Service 20 on Page 35

Regulatory News

PCBs Require Proper Disposal

by David Hughes

Washington DC ... When KWBE/KMAZ CE Bryce McBride decided to discard an old voltage transformer, he was not sure if he could just "throw the thing in the dumpster" with other discarded equipment. He hesitated because the transformer had capacitors that contained PCBs (polychlorinated biphenyls), a very toxic, cancer-causing chemical.

After checking Environmental Protection Agency (EPA) regulations issued to his station by the local Beatrice, Nebraska city government, McBride discovered that the transformer fell outside of specific EPA size guidelines that require "special disposal" by an approved firm that deals with toxic waste.

"Similarly-sized capacitors and also larger ones can be found in many pieces of older broadcast equipment (including) transmitters," McBride said. The EPA has "very strict procedures with regard to disposing of possible PCB contaminated components."

Fluids that contain PCBs are good heat conductors and were used heavily from 1940 until the mid-1970s as a coolant for large capacitors and transformers, especially those used by electric utilities.

However, studies conducted in the 1970s concluded that fluids containing PCBs, which are very stable and degrade very slowly, can, even in very small amounts, cause serious health effects in humans and other animals. Effects range from nausea, dizziness and eye irritation to illnesses such as cancer.

McBride said his transformer's capacitors were 90 cubic inches in size, "just under the 100 cubic inch limit where weight becomes a consideration." He added that "any capacitor over 200 cubic inches can be considered a large one and must be handled specially."

"Had my capacitors fallen over the size limits, I would have had to follow elaborate regulations about marking and storing them until a company that specialized in PCB disposal could pick them up in a properly marked vehicle," McBride said.

McBride added that he has a 23-year-old transmitter no longer in use that probably contains PCBs. Though leakage is not a problem, he said, he will check the EPA guidelines if he decides to discard it.

PCBs were used in transformers as early as the 1930s as a non-flammable coolant. They were used in a wide variety of transformers, including those used in the broadcasting industry, according to Harris Product Marketing Manager Joe DeAngelo.

However, he said PCBs were removed from industry use about a decade ago.

According to David Ryan, of the EPA Public Affairs Office in Washington, DC, Congress banned the use of PCBs in 1977 under the Toxic Substance Control Act. In 1979, the EPA banned the manufacture or distribution of PCBs. However, he said the only producer of PCBs, Monsanto, stopped producing them in 1977.

There is a "very complicated" list of regulations pertaining to the disposal of equipment that contains PCBs, Ryan said. "We have a Q-and-A book on the subject that is an inch thick."

In addition, some localities have additional rules regarding PCB disposal, he added.

DeAngelo said it is ultimately the responsibility of the owner of the equipment containing PCBs to dispose of the equipment properly. However, he said that, in many cases, older broadcast equipment is not scrapped. Instead, it is sold and used somewhere else.

McBride added: "If you are not sure whether the capacitor has PCBs in it, you must assume it does." "No PCBs" markings have been placed on later capacitors.

If a broadcaster is concerned about whether equipment contains PCBs, he should contact the manufacturer, DeAngelo said. Broadcast equipment in which PCBs were widely used include both power and modulation transformers, particularly those suited for high power operation.

"We would be happy to help a broadcaster determine if a piece of older Harris equipment contains PCBs," he added.

Continental Electronics Domestic Broadcast Marketing VP Vern Collins said his firm stopped manufacturing equipment that contained PCBs in 1977.

However, he added that Continental has a standard form it issued to warn broadcasters that any equipment manufactured prior to 1978 that contains oil-based transformers or capacitors, and not marked "no PCBs," could contain PCBs.

Collins also stressed that it is the equipment owners' responsibility to dispose of the equipment properly.

According to EPA rules, equipment containing capacitors must be assumed to contain PCBs unless a label or nameplate on the equipment, or in literature or "documented communications" with the manufacturer, indicates that it does not. A "chemical analysis" can also be performed to determine PCBs presence.

Guidelines involving the disposal of PCB equipment are contained in EPA Rule Section 761. For more information, contact the EPA public affairs office at 202-382-2981.

Opinion

"Dear Radio World:"

Yap! Yap!

Dear RW:

Every time I visit my business partner, Bob Eddy, at his house, his dachshund runs around chasing his tail. Yap! Yap!

When I visit WSPD Chief Engineer Bill Rossini at home, his two toy poodles kick up a racket. Yap-Yap-Yike-Yap!

Lately, when I open Radio World, all I see in the "Readers' Forum" is Yap-Yap-Yap-Yap. Everyone is chasing their tails extolling the virtues of the Kahn system.

At WSPD we had a Kahn STR-77 for two years, and last year replaced it with a Motorola C-QUAM exciter. With the same transmitter and antenna, we had better separation with C-QUAM.

Installation was easier because the Motorola system did not require the use of a spectrum analyzer (although we had one handy to check bandwidth occupancy).

Mono sound was considerably improved, since we could use final limiting ahead of the exciter. The STR-77 uses diode clipping, causing a tradeoff between audio density and distortion.

That really leaves only two issues, doesn't it? Stereo coverage and platform motion. I am well aware what platform motions sounds like and how it occurs; I made the tapes on CKLW (using the Harris system) for Leonard Kahn.

The standard line in most pro-Kahn letters is "I took my Sony SRF-A100 and dialed around . . . ." Well, folks, that radio (and the A-1) have their own peculiar problems. Mainly they are prone to maximize platform motion.

Rather than get into an exhaustive discussion on why this is so, I would suggest another radio. Radio Shack makes an inexpensive car radio for the C-QUAM AM stereo. There are Radio Shack dealers everywhere, so anyone with an interest in AM radio should be able to find this radio.

Rather than any more "Yap" from the Kahn supporters, I propose that RW readers, especially those at AM *mono* stations, install this radio (or any C-QUAM car radio) and dial around.

I'll bet you will have to try very hard to get any platform motion. Coverage differences are very subjective in evaluation, but on the Radio Shack usually the stereo just goes to mono as the signal gets weaker. It does this on the Detroit FM stations, too, here in the fringe.

I would have a hard time finding a Sony all-mode AM stereo radio here in Toledo. But I can find a variety of C-QUAM car radios: Radio Shack, Pioneer, Concord, GM, Ford and Chrysler. Finding that many AM stereo stations is a tougher proposition.

The radios are out there. There is, in reality, a single system. We should press forward and make sure that there are enough AM stereo stations to keep the public interested. Otherwise, like "FM Quad," AM stereo will fade away.

Tom Taggart, Asst. CE
WSPD AM Stereo
Toledo, OH

RW replies: It's unfortunate that the state of AM stereo has degenerated into a shouting match, instead of an open-market discussion of the relative merits of the AM stereo systems.

As the ancient Taoist proverb says, "Do not bark at the dogs."

Points monitored

Dear RW:

Operators planning to try out Frank Colligan's monitoring point evaluation technique (RW, 1 March) had better keep their checkbooks handy.

Contrary to Frank's statement that most such points are "at or very near the nulls in the pattern," I've rarely seen an array which could be retuned to the extent necessary for his test without the resulting parameters being seriously at variance from licensed values.

FCC rules don't allow much leeway for experimentation during the day. Weather-related variance from specified parameters will be tolerated for 10 days before you must apply for an STA (see 73.62(b) and 73.1635, both greatly revised 31 July 1985).

A new, unlicensed design can be operated during daytime for proof purposes under the CP only if "substantially tuned during the experimental period" (73.1615(b)(5), also revised last year).

KRLA has identified over 100 reradiation sources over the years using traditional methods, and has successfully treated scores of them. These methods are not well known.

Taking your FI meter back to the exact points used in the original proof (if you can still find them) is the one best way to tell if a monitor point is still representative of the entire radial. If it isn't, there are lots of tests to quantify and locate the problem. All can be performed by one person, with no two-way radio and no tweaking needed.

Gary O. Keener, Xmtr. Eng.
KRLA, Los Angeles

RW replies: Frank Colligan had this response: "Naturally one is presumed to know the law and that's why I didn't refer to Commission rules at the time. Mr. Keener's FCC rule citations are quite correct and I have no problem at all getting STAs for such purposes.

The reference data is obtained during a full or partial proof when adjustments are being made anyway, with STAs posted on the wall.

In any case, low power should be used. Special equipment on the FI meter may be used to allow the use of the experimental period.

In my 30 years of experience specializing exclusively in AM direction field proofs, I have resorted to every conceivable tool for far-field field-pattern shaping.

Thirty three years ago the eminent Robert M. Silliman developed the "Talk-Down" procedure, which spots reradiators and even measures their ratios and phases without running sampling cables to them.

My technique follows directly from the "Talk-Down" procedure. I have used it very successfully over the years.

I have rarely seen a directional array in which, after tweaking and resetting, the pattern failed to return to the initial status. In rare cases where additional trimming is needed, the causes are old, out-of-date phasing systems and shaky sampling systems. Naturally, one cures those ills first!

As for "handy checkbooks," I use the latest techniques and equipments to keep checkbooks in managements' pockets and off the desktop. In one recent case, where I used my monitoring point test, my bill to the station was 20 dB less than it would have been had I resorted to "traditional" methods."

Creative revival

Dear RW:

In the informative article by Steve Keating on audio processing (RW, 15 February), he discusses the shift in listening patterns from AM to FM and attributes the development to the higher sensitivity of the audience to audio quality.

There is no question that this was true. The audience began to demand that radio deliver a reasonable facsimile of the sound they got at home from stereo LPs.

But there was also a sociological reason. The younger audience in the rebellious '60s not only demanded better audio quality, but also less commercialization. Anti-commercialism was part of the rebellion; in those days, FM was running light and AM was generally loaded to the full 30% per hour.

With 10 kHz separation, we will never see the day when AM can compete with FM in audio terms. AM sound must be improved, no question. But only originality in programming will bring AM back. The day of the creative program director has returned in AM; hand-in-hand with knowledgeable CEs, the AM band will make it once again.

Arnold Hartley
Key Broadcast Management
Garden City Park, NY

Readers' Forum

Got something to say about *Radio World*? Any comments on articles? Call us at 800-336-3045 or send a letter to Readers' Forum (*Radio World*, Box 1214, Falls Church VA 22041).

Stereo shortwave

Dear RW:

I read with interest Patrick O'Gara's letter (RW, 1 March) regarding NDXE's planned usage of the Kahn-Hazeltine AM stereo system for shortwave broadcasting.

I currently have in full operation not one, but two ways of receiving NDXE in stereo with my R-390A/URR communications receiver when they commence broadcasting.

One method utilizes a modified Sony SRF-A100 AM stereo receiver used as a dedicated AM stereo detector (Kahn-Hazeltine and C-QUAM). While the Sony receiver was engineered for a 450 kHz IF, it performs quite well with the 455 kHz IF output from my communications receiver (with very slight tuning adjustment).

The other method is a synchronous detector which I constructed from plans published in *Popular Electronics* (April, 1982, also see corrrection "Out of tune" ibid. July, 1982). This project is easily modified for ISB reception and provides superb reception of both monaural and Kahn-Hazeltine AM stereo on both the AM broadcast and shortwave bands.

I agree with Mr. O'Gara that the Kahn-Hazeltine system is the *real* "Global AM stereo standard." I feel that if the Motorola C-QUAM system becomes the de facto standard for AM broadcasting, the decline of AM radio listening will continue, perhaps more precipitously.

I look forward to the sign-on of NDXE and hope to be among the first listeners with confirmed reception of their broadcasts in stereo. If anyone is interested in information on my conversions for reception of stereo (Kahn-Hazeltine system) shortwave radio broadcasts, please feel free to contact me.

Christopher Kissel
Islip Terrace, NY
516-581-4626

Preemphasis woes

Dear RW:

I knew we AM stereo broadcasters had many obstacles to overcome, but I really was floored by the preemphasis problem when our programming consultant came to town recently.

He pulled out this nice Sony continuous tune radio, and I thought, "finally, a radio that gives us a real fighting chance."

Much to my disappointment, the first thing the consultant wanted to know was if there was some way I could attenuate the lows because he thought we sounded awfully muddy! Immediately I knew he was nuts, having spent many hours listening to my Sony Walkman, Sony

(continued on page 6)

Radio World

Vol 10 June 15, 1986 No 12

Radio World is published twice a month by Industrial Marketing Advisory Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phone (703) 998-7600.

Publisher, Ad Sales Mgr: Stevan B. Dana; East Coast, Ernie Robitel (516-671-2502) **Editor:** Pamela A. White; **News Dept:** David Hughes/*Manager*, Edward Wytkind; **Buyer's Guide:** Edward Wytkind/*Editor*; **Broadcast Computing:** Roger Skolnik/*Editor*; **Columnists:** John M. Cummuta, Mark Durenberger, Floyd Hall, Bill Sacks, John Q. Shepler, Thomas Vernon; **Production Dept:** Jean Choi/*Manager*; Gina R. Rosario/*Graphic Artist, Typesetter.*

Free subscriptions are available to professional broadcasting and audiovisual equipment users. For address changes, send current and new address to RW a month in advance at the above address. Unsolicited manuscripts are welcomed for review; send to the attention of the appropriate editor.

Noisy AM Not New

The FCC's decision to act on the RF lighting debate by issuing a proposed rulemaking limiting bulb radiation frequencies to below 30 MHz is both timely and politically perceptive.

NAB and NEMA's (National Electrical Manufacturers Association) Lighting Equipment Division have been at odds since 1983 over potential interference to the AM band by RF lightbulbs.

NEMA favors self-regulation, while NAB favors radiation conduction and emission limits equal to the protection AM stations must now ensure each other.

The AM band has become increasingly noisy as electrical devices are now commonplace in the home and office. Modern construction practices and materials can make *any* reception difficult without an outside AM antenna, a commercial oddity these days.

Public utility equipment often severely affects AM reception in cars, historically AM's stronghold for reception. Dense development in cities and towns has caused interference-prone areas to grow, at times making all but the strongest signals impossible to pull in.

NAB has consistently pointed out that a consumer's *neighbor* has no choice if conducted or emitted radiation travels into his/her electrical circuitry or through the walls, thus inhibiting the neighbor's right to quiet reception.

The FCC must question whether it should: police new electrical devices to ensure that they do not interfere with AM receivers; promote the existing practice of tagging equipment that is prone to produce AM noise, or "let the buyer beware." Given present conditions for AM reception, ruling on RF lightbulbs is akin to closing the barn door post-exodus.

The FCC's timing is opportune; since RF lightbulbs are still relatively uncommon, it can expect few comments, and can push for a jointly developed solution from NEMA and NAB.

Then the FCC can, in conjunction with its AM improvement effort, promote better receiver design, joint industry cooperation and consumer understanding without inhibiting the development of a new, efficient lighting technology.

—RW

SBE Answers Education Needs

Editor's note: The 1 June issue of RW *included a guest editorial by broadcast equipment maintenance educator Ed Montgomery on the troubled status of technical broadcast education programs, and invited further exploration of problems/solutions. SBE President Dick Rudman kindly shared this SBE education update for* RW *readers.*

by Jim Wulliman

Milwaukee WI ... The SBE, as a professional broadcast engineering organization, considers education as one of its primary interests. We attempt to meet the needs of the broadcast industry for persons interested in entry level and continuing education in a number of ways.

We established a Certification Program in 1976 to recognize professional competence in the field of broadcast technology. This program has certified almost 3,000 persons in four different levels of experience since it was introduced.

The Certification Committee has evaluated a number of technical training courses which prepare students for careers in broadcasting and broadcast related industries. These students are eligible for Broadcast Technologist Certification upon graduation.

Jim Wulliman, manager of engineering for WTMJ-TV, Milwaukee, heads the SBE Certification Committee. He can be reached at 414-332-9611.

Guest Editorial

The committee has established a liaison with the Canadian Association of Broadcasters to benefit from its work in developing a common technical training curriculum offered in technical schools all across Canada.

The Certification Committee serves as a clearinghouse for technical training course information which can be used by institutions planning to offer entry-level training.

The Certification Committee is working with accredited technical schools to develop a continuing education course to be offered via a series of lessons in a nationally distributed magazine. Recertification credits will be awarded to participants who complete all of the quizzes provided with the lessons.

In addition to these educational projects administered by the Certification Committee, the SBE parent organization supports a number of other educational projects.

The Ennes Scholarship fund was established to honor Harold Ennes, who was a member of the Certification Committee and the well-known author of the series of technical manuals used in most broadcast training courses.

The SBE has arranged with Mary Lou Ennes to have these textbooks revised and republished as a service to our industry.

A scholarship is awarded each year at our national membership meeting to a deserving student in the broadcast technical field.

The SBE and its local chapters hold regional conventions which include technical seminars covering current operating practices and future technology. These regional conventions have been very successful in bringing new information and products to station engineers who are unable to travel to the NAB convention.

This year the SBE will hold its first national convention in cooperation with the St. Louis chapter. It is anticipated that this convention will be held in different regions of the country each year to provide even greater information and continuing education for the grassroots broadcast engineer.

The SBE national office offers a Broadcast Engineering Job Clearinghouse as a

(continued on page 6)

Dear RW:

(continued from page 5)

tabletop, Pioneer KAE4300 and my Delco AM-stereo and thinking "Wow, what a clean sound ... it's almost too bright."

He flipped on the Sony and, compared to the local FMs, we sounded horrible! This was the first "newer generation" radio I had heard on which we sounded bad.

I'm beginning to wonder if we weren't better off with narrowband radios that dictated we boost the hell out of the highs! Now you don't know what to do to please even the people with only the so-called "good radios."

We need to establish some preemphasis guidelines *NOW*, and it does not matter who chooses the parameters. Let's get it done now; five years down the road will be too late!

Ken Romero, Ops. Mgr.
KANE AM-1240
New Iberia, LA

Eight days a week ...

Dear RW:

It's easy for Floyd Hall to look down from his yacht club deck, with his Jag in the parking lot, and say to a Chief Engineer, "Negotiate a better deal, or quit," as he did in the 15 March issue. In the real world, it's not that simple.

There was a time when every station had at least three First Class engineers. In those days, the engineering crew had plenty of time to test all the electrolytics periodically.

Now things are radically different. With deregulation, GMs are feeling free to tell engineers to "take it or leave it," and to pay the absolute bare minimum that they can get away with. There is a surplus of engineers and technicians.

With managers hiring only part-time or contract engineers, each engineer must work for several stations in order to barely make a living.

Take the $200 a month contract engineer, for example. Let us assume that an engineer needs $1600 a month to pay the rent, car payments, gas, insurance, food, etc. In order to spend a whole day at each station really doing things right, he will have to work *eight days a week*.

In the real world, "haywire" connections are inevitable under such conditions.

Engineers with any smarts are getting the hell out of radio and into TV, industry or public utilities. That leaves the ones who don't know any better than to make the stupid mistakes that Floyd Hall gets such a kick out of telling us about.

In radio, as in everything else, *you get what you pay for.*

T.C. Sylvester
Fresno, CA

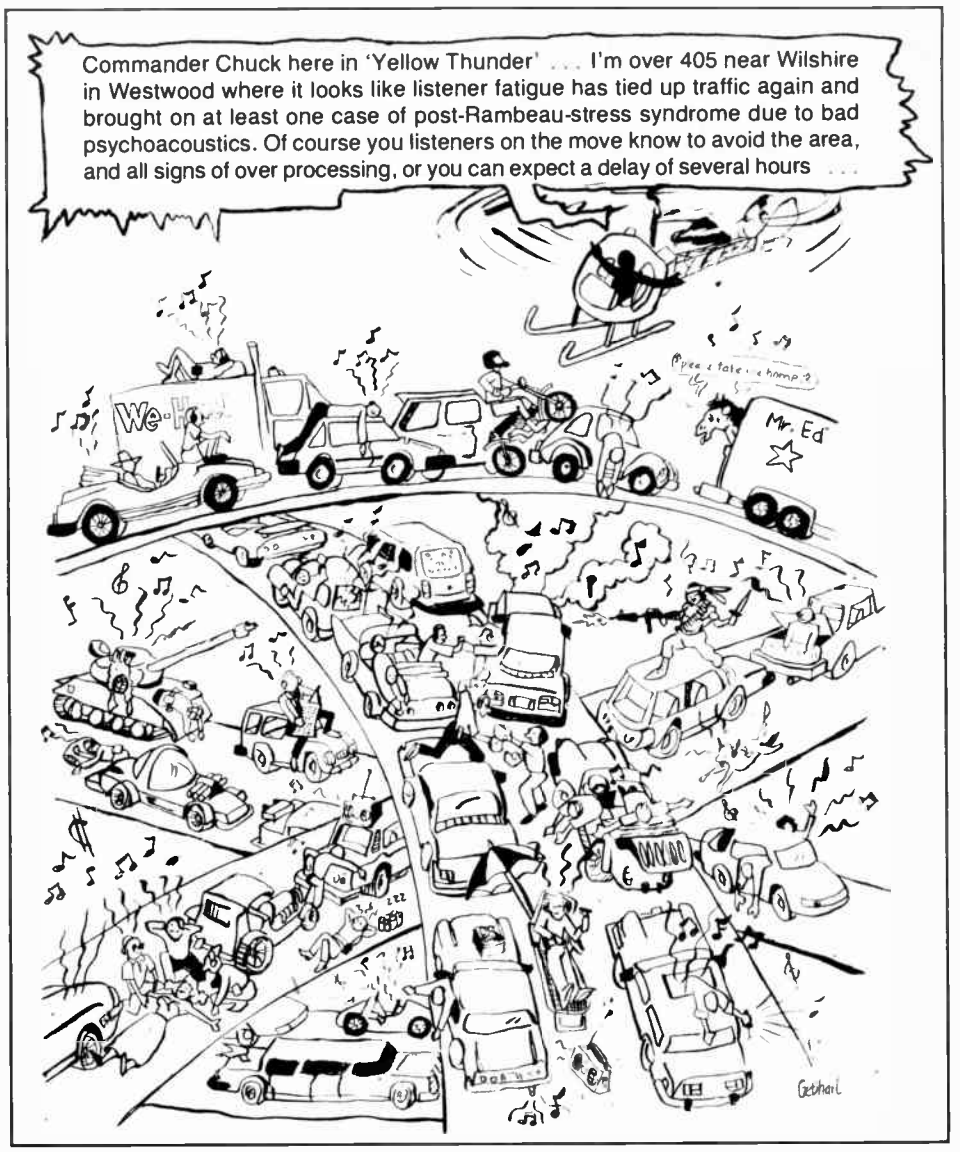
RW *replies: Columnist Floyd Hall responded thus: "Sylvester's letter expounds all the things I have been hearing for 50 years—from the same kinds of kids!*

I wonder if he thinks he is telling me anything new? Almost every time I go to a station, with a young "boy" as CE, I get the same kind of guff, i.e., "the manager/owner is a cheap swindler"—"he won't pay what the job is worth." If he did, you wouldn't get half as much as you do now.

He says I look down from my ivory castle (out of my luxury sports car) and say he should work from starvation wages! Then he ends the letter by saying, "you get what you pay for." Baloney! In this world, you only get what you earn.

When I graduated from college, better engineers than me were walking the streets looking for a job that paid as much as $15 a week! I got a job, and was glad to get it, for a large construction company, shoveling sand and gravel for 27-cents an hour! Me, with an MSC!

Time after time, I have to tell a station owner that he has been cheated! His station is so run down it is almost defunct, simply because these so-called engineers didn't clean, didn't repair or didn't adjust anything—and in most cases, for years!"



SBE Aiding Education

(continued from page 5)

service to our industry. This service is available at no charge to all broadcast engineers, regardless of membership or certification status.

The SBE national office also maintains a lending library of video cassettes for use by the chapters. These videotapes are suitable for training seminars or chapter meetings.

The SBE has made arrangements with the group which has for many years conducted the NAB Technical/Management Seminars at Purdue University to offer technical/supervisory training for SBE members and chapters. The scope of the training can be customized for any chapter if minimum registration requirements are met.

To improve the relevance of broadcast technical training and to stimulate interest in broadcast technical careers, Mary Beth Leidman, recently appointed coordinator of Student Education, will work with the Certification Committee and the SBE Board to develop and implement the mechanics of certification for broadcast technical training institutions. (Leidman is GM of WIUP-FM, Indiana PA).

In order to put all of our educational projects into one unified effort, the SBE Board, at its annual meeting, authorized the formation of the Ennes Educational Foundation. Doing so will allow us to clearly identify the educational projects and goals of the Society, and to develop funding independent of our dues structure.

RF Lightbulb Limit Proposed

by Edward Wytkind

Washington DC ... The FCC proposed in May to adopt radiation limits at frequencies below 30 MHz for RF lighting devices, which have been found to interfere with AM radio reception.

In a separate but related action, the FCC also in May denied the NAB's October 1985 Petition for Partial Reconsideration urging the Commission to adopt RF radiated limits of 25 μV/m at 10 meters for RF lighting devices. The NAB's proposed limit would have equaled the current standard of protection AM stations have from other AM station interference.

The NAB's recommended limits were "inadequate" because they were "too stringent in some frequencies and too liberal in other frequencies," according to FCC Engineer Liliane Volcy.

FCC rules now require that RF lighting devices meet certain conducted limits in the 30 MHz band and certain limits in the 30 MHz to 1,000 MHz frequency range, the Commission said.

> *"The Commission said it supports 'industry self-regulation whenever possible.'"*

According to NAB Engineer Michael Rau, the NAB's proposed emission limits "were intended only as interim standards."

"We're currently studying the Commission's recommended (emission) limits," Rau said. "We are, however, extremely pleased that the FCC has decided to propose the regulation of RF lighting devices in these frequencies."

Radiated limits explored

The FCC's proposed rule was issued to explore whether radiated limits are needed in addition to existing "conducted voltage" limits, which the FCC said have to date "proven to be satisfactory in most cases."

In addition to addressing other frequencies, the proposal offers a 15 μV/m at 30 meters radiated limit from 1.705 MHz to 30 MHz.

The Commission said it supports "industry self-regulation whenever possible," as opposed to "mandated and enforced emission limits." It added, however, that most commenting on the issue support adoption of enforced regulations due to the "interference potential of RF lighting devices."

Opponents continue battle

The NAB, which continues to lobby for stricter emission limits on RF lighting devices, has battled the National Electrical Manufacturers Association's (NEMA) Lighting Equipment Division, as well as GE, both of which support a voluntary standard to be developed by industry.

NEMA officials could not be reached for comment.

The FCC, while recognizing the potential for interference to AM radio, has stated that it did not want to "impose fixed radiated emission limits" until sufficient information is gathered.

Volcy added that the Commission has not received any reports complaining of interference to radio services from RF lighting devices.

In September 1985, the FCC relaxed certain regulations governing the use, marketing and certification of RF lighting devices.

At that time, recertification requirements for triennial equipment were lifted, and equipment marketed under various trade names would not be subject to "reports of measurement" requirements as each was released in the marketplace.

The NAB has maintained that the new rules make it easier for lighting manufacturers to develop and market new technologies without first having to prove that the resulting products do not cause interference to broadcasting.

Meanwhile, the lighting industry officials argue that the new RF lighting rules have not relieved the industry "of its responsibility to develop (voluntary) standards that protect broadcasters."

Comments on the proposal must be filed by 30 June 1986. Reply comments are due 15 July 1986.

Docket number is GEN 83-806. Contact Liliane Volcy at the FCC: 202-653-7316.

NEW!

Sexy — Versatile — telnox

EXCLUSIVE REPRESENTATION BY

ALLIED
Broadcast Equipment

Telnox LO . . . A complete telephone system designed specifically FOR BROADCAST USE

The Telnox LO is not unlike a regular PBX telephone system except that it performs the phone interfacing in the phone switch. Not only is conferencing facilitated, it provides the ability to conference 10 lines.

Many other attractive features are included: call handling on a priority basis; auto replacement of a drop-off in appropriate order; auto hold which automatically answers calls and places them on hold (an optional vocal card can answer the call and give a custom message to the caller before putting the call on hold); and program on hold.

The Telnox LO will manage up to 10 lines from the local telco central office. The remote Telnox switch will accept up to 8 telephone sets as shown above.

These telephone sets can be custom programmed by the user so that they can perform different functions to meet your needs. These sets also permit remote operations while broadcasting from a remote local or distant location.

Let us help you plan a system.

ATLANTA, GA (404) 964-1464	CHICAGO, IL (312) 794-0224	DALLAS, TX (214) 423-8667
LOS ANGELES, CA (818) 843-5052	RICHMOND, IN (317) 962-8596	SEATTLE, WA (206) 838-2705

ALLIED
Broadcast Equipment
P.O. Box 1487 • Richmond, IN 47375

Group Tests Enhance CEs' Role

by Kathleen Karas and
Mark Timpany

Severna Park MD ... Ask management what they think of their engineer, and what kind of an answer will you get? *Vague*. You'll hear seat-of-the-pants evaluations that add up to a lot of diplomatic—and sometimes not so diplomatic—garble. Why?

It seems incredible, but management has no way to rate the effectiveness of an engineer on the basis of the quality of the signal transmission he produces.

Yet, ironically, a large part of an engineer's day is spent working with things that may be measured quantitatively. Test equipment is readily available for the measurement of transmitter frequency, audio signal levels, distortion and the like.

Not-so-trivial trivia

Most, if not all, of the information resulting from these tests can be translated into easy-to-read graph form, either numerically or in line form, and consequently be presented in a meaningful way.

In as little as three months, with three reports in hand, management will have a basis for comparison. An engineer can describe a deteriorating situation by comparing the data indicated in the monthly reports.

The payoff

The information dealing with coverage and signal strength can even be used by the sales staff to demonstrate consistent performance on a month-to-month basis, using a year's worth of monthly reports.

The benefit is that management can give the sales department accurate parameters regarding area coverage and comparative audio quality. This information then becomes a useful sales tool, and can be of keen interest to sponsors. Thus, it can directly affect revenues coming into the station.

The program department can then correlate independent audience research reports (available through several sources) as a measurement of its performance in key areas of coverage. This will also directly affect the economic success of the station.

Who's on first . . . ?

Management has always had a difficult time determining how well the engineering department performs its role.

It's a relatively simple matter to determine whether or not a piece of equipment is working, but it is far more difficult for nontechnical managers and administrative personnel to assess the overall effect of a particular piece of equipment.

This limitation penalizes the good engineer. In effect, his role is reduced to that of a maintenance man, and at smaller stations he is often looked upon as almost (but never quite) dispensable.

Management needs easy-to-understand parameters, designed for the layman, to judge the effectiveness of equipment and to rate an engineer's use of that particular piece of equipment.

Hello stranger

Early in 1984, the engineers within the Shamrock Communications group began designing a program to fit their work into a "Management-by-Objective" structure. Although the program is still evolving, a number of valuable techniques for interdepartmental communications have already come out of it.

The first procedure used was a monthly report from the station engineer to the general manager.

This sort of reporting is already used by the sales and programming departments. But engineers? That's an interesting wrinkle. The Shamrock engineers found that it works (see Figure 1, a sample form).

Gems from lemons

At Shamrock Communications, the engineering department's monthly reports have been instrumental in identifying equipment unreliable enough to warrant replacement.

The reports flag down equipment that frequently needs repair by documenting its poor performance, thus showing it as a prime candidate for replacement. The reports do so in a way that allow even a layman to pick out the gems from the lemons.

The monthly engineering reports also provide a means for regularly updating major, long-term projects, such as the construction of a new transmitter site or a new production studio.

Power of the press

A group newsletter grew out of the monthly reports at Shamrock Communications.

The newsletter, assembled at Shamrock's Milwaukee station, WQFM, consists of the collected monthly engineering reports from the five group locations. Contributions and clippings come from each of the individual station engineers.

One immediate benefit was that the newsletter quickly disclosed that many station problems assumed by the on-site engineer to be peculiar to his station alone were, in fact, problems common to the entire group.

The newsletter also provides a means to distribute solutions to the on-site engineers. For example, evaluations of new equipment at one station were consequently passed along to all. One engineer's construction or interface was available to be duplicated at another station.

Just as important, the newsletter showed how the efforts of each engineer were in reality part of a team effort, supported by and beneficial to the entire group.

Once the basic lines of communication were established, the group developed a number of standardized test procedures. First they equipped all stations with test equipment capable of the measurements desired.

The group opted for the Potomac AT-51 as the standard package, since this compact, portable test set included wow and flutter, phase and intermodulation distortion measurements.

A list of standard test materials was prepared and distributed as a supplement to the newsletter. Every station in the group would use the same test record and tapes.

With a set of standard test forms, regular testing became more efficient and results could be quickly compared between stations.

A monthly schedule of testing examined each piece of equipment that contributed to on-air quality. The preliminary standard set for equipment maintenance was the manufacturer's specifications.

The concept of monthly testing was well received by station managers in the group. Their interest and enthusiasm stemmed from the emphasis that the engineers had placed on trying to find problems before any serious deterioration to the air sound occurred.

The engineers in the Shamrock Communications group meet at least an-

(continued on page 16)

Figure 1.

EQUIPMENT TROUBLE REPORT

Problem Description:_____

Reported by:_____ Time:_____ Date:_____

Repairs performed:_____

Serviced by:_____ Time:_____ Date:_____

A copy of this report will be returned to the originator after service is performed.

Figure 2.

	Field Intensity	Bearing	Distance	Predicted Field Intensity	Description of Location
1	-	4 deg.	6.1 m.	13.1	Lake Drive Baptist Church Parking Lot-Brown Deer and Fielding
2	-	85 deg.	1.54 m.	205	Highway 32 at Atwater Park Shorewood
3	-	190 deg.	11.4 m.	3.74	Southwest Park and Ride College and I-94
4	-	230 deg.	9.33 m.	5.6	Parking Lot West Allis Library-102d and Lincoln
5	-	270 deg.	8.26 m.	7.1	Parking Lot Southeast corner-Capitol Drive and 107th
6	-	315 deg.	8.36 m.	7.0	Parking Lot Toys 'R' Us Northridge
7	-	-	-	-	-
8	-	-	-	-	-

Station_____
Date_____
Time_____
Weather_____
Performed by_____

$$\text{Predicted Field Intensity} = \frac{137.6 * (\text{ERP in kilowatts})^{\frac{1}{2}}}{(\text{Distance in miles})^{2}}$$

Figure 3.

CAPITAL EXPENSE PROJECT FORM

Proposed change

Benefits expected

Expected completion date and contingencies (note equipment delivery and installation schedule)

Capital costs of project and construction

Continuing costs or savings from project

Operational effect of proposed change

Operational effect of construction period

signed_____ date_____ signed_____ date_____
submitted, chief engineer revised, general manager

- - - use reverse side for block diagram if necessary

Figure 4.

FULL AUDIO CHAIN

Intermodulation Distortion

Left ——% Right ——% Mono ——%

Signal to Noise

Left ——% Right ——% Mono ——%

Stereo Phase at 8 kilohertz

——degrees

Station_____
Date_____
Time_____
Performed by_____

Figure 5.

Standard Test Forms

STF-1	Equipment Trouble Report
STF-2	FIM-71
STF-3	Capital Expense Project Form
STF-4	Full Audio Chain
STF-5	CBS Labs STR-151 Phono Test Record
STF-6A	STL C-4039-2-AF (Audiopak AA-4) Test Cartridge or STL C-4039-2-SC (Scotchcart) Test Cartridge LEL C10A Test Cartridge Station produced I.M. Test Cartridge
STF-6B	STL C-0034-2-AS Aristocart AA) Test Cartridge LEL C10A Test Cartridge Station produced I.M. Test Cartridge
STF-7	STL C-3002-2 Reel to Reel Test Tape STL X-1252 Reel to Reel Test Tape
STL-8	STL C-0086-2 Cassette Test Tape
STF-9	Console Parameters
STF-10	Inventory Transfer Form

Kathleen Karas is VP/Sales at Radio Resources, located between Baltimore and Washington, DC, and Mark Timpany is CE at WQFM, Milwaukee. Kathleen can be reached at 301-859-1500 or 800-547-2346; call Mark at 414-276-2040.

Radio '86 Targets Engineers

(continued from page 1)
hibitor registration, the SBE hopes to sell as many as 300 booths.

Richard Rudman, SBE president, said 200 booths was an attainable goal, and is closer to what the SBE is expecting.

Caputa added that SBE would be satisfied if it could attract between 2,000 to 3,000 people to the show, up from the 1,350 attending the show's antecedent, the 1985 SBE Central States Convention. "We want to be known as the engineers' convention," Caputa said.

In hope of setting record exhibit space and overall attendance levels for Radio '86, the NAB will be strengthening the engineering program, according to NAB Engineer Mike Rau, who is organizing the program.

He said the 12 sessions will have a more "nuts and bolts" feel, in contrast to the engineering sessions held at the full NAB Convention, which concentrate more on "policy."

Engineering highlights at the show, Rau said, will include the debut of a detailed report on AM overmodulation that will feature its "causes and cures." He also said the AM preemphasis/deemphasis standard now being drafted by the National Radio Systems Committee (NRSC) will also be featured, along with an update on the NAB-sponsored AM antenna testing program.

Engineering sessions will cover AM stereo, directional antennas, new ground radial and lightning protection technologies, FM upgrades, FM antenna developments, the FMX FM-stereo signal extension system, studio design, CD players and satellite technology.

The program will also include an FCC "open forum," along with a seminar to "help engineers to communicate to program directors and general managers" and a maintenance workshop.

The day before the show opens, the NAB is also planning an all-day session on radio frequency radiation (RFR) regulations. The event will examine regulation compliance, federal preemption of local standards and local zoning commissions.

In addition to the engineering sessions, Radio '86 will also feature about 60 other sessions dealing with management, programming and sales.

Registration fees, according to NAB, are unchanged from last year: $295 for NAB members, and $445 for nonmembers.

In comparison, SBE show attendees will be charged $25 to attend three days of engineering sessions organized by John Battison, from *Broadcast Engineering* magazine.

Compete or complement?

Despite upgraded engineering plans for Radio '86, some firms still say they will not exhibit at the show, and instead favor the SBE show a month later.

The SBE event, which covers both radio and TV, will feature an open forum with the FCC, in addition to radio sessions covering directional antennas, SCAs, audio system interfacing and synchronous AM transmitters.

However, NAB Science and Technology VP Thomas Keller said the SBE show is focused too largely on TV, and therefore is not in direct competition with Radio '86.

Rudman agreed with Keller: "The

(continued on next page)

Radio '86 Targets Engineers

(continued from previous page)
NAB show is attended by more managers and programmers, while the SBE show will be geared more toward working engineers."

Rudman, who spoke last year at the Radio '85 engineering sessions, said he saw lots of programmers but relatively few engineers. Labeling the SBE show more of an "educational event," he said it "filled a new niche" and was "more affordable."

"Vendors that attend our show know they will be talking to the working engineer, not general managers, news directors and programmers," he said.

One firm that plans to skip Radio '86 in favor of the SBE show is TFT.

"We have limited bucks for shows, and we plan to direct that money at the SBE convention," said TFT Marketing Director Jesse Maxenchs. Both NRBA and NAB promised that many engineers would attend past radio-only shows, but that did not happen, he said.

Even with NAB's plans to double the number of engineering sessions, Maxenchs said that he still believes the SBE show will draw more engineers.

"They (NAB and NRBA) blew it last year," said Howard Mullinack of Orban Associates. He said Orban will not exhibit at Radio '86, but will show equipment at the October SBE show.

"We went (as non-exhibitors) to Radio '85, but the turnout featured 'more exhibitors than attendees'," he said. Last year's Central States show in St. Louis featured a "decent turnout," so Orban decided to go to St. Louis.

He said that while Orban will not exhibit at Radio '86, company officials will attend the show. If there is a significant increase in the number of engineers that attend, then Orban may attend the Radio '87 show as an exhibitor, Mullinack said.

"There are just too many conventions, and we can't go to all of them," he added.

Nautel Broadcast Sales Manager Jorgen Jensen, for example, said his firm will have a small booth at Radio '86 despite the fact that "a lot of manufacturers have been discouraged about past shows" that featured "too much programming."

Radio '85 "was not a good show. However, I like New Orleans and will give (Radio '86) another try," he said.

Jensen added that his firm has no plans to exhibit at the SBE show, calling it "a total unknown. It's been a small show in the past." However, if the SBE show develops into a larger draw for engineers, Nautel could change its plans in upcoming years, he said.

For more information on Radio '86 contact Bob Hallahan at the NAB: 202-429-5350. For more information on the SBE show, contact Sam Caputa at Adams Communications: 314-727-2160.

Kahn, Tohtsu Sign

by Edward Wytkind

Washington DC ... Kahn Communications, Inc. (KCI) has announced a marketing agreement with a Tokyo-based broadcast equipment trading company—Tohtsu Co—which will distribute KCI's AM stereo system.

KCI President Leonard Kahn refused to comment on the matter. Further details on the agreement were not available.

At press time, the FCC had not concluded its investigation of KCI's complaints, filed 11 April, which alleged that Motorola Corporation's C-QUAM™ AM stereo system violates Commission type acceptance rules concerning spectrum usage and adjacent channel interference.

Motorola and its licensees (Harris Corporation, Delta Electronics, Broadcast Electronics and TFT, Inc.) maintain that the C-QUAM system complies with all type acceptance requirements.

The Commission's field operations bureau is currently conducting measurements on the Motorola system, according to FCC Engineer Bruce Franca. No timetable for completion of the investigation has been set.

For more information on KCI's allegations, contact Bruce Franca at the FCC: 202-632-7060. Contact KCI at 516-222-2221.

EEPA Eyes US RFR Policy

(continued from page 1)
ranging from 1/10 of ANSI to no standard at all—and will solicit public and industry comments on the merits of adopting an official federal guideline. The recommendations should be released this summer.

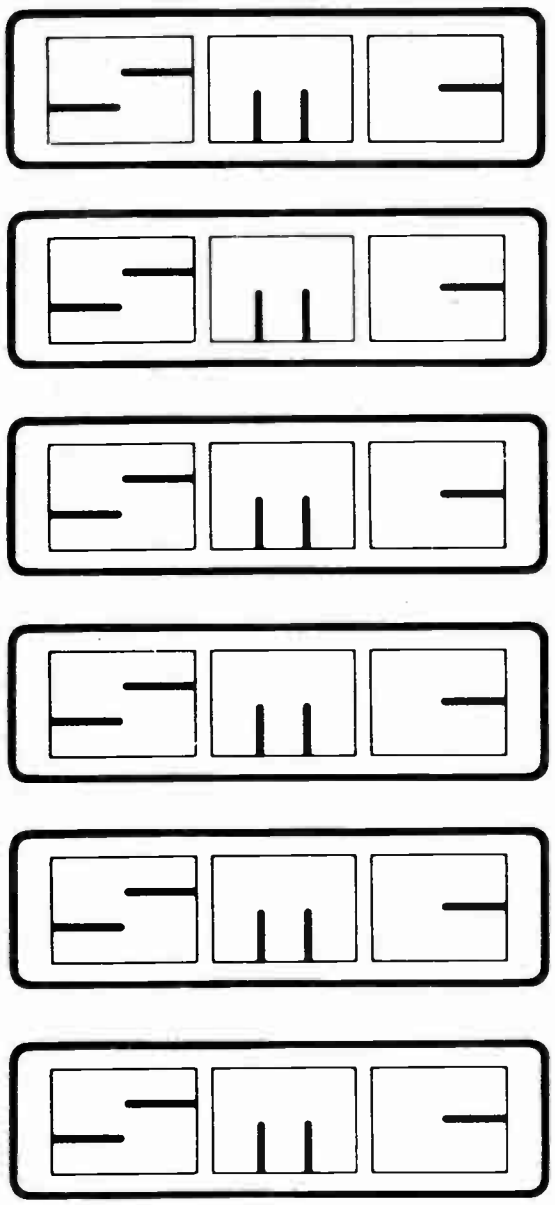
Robert Curtis, an area director for the Occupational Safety and Health Administration (OSHA), said the industry "claims" it is concerned with antenna sitings and public exposure issues.

"Yet, I can still go to a facility and find violations of the ANSI standard," Curtis said. "This hurts your credibility as an industry."

He added, however, that OSHA cannot issue a citation for violations because the agency operates under a voluntary worker standard based on the outdated 1966 ANSI standard. ANSI reviews each of its standards every five years.

Citing employer perception as a problem, Curtis said that when an OSHA representative visits a facility and finds a violation, but doesn't issue a citation, then the facility's management perceives this as "no problem ... This is the wrong perception."

Next year's EEPA conference will be held 22-24 April in either Washington, DC or New Orleans. For tapes of this year's symposium, contact the EEPA at 202-452-1070.



SUCCESSFUL AUTOMATED RADIO DEPENDS ON THE PARTNERSHIP

This partnership formed between The Station, Programming Syndicator and Automation Vendor, assures success in a number of ways.

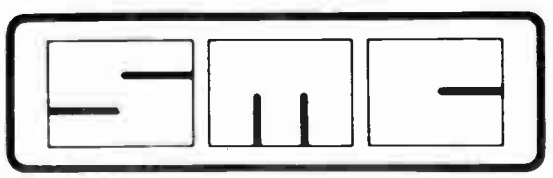
- Positive programming control and discipline
- Professional programming guidance for your market
- Practical staff utilization
- Improved cash flow

We could go on, but to find out what hundreds of other stations already know contact any of these program syndicators:

TOBY ARNOLD & ASSOCIATES - Carrolton, Texas
B-P-I - Bellingham, Washington
CaVOX - Hawthorne, California
CENTURY 21 PROGRAMMING, INC. - Dallas, Texas
CnB STUDIOS - Belmont, California
CONCEPT PRODUCTIONS - Roseville, California
DIGITAL PROGRAMMING, INC. - Van Nuys, California
DRAKE-CHENAULT RADIO CONSULTANTS - Canoga Park, California
FM-100 - Chicago, Illinois
KALAMUSIC - Kalamazoo, Michigan
MEDIA GENERAL BROADCAST SERVICES - Memphis, Tennessee
THE MUSIC WORKS, Inc. - Nashville, Tennessee
PETERS PRODUCTIONS, INC. - San Diego, California
RADIO ARTS - Burbank, California
REAL RADIO COMPANY - Pasadena, California
SATELLITE MUSIC NETWORK, INC. - Dallas, Texas
TM COMMUNICATIONS, INC. - Dallas, Texas
TRANSTAR - Denver, Colorado

And,
The World Leader in Broadcast Automation Equipment and Systems.

SONO-MAG - offers the most complete selection of programmers for the most simple or complex format, including satellite, live assist and compact disc operations.



SONO-MAG CORPORATION

1833 West Hovey Avenue Normal, Illinois 61761
TELEPHONE: 309/ 452-5313 TWX: 510/ 352-2506

Circle Reader Service 36 on Page 35

NPR Satellite Show Marketing Scheme

by Edward Wytkind

Washington DC ... As part of an overall plan to better utilize and market its satellite transmission system, National Public Radio (NPR) recently coordinated a live, two-way radio conversation between students at Southern Illinois University and Moscow State University in the Soviet Union.

The two-way link was accomplished 16 May using international phone circuits between Moscow and New York; a fiber optic link between NPR affiliate station WNYC, New York and NPR's Washington DC headquarters; satellite uplinks/downlinks in New York and Washington, DC and a portable uplink in Carbondale, IL.

> *"It was a technical phenomenom."*

"This unique event gave us an opportunity to make use of just about every technical capability and satellite service the public distribution system offers," NPR Distribution Division VP Peter Loewenstein said.

"It was a technical phenomenom," said NPR satellite services Marketing Manager Pam Fennell.

Better utilization sought

Aside from NPR's more than 2,500 downlinks and 20 uplinks around the US—manned by members and affiliates who receive 24-hour programming—NPR wants to encourage the creation of more "ad hoc, regional networks," Fennell said.

Fennell pointed out that regional public radio networks in Minnesota, Georgia and other regions of the US are the type of ad hoc efforts necessary to promote NPR's satellite distribution services.

"The mission of Satellite Services is to effectively market the excess (satellite) capacity, while maintaining the delicate balance of serving the needs of public radio and creating new services to serve commercial clients," Fennell added.

Budapest remote

In late February, NPR also coordinated a two-way satellite talk show for WASH-FM, Washington DC, which featured live, two-way transmission from Budapest, Hungary.

The transmission, arranged by NPR and international satellite carriers, linked WASH studios with the studios of Magyar (Hungary) Radio in Budapest via satellite.

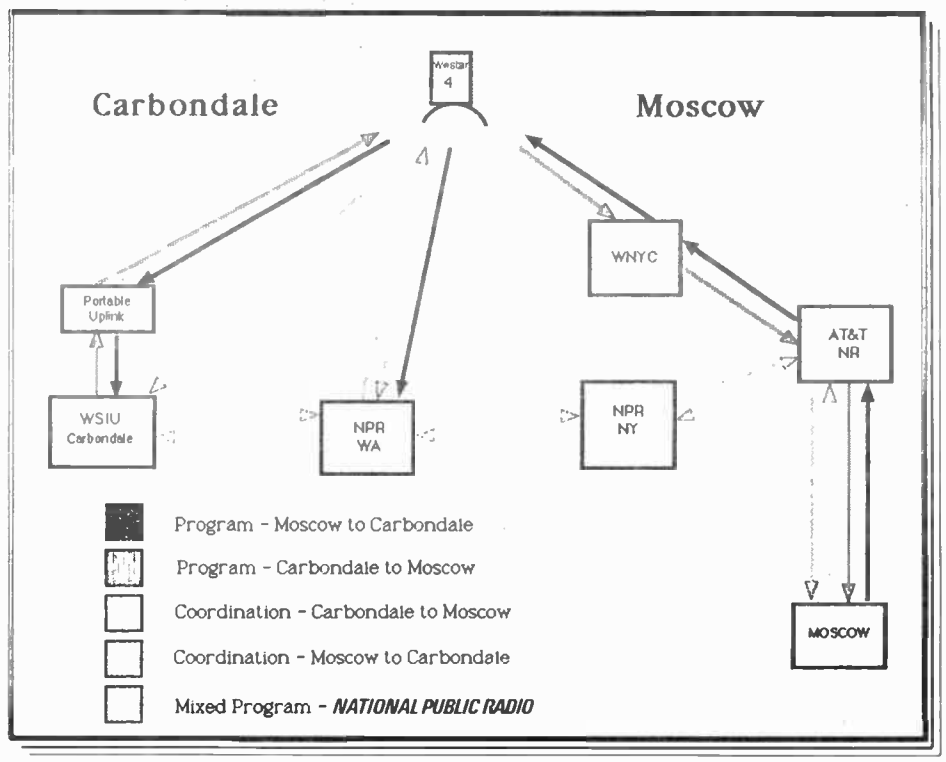
Other scheduled NPR-coordinated international transmissions include the distribution of World Cup Soccer in June for Radio America to 20 Hispanic markets via a "handoff" from a public radio downlink station to the Radio America end-user, according to Fennel.

System specifications

NPR's satellite system handles approximately 1,700 transmissions a month in addition to its 24-hour fulltime networks and the ad hoc networks designed on request.

Utilizing an SCPC (single-channel-per-carrier) analog system and multiple circuits, the system currently has 13 fulltime networks on its transponders (Westar IV, 2D and Satcom 1R).

The networks range from the Satellite Music Network, a wideband 15 kHz stereo service, to Brookmont, a narrowband 5 kHz mono ad hoc network that transmits news, sports, weather and data transmission to regional member stations.



NPR licensees are equipped with one receiver subsystem, which consists of a down converter, four demodulators and audio processing equipment.

The down converter may be tuned to one of two wideband transponder frequencies, while each demodulator unit may be independently tuned to one of many frequencies within the selected transponder.

The earth terminal antennas, 4.57 meters or 3.66 meters in diameter, offer manual "re-pointing" capabilities to another satellite in the case of prime satellite failure or malfunction.

Distribution of PBS programming is handled through the Main Origination Ground Terminal System, which is located in Bren Mar, Virginia, about 10 miles southwest of Washington, DC.

For more information on NPR satellite services, contact Pam Fennell at 202-822-2628.

2 Antenna Sites Set

by David Hughes

Washington DC ... The NAB announced that its program to build and test two prototype AM antennas designed to increase groundwave coverage will involve two sites in the Washington, DC area, instead of one.

NAB Engineer Mike Rau said the antenna program will utilize a previously announced site in Aldie, Virginia, about 30 miles west of the national capital, and a site just northeast of Washington, DC in Beltsville, Maryland.

Using two sites, he said, will allow work on both antenna projects concurrently rather than having one project follow the other.

The prototype antenna designs were developed by Richard Biby of Communications Engineering Services, Arlington VA, and Ogden Prestholdt, a consulting engineer with A. D. Ring and Associates, Washington, DC.

Tests using the two antenna designs are scheduled to start this summer using the 1600-1700 kHz band range.

Additionally, NAB Science and Technology VP Tom Keller said the two sites could also lend themselves to future tests of synchronous AM transmitters.

He said the NAB wanted to keep on top of the issue, especially since the FCC proposed allowing synchronous transmitters in its much-heralded AM improvement report, released in April. A formal FCC rulemaking proposal on synchronous transmitters could be issued later this year.

AM stations could utilize synchronous transmitters, which operate on the same frequency as the main transmitter, to extend their coverage area or to fill in coverage gaps.

For more information, contact Mike Rau at 202-429-5346.

Circle Reader Service 22 on Page 35

Remote Broadcast Van Enviable

by Henry Ruh

Chicago IL . . . Being an engineer first and a small-market FM owner second, I naturally think of technology when thinking of ways to make money.

From the moment that I drew up the first concept of my station, a remote broadcast van was on the list of priority items. There were several reasons for this.

First, entering a market which already has several established stations, including AM/FM combos, is tough, and I felt a competitive edge was needed.

Second, the station's image and finances would require smart thinking, as well as hard work.

Third, I'm in love with technology and get a real ego boost from doing things I know my competitor can't or won't do. I don't believe in beating the competition—I believe in *killing* the competition, and if technology will help do it, buy it.

Here is what we did, how we did it and the results.

First, small-market economics do not allow the purchase of a $25,000 custom van filled with all the goodies—not even on a lifetime tradeout with a local dealer—so we opted for a used van.

We found a used Dodge four-wheel drive van with a decent body and already outfitted with a "custom" interior: i.e., it had carpeted walls and ceiling, extra chairs and dashboard goodies.

Because we wanted reliable transportation, we had the mechanical guts redone, including a motor overhaul, new brakes, new exhaust system, etc., so that first-year maintenance would be at a minimum.

As it turned out, this was a reasonably good idea, since we accumulated over 20,000 miles in the first nine months.

The four-wheel drive also helped. Since the van is used to transport equipment and visit the remote transmitter site, soft ground and icy roads are not a hindrance.

Henry Ruh, the "Radio Doctor," is at WMAQ-TV, Chicago. He can be reached at 312-861-5555.

Van "stuffed" with gear

The van came with a fiberglass overhead "dash" to hold a stereo system. Though it came *sans* stereo, it had speakers all around the interior. A little wire work gave us a completed system.

Radio Doctor

The overhead was stuffed with a digital readout stereo receiver with cassette player, 4-channel power booster, CB radio, audio equalizer, 2-meter ham radio and a 10-channel scanner radio.

Five antennas were mounted on the roof with a pair of 12" PA speakers. A Marti RPU repeater and a turntable-sized cabinet were mounted near the center of the van.

Altogether we spent about $5,000 on the van and about $5,000 for remote gear in the van, plus two base RPU receivers and base antennas/coax.

A Honda emergency gas generator, capable of 800 W of AC plus 10 A of 12 VDC, was added to supply AC power or charge a dead battery as needed. We built a box and welded it to the back of the van. So far, we have not had a dead battery.

The RPU receiver/transmitter can be powered from both AC and DC. We normally use the AC generator, but if it fails, the DC is already on and the system is thus "failsafe."

The generator is rated to provide continuous operation for five hours on one fill-up of its tiny tank. It was possible to tap into the main van tank, but we felt it better to leave it separate since it could then be removed and used elsewhere, if needed.

In practice, the generator will run about four hours under load, although during double header sports night we refill it between games just so it doesn't run out if the game runs into overtime.

An RPT-2 is used to send the remote audio from the site to the van repeater. The van repeater then relays the signal to the studio base receiver. With a small yagi-type antenna, ½" heliax and a 90' tower, we have a range of 35 miles or better.

A second base receiver lets us receive the RPT 2 directly, thus serving as a backup for the mobile repeater at short range (up to 10 miles) or when used direct without the mobile repeater for local events.

If everything fails, you could always press a scanner into operation, although the audio suffers greatly if you do.

The other hardware uses are perhaps less obvious. The CB radio helps get around traffic problems. If you are going to an accident or chemical spill, you don't want to get caught in the traffic jam it caused. We have the ham radio because half of the staff are hams and it offers recreation.

We also get a lot of good weather information from the area hams. It's good public relations; we run their PSAs and they supply us with emergency weather information. All at no cost!

The stereo radio/PA system allows us to have a local PA system without carrying around extra gear. All we have to do is turn on the radio and flip the switch to the external speakers. When on remotes, the built-in PA system not only carries the remote-generated programming, but also the studio inserts for continuity. We have had a lot of favorable comments from advertisers, as well as from the public, during remotes for this function.

Remote Broadcast Van

It also works well for parades; to save your voice from endless repetitions, just crank up the station audio as you drive by and wave.

The center-mounted cabinet can hold a variety of stuff. The top was cut out to hold a turntable. Rack rails on the front hold the RPU equipment and any other stuff you may need, such as a cart machine. Having rack rails ensures that everything is secure and does not get bashed around while driving from the studio to the remote site.

We mounted an AC outlet strip inside and included distribution to power all the hardware.

All four sides of the van were of course painted with the station call and frequency, so it serves as a rolling billboard. The four-wheel drive makes the van look even more impressive to the general public.

The bottom line

The bottom line on results is—does it help you make money? As in any business, you don't want a lot of activity that does not have a positive result; your own circumstances and format will determine to some extent your usage and particular advantages/disadvantages.

In small-market radio, I feel that community involvement and support are synonymous with success.

The van has allowed us to be active in many local events which otherwise would not have been affordable because of the cost of phone lines or other expenses. At $200-per-phone installation, plus a minimum billing of one month, plus all the other charges Ma Bell's relatives will stick to you, it doesn't take long to eat up your revenues. The monthly cost of the RPU is less than doing one remote by phone, so for us it is a great money saver and money maker. We used it to cover over 90 local sports events, plus many commercial remotes.

You have to balance your costs versus monthly use.

The remote broadcast van has also saved us a few times.

• *(continued on page 24)*

Ideas Promote Good Production

by Tyree Ford

Baltimore MD . . . "I'm looking for a great production person. Someone who likes to stay locked in the production studio 18 hours a day, 6 or 7 days a week. Somebody who can write (and rewrite) tons of copy, someone who's an endless source of audio fire-power, someone able to turn lackluster promotions into high-gloss, air-quality shinola.

"We had a guy like that here a few years ago, but he burned out. Besides, he was always complaining about how the chief engineer couldn't keep the machines tuned up. He even asked the sales manager to make a 24-hour copy deadline.

"Then he tried to get the general manager to buy some real expensive new stuff.

"I said, 'What's wrong with the studio the way it is? If that console's been on the air for 12 years, it's good enough for production.'

Producer's File

"The last straw was when he wanted some fancy music package. The guy turned into a real prima donna. Anyway, we really need to sound sharp for the next book, so if you hear of somebody, tell 'em we're lookin'."

The preceding story is a familiar one, especially if you've been a production director.

If you are a GM, CE or a PD, I suggest you show this article to your production person or airstaff. In this new RW column, I will be taking a close look at the technical, operational, creative and personal skills necessary to be a successful production person. Any ideas you or your staff may have about production and how to make it better are welcomed. You may write to me in care of RW, or to my home office at 3804 Ednor Road, Baltimore MD 21218, or call 301-889-6201. I hope to create a forum from which everyone can benefit.

Communicate with CE

The most important technical ability a production person should have is the ability to effectively communicate with the chief engineer. Engineers hate to hear that you think something "sounds funny." The more you can help them by isolating problems, the easier you make their job. This requires a simple vocabulary and a basic understanding of signal flow.

The four most-often-used terms describing bad audio are:

- Distortion (audio appears to splatter and sound over-driven);
- Muffled (a lack of high frequencies);
- Tinny (a lack of low frequencies); and
- Broken Up (the audio is there only during intermittent intervals).

Sometimes two or more of these symptoms exist simultaneously.

The secret to simple diagnosis is to find the place in the audio chain where the problem(s) doesn't exist. The following link is usually where the problem lies.

For example, if you can relate to your engineer that your tape sounded fine in the production studio, and in cart machine #2 in the air studio, but muffled in #3, you will have helped your engineer and your station. Few engineers spend as much time as airstaff or production people do operating the equipment.

It's a good idea to discover what vocabulary your engineer uses. It's also a good idea to defer to his or her knowledge, and to listen. Unless you have previously proven to the engineer's satisfaction that you really know what you're talking about, it's a bad idea to tell him/her what's wrong and how to fix it.

To be sure, there are some engineers who have been so continually misunderstood and abused that direct and positive communication with them will be highly suspect. If that's the case, proceed slowly.

Make a few copies of this article and send them around with the monthly

(continued on page 24)

Ty Ford, a radio audio production consultant, helps stations optimize their use of production equipment and airstaff skills. Call him at 301-889-6201.

Group Tests Aid CE's Role in Station

(continued from page 9)

nually. They usually hold their meetings while attending an industry-wide national conference.

They used the first meeting after monthly testing was instituted to review and revise the standard test forms. They dropped items that did not provide any useful information, and streamlined the entire procedure.

At the meeting, they devised a form (Figure 2) for quarterly measurements at each station with a Potomac FIM-71, which was shared within the group.

This piece of gear could alleviate any questions on FM signal coverage, and any deterioration in the antenna system can be found almost at once.

With regular field measurements, monitoring coverage becomes a routine matter, so it will be apparent if and when a consulting engineer needs to be called.

The budget form

The annual capital equipment budget procedure was modified with another standard form, devised to answer the usual management questions on new equipment (Figure 3).

The form shows equipment costs, construction costs, continuing costs or savings, the operational effect of the proposed change and the construction period.

The form also allows room to list contingencies so that delivery and installation schedules do not present any hard-to-swallow surprises.

The capital project form

The capital project form is submitted by the CE and reviewed by the GM. Because of this form, when the subject comes up at budget discussions, management is well informed and misunderstandings are virtually nonexistent.

The combined effect of the written equipment trouble reports and the monthly testing schedule makes it an easy matter to decide when a capital project will be required, or when a single piece of gear needs to be replaced.

Effect of deregulation

The Shamrock Communications program for monthly testing of equipment coincided with the FCC's elimination of the annual proof of performance.

In the Shamrock procedure, all elements that contribute to air quality are tested monthly. Time spent with on-air measurements of the full audio chain is minimized because engineers can spot problems with only a few checks (see Figure 4).

Intermodulation distortion measurements of the total audio/RF chain give useful information faster than a larger number of THD (total harmonic distortion) measurements. Putting each link in this chain under the scrutiny of monthly testing discloses the weak links that will require repair or replacement.

Downtime

Equipment reliability is documented in the compilation of equipment trouble reports and in the monthly reports to the GM. The available information greatly exceeds the usual "yearly proof/repair when failed" schedule of maintenance.

Good vibes

Viewed as a package, the program that Shamrock Communications' engineers began in 1984 has been a success. The standardization of procedures has elevated the engineering function into a well-organized, broad-based group effort, rather than as isolated individuals operating on a wing and a prayer.

The standard forms and practices have created better communications both with management and among the engineers (Figure 5 lists standard test forms currently in use).

The program structure provides the means for management to readily determine how well the engineer is performing. The monthly report tracks both repairs and projects. Day-to-day response to needed repairs is reflected on the equipment trouble report forms.

Construction and large-scale project work can be judged by comparison to the effects and costs predicted in the capital project form. The engineer, of course, can use the same structure as a guideline to rate his own performance.

At budget time, the monthly equipment testing determines the weak spots in the audio chain and prioritizes equipment replacement needs.

In selecting new gear, the engineer benefits significantly from the cumulative experience of all the group stations through the frank appraisals shared in the newsletter.

In this era of FCC deregulation, Shamrock Communications has opted for more testing, and more thorough testing.

The group's owners have supported this program because of the confidence it provides the station managers. The equipment and materials purchased to implement the program are in constant use, rather than stored on the shelf waiting to break down (see Figure 6 for an example of how Shamrock keeps track of shared test gear).

The engineers in the group have adopted a role at the stations far beyond that of a "Mr. Fix-It." They remain in contact with all parts of the station's audio chain, and have that work documented in a fashion that can be communicated to the station management.

The engineering program at Shamrock Communications has translated the quantitative nuts-and-bolts world of the broadcast engineer into a language that can be understood by everyone in station management—and that is a job well done.

Figure 6.

Inventory Transfer Form

Equipment_____

Model Number_____

Serial Number_____

Appeared on inventory of station room or category_____

Purchase date_____

Price_____

Transfer to inventory of station room or category_____

Date_____

Submitted by_____

Choosing Marketing Strategy

by John Cummuta

Chicago IL ... Let's say you're about to get into a fight, and let's say that the other guy is a lot bigger than you.

Under those circumstances, you'd probably tell yourself to keep a healthy distance, move in and out, and inflict damage in stages rather than going toe-to-toe.

That would be your strategy, based on the circumstances.

"Strategy," in terms of marketing, begins with asking, "How do we approach our market situation—considering all the pertinent circumstances?"

You are in a battle of sorts, and how you plan to fight that battle will depend on several things, such as the competitive situation, your strengths and weaknesses, the market's potential and so on.

Last month we covered a lot of ground exploring the Situation Analysis. That was designed to help you get a firm grip on just where you are at the present. It is a determination of the starting point, and thus of your realistic potential for progress.

John Cummuta is RW management editor and GM at WCFL, Chicago. Call him at 312-963-5000.

Engineering-Manager

Once you know where you are in the market arena for your particular product or service (I've kept this generic go you can apply it to any business), you can begin to understand what marketing strategies might be natural for your position.

Different strategies are natural for different market situations. For example, in the combat scenario described above, the natural strategy might be running as fast as you can.

The normal determinant for selecting "natural" marketing strategies is identification of the life-cycle stage of the product or service. Businesses or product/service lines go through four stages in their lives: introduction, growth, maturity and aging. How you approach your marketing will either be natural or unnatural for the life-cycle stage of the given product or service you're considering.

For example, if you're in the growth stage of a given market (for a product or service), the natural strategy may be *market penetration*, attained through high promotional expenditures.

The most common marketing strategies include: market-share penetration/maintenance/relinquishment; vertical integration; market segmentation; product/service line extension; pricing; expanded distribution; cost efficiency; annual modifications and increased promotional expenditures.

Before we go into brief explanations of these strategies, it's important to review the chronological sequence of the marketing process.

First comes the Situation Analysis, including its identification of your business and your target markets. From there you can begin to frame the strategies for approaching your marketplace. That's where we are in this article.

Next, you refine the broad strategies into definitive plans to carry out your strategies. Finally, you execute the plans to accomplish your marketing goals.

The sequence is Analyze, Strategize, Plan and Execute.

Now, let's look at some strategies and see when they're applicable.

Market-share strategy: The game of either penetrating, maintaining, or relinquishing market share is to decide whether you want to capture a larger share of the market, maintain the relative share you have or relinquish your piece of the pie.

If the market itself is expanding, market-share penetration is a natural strategy. If things are getting stronger out there for your product, grabbing a larger piece of the action makes sense.

If the market is either steady or only growing slowly, you may be content to simply hold your place. This could be because you have bigger plans for an upcoming product line, or because you simply don't have the resources to fight

(continued on page 18)

Marketing Strategy

(continued from page 17)
it out in the marketplace.

It should be obvious that to increase or even maintain one's market share takes promotional expenditures: i.e., advertising. Thus, part of the natural strategy here is higher marketing expenditures while betting on an even greater return.

Vertical integration: Vertical integration simply means cutting out the middlemen, both above and below you. For instance, suppose you were a paper manufacturer. In the early days of a product's life cycle, you'd be buying pulp and other supplies and making your paper.

Later, when the product process is more mature and competition has driven the prices down, you need to be more efficient. You may choose to buy your own timberland, harvest the trees, make the pulp, buy your own trucks to transport it, make the paper and deliver it in your own trucks, possibly through your own distribution arm.

If so, you have vertically integrated.

Market segmentation: Market segmentation could be a natural strategy in almost any life-cycle stage. It simply means looking at the market for a given product or service and determining whether it can be divided into subgroups.

You would then address your marketing efforts to one or more of those subgroups with more closely targeted promotional efforts.

Product-line extension: Extending the product line means offering more of what the same target market wants.

If, for example, you sell computers, extending the product line could involve selling printers, hard disks, software, books, training or instruction, etc.

Pricing: In the introduction stage of a product or service, high pricing can be a natural strategy because it allows you to recover startup costs while there's little competition to drive prices down.

Later, when the competition is there, you can cut prices to undersell them. That's a natural pricing strategy for the growth and mature stages.

Expanded distribution: Expanded distribution could mean opening more locations for your business or getting into mail order in addition to retail.

Expanded distribution is a natural strategy for the growth and mature stages, after initial product modifications are complete. You expand after you know the product or service is going to make it in the marketplace.

Cost efficiency: When the product or service is mature, and there isn't an expanding market to go after, a natural strategy is to make every effort to reduce operating costs.

Since you can no longer enlarge your profit margin by increasing revenues, you now have to do it by reducing costs.

Annual product modifications: Detroit has a lock on the annual product modification marketing strategy.

Every year, automobile manufacturers make your car "emotionally obsolete" by introducing modifications that are designed to make the new models appear superior. If they didn't change the cars yearly, their sales would drop fatally.

Increased promotional expenditures: An increase in promotional expenditures is the natural strategy for the growth stage in the life of a product or service. Though it can be successful in other stages, this strategy is generally most effective when the market forces are all moving in an upward direction. It's at that point when you get the most return for your promotional dollar.

Almost without exception, when I'm consulting someone on a marketing plan for their business, they'll say something like, "I had no idea there was this much intricacy to marketing." There is—if you want to do it right, and if you want to be a success in the marketplace.

We've only scratched the surface here, and there's more to come.

Obsolete Devices Fun to Recall

by Floyd Hall

Crestline CA ... DID YOU KNOW THAT ...

A potentiometer was once a very important piece of radio equipment?

What brought this to mind was a small device I discovered in my junk box a while back, labeled a "Bradleyometer" (Patent Applied For)!

I think the construction of this little Allen-Bradley pot is interesting. The resistance wire is wound on a straight form about 5/16" in diameter and 1" long.

The slider, which moves along this resistance strip in an arc, is driven by a little plastic rack and pinion! So, the slider moves the length of the strip with a knob rotation of about 330°.

This led to a discussion with an old friend—a long-time ham, commercial brass pounder and broadcast engineer—about the names of some of the early radio parts and equipment.

Old Timer

Of course, a "rheostat" was a very early piece of equipment which preceded the potentiometer mentioned above.

Now, there was a distinct difference in the two. The word "rheostat" is derived from the Greek *rheo*, a combining form meaning current, and the Greek *states*, used to denote apparatus to render (something), or control "current." The original "rheostat" was simply a series circuit, variable resistor.

As the state of the art advanced, a need arose for a variable resistor which could be varied between two points. Hence the potentiometer, with its three connections—each end of the resistor, and a slider in the middle. Potentiometer means "potential plus meter"—in other words, a voltage divider!

These were only two of the things my old friend and I came up with. Then we thought of "variometer" and "variocoupler." About the latter I remembered my old Navy type "D" tuner, which would go to 3,000 meters (100 kcs).

I like the definition of variocoupler given in my ancient dictionary: "An inductive coupler, of which the mutual inductance is adjusted by rotating one of the coils."

To get this down to the vernacular, it consisted of a fixed coil, usually tapped to a tap switch, and on one end a rotary coil, usually mounted in the end of the fixed coil. These devices were the primary units of early telegraph receivers.

Code signals

By the way, this reminds me that every now and then I hear, or see in print, a blatant misuse of the names of the different telegraph codes. Let me set the record straight.

The very first code signal for transmitting intelligence by wire or telegraph was the "Morse Code," sometimes called American Morse, now used almost exclusively in the United States on hand-worked land lines.

The "Continental Code" came along later; it was adopted by almost all foreign telegraph administrations, and is now used universally on radio telegraph circuits.

Although both of the above codes used the dot as the basis of time measurement, there are several character differences between them. In addition, in Morse telegraph you copy the spaces between clicks of a sounder, while with "Continental," or wireless code, you copy short and long tones, i.e., dots and dashes.

A third code, the "Cable Morse" code, is used exclusively in the operation of long submarine cables. In this code, all impulses are of equal length. A positive impulse represents a dot and a negative impulse represents a dash. (You think digital technology is new?)

(continued on page 20)

Floyd Hall is a regular RW *columnist and an engineering consultant at Consulting Radio Engineers, Crestline, CA. Call him at 714-338-3338.*

Obsolete Devices Entertain

(continued from page 19)

While the Morse and Continental codes are designed for manual operation, the Cable Morse code is transmitted automatically.

My brass pounder friend and I agreed on these definitions, and reminisced about straight keys, bugs and Marconi ship keys. (I hope old Tommy reads this, wherever he is. He went home about a year ago.)

Tube life

OK, now back to the old transmitter shack and some discussion of how to keep it running efficiently without spending any money! Of course this is impossible, but it's what many GMs think you should be able to do!

However, I want to talk a little about tube life.

A few years ago I wrote an engineering newsletter which I sent out to my clients. In it, I outlined the importance of correct filament voltage on the life of thoriated tungsten cathode tubes: "A 3% increase in filament voltage will result in a 20° K increase in filament temperature, a 20% increase in peak emission, and a *50% decrease in life due to carbon loss!*"

This letter is too long to go into further, but if you would like a copy, drop me a line and I'll send you one.

Tube prices being what they are these days, if you can get an extra 1,000 hours out of your finals, AM or FM, it is certainly worthwhile.

I do not believe you can achieve more than about 3,000 hours of satisfactory operation from tubes in an AM transmitter. Of course, when you start losing peak emission (and peak power output), you better think about a new pair of finals.

You can extend the life of PA tubes a little by increasing the filament voltage, but this is at best a temporary expedient.

Along the lines of preventive maintenance, I don't believe for a minute in our FCC friend McKinney's philosophy of "If it ain't broke, don't fix it." If I had practiced such a belief with my automobile over the past 30 years, I would probably still be sitting out in the middle of the Nevada desert, hoping somebody would come along and give me a lift.

Just in passing, it might be of interest to some of you that, since 1957, I have gone through 14 automobiles, driven a total of 1,385,000 miles (I can verify this) and I have never, in all that time, had as much as a fender bump or a ticket for a moving violation. (That's bragging, pure and simple. I knock on wood!)

As I said, most GMs and owners take better care of their automobiles than they do of their radio stations. You don't think these guys practice "preventive maintenance"? The hell they don't!

They take their Cadillacs in and have them serviced—and maintained—and if they should break down on the way to the big city, they would go back to that garage or dealer and really raise the devil! Do you get the point?

Most thinking people practice "preventive maintenance" on their automobiles, their home and their own health! Think about that a while. That's ammunition!

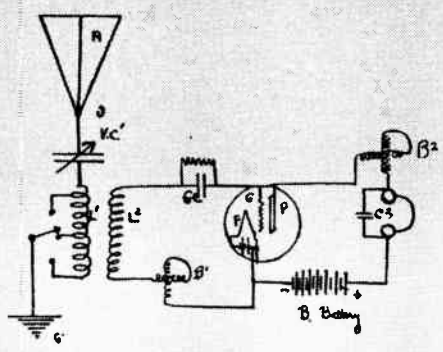
64 Years Ago in Radio World

Many radio amateurs experience difficulty in the operation and construction, or assembling of the continuous regenerative type of receiver which is at the present time so popular.

There are many ways by which troubles can be divided: namely, inability to tune to a given wave length, or difficulty in controlling the regeneration effects, an important factor in this type of receiver.

The former trouble is due to an improperly designed circuit and the latter trouble to the plate circuit failing to regenerate.

However, this may be laid to improper connections or incorrect plate voltage.



This trouble can be overcome by testing out your circuit or by a little experimenting. Tubes sometimes give you trouble, as they all have different characteristics which require specific amounts of current for successful operation.

This diagram shows you a regenerative circuit using two variometers and a variocoupler, and if they can be purchased at any radio shop, you can start building your own set.

The assembly is as follows: One 0.001 Variable Condenser (VC') Variocoupler as (L1 and L2 in diagram,) two variometers as B1 and B2, Grid Condenser and leak as GC, "B" Battery, Telephones, Tube and socket, A-Battery of six volts to light filament. Rheostat to control filament, and a condenser as C2.

This set, when wired up as per the diagram, will operate on amateur wave lengths and, if properly adjusted, will give absolute satisfaction. The grid variometer tends to tune the input or secondary circuit, while the plate variometer controls the amplification on regeneration by tuning the output on plate circuit in resonance with the input circuit, thus causing it to oscillate direct, feedback being avoided in this receiver.

The condenser is a great help in controlling the plate circuit for fine adjustment and acts as a by-pass for high frequency currents. Of course, in picking up stations, tight coupling should be used.

(Reprinted from Radio World 1922.)

Active Summing Tips

by Bill Sacks

Arlington VA ... The ability to mix audio sources together is one of the most basic requirements in a broadcast facility.

Early broadcast consoles summed inputs passively through the use of a ladder network. Unfortunately, ladder network summing produces loss in proportion to the degree of isolation obtained.

Console ladder summing networks also require that the program switch have a backloading resistor placed across the input to the ladder instead of the attenuator when the channel is turned off. The backloading resistor is required to maintain constant loading of the ladder, since the loss of the ladder will change if an input source impedance changes.

Straight Talk

This is why constant output impedance attenuators are used in older console designs instead of pots. These attenuators are actually switched tee pads, which have a specified constant output impedance. A pot's output impedance changes according to the wiper position for a particular attenuation setting.

These passive ladder networks also have a tremendous amount of loss, usually at least 40 dB. A high-gain program amplifier is used on the output to bring the audio up to a reasonable level.

Since the output impedance of the ladder networks is generally 150 ohms, the program amplifier was actually a microphone preamplifier. Its input was almost always a step-up transformer in order to match the low impedance input to the first amplifier stage (a tube grid or transistor base), as shown in Figure 1.

This arrangement has served general broadcasting needs very well, particularly when life was simpler and mix-minus techniques were not generally used.

Mic preamp saves old console

If your operation does not require a lot of fancy options, your old console can still provide yeoman service. All you do is replace the program amp with a modern, high-quality mic preamp.

Another tip for rehabilitating these older consoles is to elevate the input levels from the old −22 dBm standard to a 0 dBm or +4 dBm level. Older tube-type preamplifiers and other ancillary equipment were not generally designed to produce this kind of an output level.

Upping the console input levels by 20 dB and reducing the program amplifier's gain proportionally can bring a dramatic improvement in the noise performance of an older console. Just make sure that the new microphone preamplifier with which you replace the program amplifier can comfortably handle levels in the −40 dBm to −30 dBm range. Older program amplifiers may have trouble handling this kind of level.

Replacing the passive ladder mixing arrangement in an older console with an opamp summing amplifier is generally not worth the trouble. It is better to up the levels and replace the program amplifier—unless the input attenuators are totally shot, or the basic wiring has been hacked beyond repair.

The attenuators can be rescued with a good cleaning and application of Cramolin™.

Active summing

The active combining network—or lossless summing amplifier—allows you to sum inputs together while it simultaneously keeps them isolated from one another. This allows such options as mix-minus, where there are essentially two program line feeds that share some inputs and not others. This technique is particularly useful for telephone talk, remotes and news programs.

The opamp active summing amplifier is a variation on the basic opamp inverting stage shown in Figure 2. The voltage gain of the stage is determined by the ratio of the feedback resistor to the input resistor. The formula is: voltage gain equals the feedback resistor divided by the input resistor.

The input impedance of the stage is the value of the input resistor (that is, with an ideal opamp). This is because, in an ideal situation, the impedance at the summing point (the minus input of the opamp) is zero. This summing point is known as a virtual ground.

The bias resistor connected from the plus-input-to-ground does not affect the gain. Its value should be equal to the parallel value of the input resistor and the feedback resistor in order to achieve the best DC balance of the input stage, which minimizes DC offset.

In the real world of non-ideal opamps, the impedance of this summing point is very low, but non-zero. The formula for determining the actual summing point impedance is: summing point Z equals

(continued on page 23)

Figure 1.

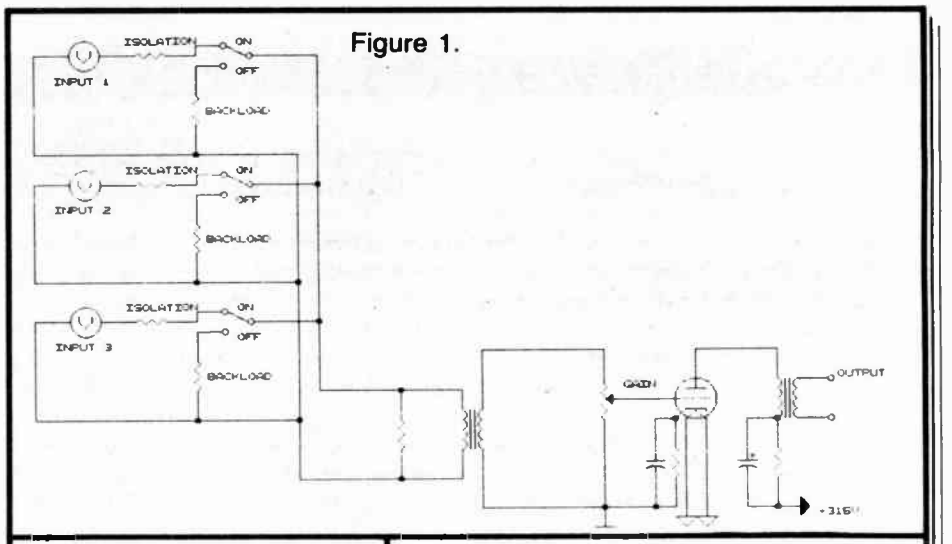


Figure 2.

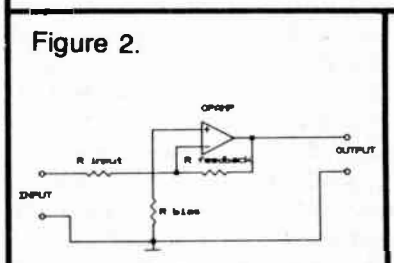
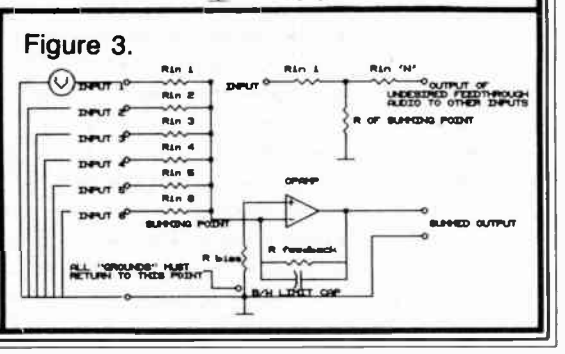


Figure 3.



Bill Sacks, a senior RW columnist, is president of Straight Wire Audio. You can call him at 800-368-2081 or 703-522-7780.

Processor Search Complicated

by Ted Sims

Washington DC ... There are as many varieties of musical tastes among people as there are people. Fortunately for radio engineers, these musical tastes can be placed in broad groupings, which limit the number of electronic devices we have to come up with in order to satisfy most people.

Give the rock enthusiast compression and loudness, the jazz aficionado lows and highs and the classical music lover his dynamic range, and the battle is half won.

Today we are able to alter all sound that we choose to listen to in order to satisfy individual tastes.

In choosing an audio processor, today's radio engineer must satisfy a bewildering list of concerns, including FCC rules on overmodulation; the PD's concern that the station is not "in a valley" when he/she tunes up and down the dial; the GM's concern that his "gadget-happy" engineer isn't spending too much money on processing equipment; announcer's concerns that the entire audio chain be transparent to voices; the news director's concern that actualities taken from a locker-room interview with built-in electret microphones sound as good as those read in the studio, and finally, the sales manager's concern that the commercials sound just a little louder than the music.

To complicate matters, the choice of audio processor or processors must fit the station's format.

At WHUR-FM we've just about run the gamut of audio processors up until the CRL FM-R system, which is presently in use at the station.

At 96.3 MHz, WHUR's format includes, jazz, top 40, easy listening, ballads, Caribbean music, gospel, and news and information. We also broadcast chapel services, radiothons, telephone talk programs, and various outdoor events.

Psychoacoustics

It is well known that the name of the commercial radio game is to be very loud on the dial in your market, which is fine if you are playing rock music or top 40.

However, if you play Softones or Quiet Storm-type format, you want dynamic range, which translates into less compression and even less limiting.

The pumping sound that comes with excessive compression, limiting, and fast attack/release times that make a station sound "loud" has been shown to cause listener fatigue and subsequent listener tuneout. This brings us to the subject of psychoacoustics, which concerns itself with, among other things, the reasons for listener tuneout.

Human ears hear in stereo and respond to sound logarithmically. We also have the ability to focus our hearing, i.e., to concentrate on a particular sound, even though many different sounds are impinging on the ears.

However, we all share a definite fatigue factor in our tolerance of sound. This fatigue factor varies from person to person.

Another characteristic of human hearing, one which is of particular importance to the broadcast engineer, is the preferred release time of a sound which impinges on the human ear. The integration characteristics of the human ear require that a sound have a mean attack time of 20 ms and a mean decay (release) time of 500 ms. Exceeding these limits can cause listener fatigue and inevitable tuneout (dial changing).

Of course, we all know that unwanted sound inputs to the ear (noise and/or distortion) when we are trying to listen to one particular sound is very irritating and also causes tuneout.

In the same way that an electric drill needs time to cool off, the human brain has a definite "duty cycle," and needs time to recover from a given sound input before being bombarded with another—especially if the first was extremely loud. Without this rest period, of several milliseconds, the brain "overheats," if you will.

Heavy compression and limiting allow a great deal of audio information to be packed into a short time period, thereby giving the impression of loudness.

Stations that transmit with high apparent loudness, use heavy compression, with their devices set for a short release time (far less than 500 ms). Thus, they achieve their objective, which is to attract the listener's attention when he/she is tuning up or down the dial, while not overly exceeding the modulation limits set by the FCC.

Heavy compression is also used at discotheques, where listeners are willing to be completely bombarded by the music.

If, on the other hand, the listener is in an office setting, where an awful lot of people are (especially in Washington) during the day, such total bombardment of the brain by the music inhibits the listener's ability to concentrate on work.

I believe that this "Washington factor" accounts for the fact that the #1 station in this market is an "easy listening" station.

Trial-and-error processing

With the new Softones format during the day, retaining the Quiet Storm and jazz at night (with a smattering of top 40 here and there), we decided that we needed a processor which would give us our

(continued on next page)

Ted Sims is CE of WHUR-FM, Washington, a commercial station owned by Howard University. He can be reached at 202-232-6000.

Processor Search Complicated

(continued from previous page)
full spectrum of sound, great dynamic range, low noise during low passages (noise gating), and get us out of the valley. All of this without having to switch settings all day long.

In short, the all-things-to-all-people processor.

Enter Circuit Research Laboratories (CRL) of Tempe, AZ. The engineers at CRL apparently share our view that a processor is not supposed to remake your audio for you, since record producers spend thousands of dollars on equipment to "make" the audio.

As used in radio broadcasting, we felt that, at most, a processor is supposed to get your sound through that narrow channel imposed by the FCC (the FM channel width is 150 kHz at a modulation index of 5) and get you through it at a level such that listeners are able to pick you out on the dial.

The rest of the equipment in your audio chain is supposed to enhance this transparency. So we were not looking for a processor to re-make our audio; we were quite satisfied with the way it sounded leaving the on-air console.

I attended several trade shows and conventions in an attempt to learn everything I could about audio processing and processors on the market. The selection process had been underway for approximately two years when I learned about the CRL system from an audio equipment supplier (Pro Audio General Store), whose judgment I had learned to trust.

Pro Audio sent me the unit on a trial basis for one month (CRL has a policy of letting the potential buyer try out its products for several weeks with no obligation to purchase).

At the time I had no intention of ending the search with the CRL system. I was also under considerable pressure from a new GM to come with a new sound to coincide with the introduction of the new Softones format. The gray hairs were beginning to multiply by the time the CRL arrived.

When this system first went online, the assistant CE and I looked at each other in utter amazement. We could not believe our ears—the sound of the station was incredible!

Utterly amazed

We could hear high frequencies that we didn't know were possible through a radio station; we could hear incredible separation, and the music had a definite timbre or vibrancy to it, as if we were in a concert hall.

The low passages were clear and distinct—not buried in noise—and the high passages literally burst upon us.

In short, it was a full-bodied, clean sound.

Even more incredible was the comparison test against our competitors. There was no question but that we sounded the best, and we were finally out of the valley!

Within hours of the CRL system installation, we had calls from listeners commenting on the improvement in our sound. For the first time that I could remember, *all* of the announcers noticed the difference, and most of them liked it.

The GM, a former CE himself, had recently installed a 200 W amplifier in his car and could hear every nuance of the sound. We spent several days tweaking the system before he was completely satisfied that we could end our search for a processor.

We have the FM-4 system, which includes the SPP-800 Stereo Preparation Processor (which we placed at the input of the telephone lines); the SEP-800 Spectral Energy Processor; the SMP-800 Stereo Modulation Processor and the SG-800 Stereo Generator, all of which were placed at the transmitter.

The AGC amp is an absolutely incredible piece of equipment. It has a built-in pink-noise generator for easy system setup. This, in conjunction with the three sets of LEDs on each front panel, allows the engineer to adjust exactly to the desired amount of processing. Programmable AGC of low input levels and selectable gating action keep noise below a certain level from entering the program lines. This, along with the units at the transmitter, keeps the system quiet during low passages in the audio.

The rest of the system can be adjusted to suit the particular format. We chose the easy listening adjustment, which still gives us sufficient loudness so that we are not missed when a listener is tuning up or down the dial.

As with a new, high-quality home stereo system—when you finally *hear* your records and discover that many of them have scratches and other ailments previously unnoticed—we discovered that the program lines needed real work.

After several bouts with the telephone company, we persuaded them to install new amplifiers and equalizers on our lines and to get the noise level down below 60 dB.

We've been running with the CRL system for approximately eight months, and have not adjusted it since its initial tweaking.

We've had no trouble out of the system. There was a burned out LED in the stereo generator when we got the system (a loaner system that was shipped directly to us from a trade show demonstration), but we are waiting until our back-up system arrives before taking the system out of service to replace it. (Yes, we purchased the loaner—once we got it we couldn't afford to give it up.)

We shot from #6 in the market to #1 three months after installing the CRL system. Some people say it was the format change; others say it was the new management. I say it was our fantastically improved sound.

Active Summing Tips

(continued from page 21)
the feedback resistor divided by the product of the open loop gain and the close loop gain.

The summing point is shown as an impedance because its actual resistance varies with frequency; real-world opamps do not have infinite bandwidth, and their gain falls according to the curve of their Bode plot.

The active summing amplifier (Figure 3) is a logical extension of the basic inverting stage. The difference is that more input resistors are added to the summing point.

The gain of each input is independent of the others, and is determined by the ratio of that particular input resistor and the feedback resistor. If you want, each input can have a different value of gain. Generally, all of the inputs have the same gain, but it is important to remember that the gain formula for each input is independent.

The backfeed isolation from input to input can be calculated by looking at the two input resistors and the summing point impedance as a tee pad, with the summing point impedance as the shunt element. Since the resistance of the summing point increases with frequency, the isolation diminishes as the frequency increases.

The noise gain of the stage—that is, the amplification of the input noise of the opamp—is equal to: the feedback resistor divided by the parallel value of all of the input resistors.

An ideal opamp with infinite gain and bandwidth and zero input noise could have an infinite number of summed inputs with infinite isolation between them.

But once again, in the real world, we are limited by the input noise and gain limits of a mass-produced opamp. This is why most practical summing amplifiers operate with unity gain on the inputs. With only a few inputs used, you can get away with running some gain in the summing stage.

The value of the bias resistor of the plus-input-to-ground is equal to the parallel value of the feedback resistor and all of the input resistors. Once again, this is to optimize DC parameters.

Some practical tips;

- The bandwidth of the stage should be limited with a capacitor of the appropriate value across the feedback resistor.
- The resistor values should be kept as low as possible, consistent with loading considerations of the stages feeding the summing amplifier.
- *Very important!* The audio returns—that is, *grounds*—should come directly to the bottom of the bias resistor in a star configuration, if possible. This minimizes crosstalk and noise. Unused inputs (channels turned off) should be shorted to the star return; pots work better than attenuators, because their output impedance is zero when they are cranked off.
- Don't forget to pay attention to power supply bypass techniques.

See you next month. Happy trails and *stay straight!*

Good Ideas Assist Production

(continued from page 15)

mimeo. The idea here is to develop a team. If continued efforts to make your engineer (or any other member of your staff) part of the team don't meet with success, consider new players.

Discrepancy reports

The production director and the production studio should be the front-line defense for quality control. Since getting timely feedback about quality is sometimes difficult, some stations find discrepancy reports for the production and air studios very helpful.

A simple form, showing the nature of the problem, the time it was found and by whom, is usually sufficient. This form is not meant to take the place of verbal communication. It is also not meant to be a place for editorializing.

Regardless of whose responsibility it is to get the report out, the most important point is to get the report out first thing every morning. Account executives may learn of missed spots before hearing from an irate client. Engineering may learn of some small, intermittent problem that could become more serious the next day. The production director may find out that a promotion cart has self-destructed or disappeared.

The only downside I have ever encountered with a discrepancy report came from some engineers who felt as though the reporting of malfunctioning equipment reflected negatively on them (as though others would think it was their fault if a piece of equipment went down!). In response to their sensitivity, another form was made available in every studio. Completed forms were put on a bulletin board in the maintenance office.

Systems are only as good as the people who use them. If the discrepancy report works for you, great! If you have something else that's as good or better, let me know about it.

Monitor quality

One final subject I want to cover in this first column concerns monitor systems.

It's mighty tough to tell anything qualitative about audio with a system that wasn't designed to pass anything over 10 kHz. There are too many production studios and air studios with substandard monitor systems.

If the specs of your monitoring system are not as good or better than the upper-middle part of consumer equipment now on the market, you could have serious problems and not even know it. In addition, the more highly processed a station's audio is, the more critical good monitoring becomes. Distortion problems masked by poor monitors become surprisingly noticeable when highly processed.

If a new monitoring system allows you to pick up problems in your audio and leads to a reduction in listener fatigue, the return on your investment (increased TSL) yields a big payoff.

Monitoring, incidently, includes the speakers and the power amp. Don't be surprised when that 8 W per channel Army Surplus power amp keeps those new speakers from making any noticeable difference. Thirty watts rms per channel—with a set of speakers that can handle that much power without blowing out—is a good place to start.

Don't heave the old amp and speakers. Use them in the station's bathroom, or in some other area where fidelity is not important.

That's all for now. If you have any comments, problems or questions, send them in and we'll try to respond ASAP. I look forward to including your ideas and comments in future columns.

'Remote' Van Enviable

(continued from page 14)

Our competition is fierce, if not downright underhanded. At one ballgame a competitor pulled the AC plug to the mixer. This had no effect on our broadcast, since the talent had already switched to a direct mic input on the RPT-2 and was "wireless" direct to the van.

On another occasion our phone line was cut, but this, too, caused us no loss of on-air signal, as the phone was a back-up circuit.

The wireless system is a major benefit, and once allowed the PBP man to snatch the coach for an after-the-game show because he was able to walk across the court unhindered by long mic lines or an AC cord connected to a mixer.

The freedom to get up and walk where necessary to get the story is, to us, enough reason to be totally wireless. It allows instant response and access with no tether keeping the PBP man at the broadcast booth. If the location is too noisy or is otherwise not suitable, we can move sites without having to worry about where the phone jack is.

During the first nine months on the air we lost only two events, and managed to save one of those.

The first was about 60 miles away and the phone company had failed to provide the ordered circuit. This was saved by a quick arrangement with the local station at the event, which most graciously allowed us a direct feed from their station via their phone line and PBP man with dual IDs during the game and cutaways to allow our commercial inserts.

The second was being recorded for tape delay while a third event was in progress and the operator recorded tone through the entire program.

The cost savings, good public relations and ability to cover a host of events quickly and easily was more than enough to cover our expense. In addition, it was a major influence in our ability to kick you-know-what in the market, and to drive the competition to try dirty tricks to no avail.

If imitation is the most sincere form of flattery, we are the most flattered station in our area. When you hear your own local news stories being repeated word for word, you know you have the competition beat hands down.

Buyers Guide

Program Audio Processing

Aphex Offers Performance

by Don R. Werrbach, Eng VP
Aphex Systems, Ltd.

North Hollywood CA ... Aphex systems' new Studio Dominator was designed to address the audio industry's need for a high quality limiter which is flexible in use, simple to adjust, extremely transparent below limiting and free of the over-threshold sound artifacts produced by the other limiters presently available.

Advanced circuit innovations (patents pending) are incorporated to obtain this high level of performance.

The Studio Dominator departs from tradition because it is easily used in a wide range of applications from broadcasting to satellite uplinks, to disk or tape mastering and digital recording.

Because the unit's circuitry is "intelligent," only a few basic adjustments are necessary to get proper results in any application.

The user simply sets the calibrated output ceiling control to the level where he wants the peaks to absolutely stop, and sets the drive control to obtain the desired gain reduction.

Some additional controls are provided, but they are mainly available for those who wish to obtain effects from the limiter.

A newly created multiband technique, which overcomes problems previously encountered with multiband limiting, is responsible for much of the Studio Dominator's performance as a limiter. The multiband limiter concept, while not new in its basic form, has mostly found practical applications in broadcast audio processing, but not generally in the audio industry.

While multiband limiting seems to be the perfect way to handle audio signals, special problems exist which make the design of a multiband limiter anything but trivial.

For example, there is the attack/release rate of each band to consider. Why should they be different in each band, or equal? What about the relative limiting threshold of each band and the relative summing weight of the band outputs?

These could all be made adjustable, but for the 3-band limiter, the number of controls could easily run up a count of 12 per channel!

Lengthy research has shown that some of these parameters need not be user adjustable if they are properly factored into the circuit design of the limiter.

Thus, we simplified the Studio Dominator by removing all unnecessary user adjustments.

Solving the problems with multiband limiting does not stop at simplifying the operating controls. A major problem inherent in multiband limiters is that they do not limit the audio signal amplitude to a consistent predictable level.

This is a result of frequency-discriminate limiting. Since all of the bands add together to form the output signal, the output amplitude will always depend on how much energy exists in each band, and in the band-to-band relative phases of the signals.

Maximum output amplitude will occur only when all the bands are in full limiting, and their output signals are in optimal phase relation. If only one band contains significant energy, even if it is in limiting, then the total output will be a fraction of the maximum possible output level.

In practice, the multiband limiter output will vary over a considerable range with varying audio sources, even if heavy limiting is used.

Since this condition is unacceptable for a limiter, in broadcast applications a final clipper is usually added to chop down the output level to a reliable peak amplitude at the expense of added distortion.

One other solution to the problem is to add a wideband limiter to the output of the multiband section. But this solution only reintroduces all of the unwanted characteristics of wideband limiting, and diminishes the benefits gained through multiband processing.

Therefore, a totally new solution had to be found to make a general-purpose multiband limiter practical.

A new circuit concept termed "ALT" (Automatic Limit Threshold) is incorporated in the Studio Dominator to manage output summing consistency in a way which produces no distortion, while still avoiding the problems of wideband limiters.

In the ALT system, the total limiter output signal is measured against a fixed reference level. When the sum of band outputs fails to meet the comparison criteria, the ALT system automatically adjusts the limiter threshold to establish the correct output level.

(continued on page 30)

KNID Picks DAP Unit

by Scott Clark, CE
KMYZ-FM/Bdcst Consultant

Tulsa OK ... Crystal clear and unsurpassed sound quality typify the Dorrough 610 Discriminate Audio Processor (DAP) with the companion model 80-B stereo generator.

User Report

After its audio processing rack was completely crippled by a devastating bolt of lightning, Enid's KNID-FM made the move to upgrade its equipment.

We selected the DAP 610 after rigorously comparing specs with "Brand B" and "Brand C." It is the perfect compliment for KNID's urban-country format.

The DAP 610 divides the audio into three distinct bands.

Most engineers agree that spectral density provides solid evidence that maximum amplitude occurs at mid-frequency, with only slight slopes towards lows and highs. Since lower frequencies display lower amplitude, to have equal power distribution of the amplitude vs. time, "the rule is the longer the duration, the lower the amplitude."

The high frequency of music and voice has a lower amplitude. This section of the spectrum carries the harmonic content of the program, which is naturally reduced in amplitude.

Six dB per octave equalization slopes were made as crossover points to the compressors. This provides the best masking of compression by-products.

By listening to the processor summed out of phase with the source feeding it, I firmly believe that I have proven the integrity of this program. The sum nulled smoothly at 19 dB.

The band splitter feeds three digitally controlled attenuators, with individual controls located on the front panel. This allows control of the amount of AGC on the compressors.

The attenuators automatically adjust the dynamic parameters of the program, which limits the peaks as channels are summed, and stops the buildup in IM distortion in the peak clipper.

Recovery times were intentionally set at slower rates at the factory to allow for better dynamics at deep levels of compression. Providing a slight upbeat sound, we changed the recovery times again by experimenting with lower values in the time-constant resistors. This adjustment is made on the large mother board under each card.

For a more acoustically pleasing sound, soft clipping was incorporated into the system.

The limiting device suppresses the speed of acceleration of the leading edge of the input waveform, drastically reducing the odd-order harmonic content.

Soft clipping produced an average

(continued on page 28)

Buyers Guide

JBL/UREI Equalizer

by Frank Kelly; CE, UREI

Sun Valley CA . . . Broadcast production engineers have a new tool, the JBL/UREI 5547 graphic equalizer, that allows them the virtually unlimited ability to shape the audio spectrum and easily understand and control changes to the EQ.

The 5547 has many uses in the broadcast production room. Cleaning up tapes or programs with hum, buzz and high frequency noise is the most common use, in addition to creating special effects like a telephone sound or enhancing an announcer's voice.

Any program with limited frequency response like recordings off the phone line or remote interviews will be enhanced by having the 5547 reduce hissing and out-of-voice band information before airing.

A user can also create psychoacoustic effects with the 5547. An example would be to make a telephone recording appear to have a wider frequency response by boosting the high frequencies before they naturally roll-off.

Low noise output, one of the most significant benefits of the 5547, is achieved through the use of UREI-designed low noise, high output hybrid circuits in the critical equalizer signal paths.

A noise output 10-15 dB lower than other popular equalizers (depending on operating levels) can be achieved and maintained through the use of the front-panel LED headroom indicator and the tracking input/output level controls.

The 5547 has 30 bands of boost/cut equalization. Each control has a ±12 dB range about its detented center. The frequencies of the 30 filters are spaced on ⅓ octave centers from 25 Hz to 20 kHz (an octave goes from any frequency to twice its value).

In addition, two tunable end-cut filters (one low-pass, one high-pass) are provided to set the upper and lower frequency response limits.

An in/out switch bypasses the endcut filters and an in/out bypass switch for the whole equalizer allows the user to make a before/after EQ listening comparison or insert equalization only during a segment of a program. Also, the equalizer automatically bypasses itself if power is turned off or removed.

Finally, connections are made at the rear panel via a barrier strip—¼" phone jack and/or XLR connector. A jumper on the rear barrier strip allows the user to separate chassis and audio grounds in the event of hum or RF grounding problems.

Room acoustics, speaker type and location, or inadequate equipment often yield a poor-sounding production or control room. A graphic equalizer can help remedy this situation.

The most common corrective use of graphic equalizers is in tuning the monitor sound for improved sonic quality. A good sounding monitor is less fatiguing and more stimulating for the operator.

The JBL/UREI 5549 room equalizer is ideal for monitoring applications. It should be noted that an equalizer can cause problems if not properly used. There is always a tendency to overdo it, resulting in distortion, overmodulation or even undermodulation if the frequency response becomes severely imbalanced.

The 5547 graphic equalizer requires 3½" of rack space. Both top and bottom covers can be removed for service.

All components are accessible and well-marked for identification. Special attention was given to the design of RF-immune circuitry, and no internal connectors which can become intermittent in time are used.

Editor's note: For more information on the UREI 5547, contact John Eargle at JBL Professional: 818-893-8411.

Transient Limiters Offered by Gotham

by Karl O. Baeder, Tech Dir
EMT-Franz GmbH

New York NY ... The growing popularity of the CD, as well as the advent of DMM technology for the black vinyl disk, offers broadcasters source material of unprecedented dynamic range that is far greater than the modulation limits of AM, FM and TV audio.

However, it causes broadcast engineers to break out in a sweat in trying to preserve the dynamic range while also preventing severe overmodulation.

The problems are a result of the fundamental design constraints of conventional limiters. In simplified form, such limiters consist of a multiplier and a gain computer for deriving the factor g (Figure 1).

This factor remains a constant value (unity) for all input signal levels below the limiter threshold. For the levels above the threshold, gain must be reduced sufficiently so the output level remains constant.

Obviously, limiters based on the feedback principle can only begin to reduce the signal amplitude after excessive levels appear at the output. If the limiter reacts quickly, the output overshoot will be small, but audible clicks will be heard.

On the other hand, if the limiter reacts slowly, the audible clicks will disappear, but more overshoot will occur.

It would be possible to solve these problems by alerting the limiter control circuitry of an amplitude peak before it occurs.

However, by employing a feed forward control scheme, a delay stage can be inserted between the point at which the control information is extracted and the actual multiplier stage.

Therefore, from the point of view of the multiplier, the delayed input signal represents the present moment, while the control signal appears to be derived from a knowledge of the future.

In this way, the limiting action required to control a peak is accomplished before the modulation signal actually reaches the multiplier.

The basic design concept for a new broadcast transient limiter which uses this principle is shown in Figure 2. In short, the main multiplier employs feed forward control, since its control information is derived from the input signal.

However, in order to ensure stability, an auxiliary multiplier with a feedback control loop is also incorporated into the main multiplier.

A delay time of 0.3 msec for the main audio path is sufficient for the control process, regardless of the overdrive level at the input.

Low-pass filtering at the input (with phase correction) ensures linear delay for all frequencies from 30 Hz to 15 kHz.

Because of the delay, the control circuitry can take advantage of an attack time greater than the conventional 50 μsec (Figure 3). As a result, the reaction of the limiter to transients is imperceptible even to critical listeners.

The choice of release-time parameters is also of particular importance. Based upon listening tests, a 3-phase release curve offers the best performance.

Phase one is a holding period of about 40 msec, which keeps the limiter from reacting to each half wave of a low-frequency signal.

Following this initial holding phase is a rapid phase which prevents any noticeable drop in signal level. The original gain is restored in the third phase after a very long, inaudible release time (Figure 4).

The 3-phase release characteristic is designed to complement wide dynamic range signals. Very brief limiting periods caused by transients in an otherwise normal signal are complemented by the rapid release of phase two.

On the other hand, very loud, long duration passages are controlled by the slow release of phase three. With this approach, short signal impulses do not reduce level preceptibly, while pumping effects caused by signals which frequently exceed the limiter threshold are prevented.

The basic concepts just described serve as the foundation for the design of two new broadcast transient limiters for AM and FM/TV applications.

Preemphasis is used in FM and TV broadcasting to improve the SNR. High frequencies are boosted in amplitude at the transmitter and reciprocally rolled off by the receiver.

Because of the preemphasis boost, high frequency signal components will often exceed the 100% modulation level.

The conventional design approach is to duplicate the preemphasis frequency characteristic in the control loop of the limiter. This method has the disadvantge that the level of the entire program signal is reduced whenever high frequency components exceed the limiter threshold.

The problem can be solved by using a second control circuit after the main limiter. In its quiescent state, this circuitry produces the standard 75 μsec preemphasis boost for the transmitter.

When the circuit detects high frequency transients exceeding the threshold, their amplitude is reduced by shifting the preemphasis time constant to a smaller value (Figure 5).

In actual practice, the curve slides upward in frequency, giving less boost and thereby reducing the output signal to the threshold level.

Since the control action is restricted solely to high and very high frequencies, it does not affect overall level.

The result, for the listener is a small reduction in high frequencies which, in most cases, is barely perceptible and far less disturbing than a reduction of the entire signal volume.

AM broadcasters have a different preemphasis requirement. Most AM receivers have a pronounced roll-off at high frequencies in order to improve their selection characteristics.

Intelligibility, especially for speech, can be greatly improved by boosting frequencies in the presence range (800 Hz to 3 kHz) at the transmitter to overcome this roll-off.

The input signal amplified by 10 dB is routed through an auxiliary 150 μsec delay line to a multiplier which operates only in the presence range.

This is followed by a fourth order low pass filter which suppresses noise above 6 kHz. The multiplier and its control circuitry produce a boost of up to 6 dB for low level signals, which are then added back into the main limiter signal.

AM broadcast coverage can be extended by utilizing the transmitter's ability to exceed 100% modulation on positive peaks. This can be accomplished by using two peak level rectifiers which separately detect positive and negative peak information.

The principles of the polarity reverse circuit are depicted in Figure 6. Shown in the upper left is a simple operational amplifier circuit with a switch which allows −1 to appear at the output when closed, and +1 when open.

Using this same principle, the first order, all-pass network shown at the right inverts phase from 0° through 90° (when Zc=R) to 180°.

This technique is realized in practice by using an OTA with resistance R variable over a range of 1:1000. The frequency of phase rotation begins at 15 Hz and extends to 15 kHz.

The output of the polarity reverse network always delivers the higher peak in positive erection. The subsequent limiter controls may be adjusted for positive peak levels up to 3 dB higher than nominal level, while at the same time the negative halfway is held to exactly 100%.

Because of the differing requirements of FM/TV broadcasting and AM broadcasting, EMT offers two transient limiters similar in design concept but differing somewhat in their building blocks.

The FM/TV EMT 266's key elements are the 0.3 msec all-pass delay network, main multiplier with control circuitry and the auxiliary, variable preemphasis network.

The EMT 277, intended for AM broadcast, also utilizes a 0.3 msec delay line and main multiplier.

In addition, this unit incorporates expander and compressor sections which work together with the polarity to reverse the adaptive presence functions to increase AM coverage range.

The EMT transient limiters are designed to be installed directly at the transmitter site.

Red, yellow and green LEDs illuminate to show the extent of signal processing. Should power to the unit be interrupted, the signal is routed directly from input to output through relay contacts.

All circuitry is mounted on PC boards which are accessible from the front.

Editor's note: EMT-Franz is represented in the US by Gotham Audio Corp. Call Jerry Graham at Gotham: 212-741-7411.

Figure 1.

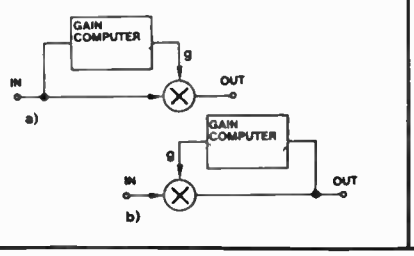


Figure 2.

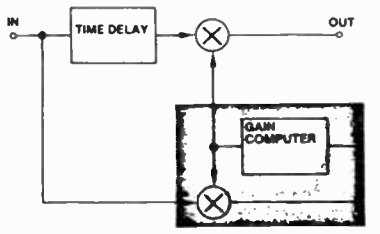


Figure 3.

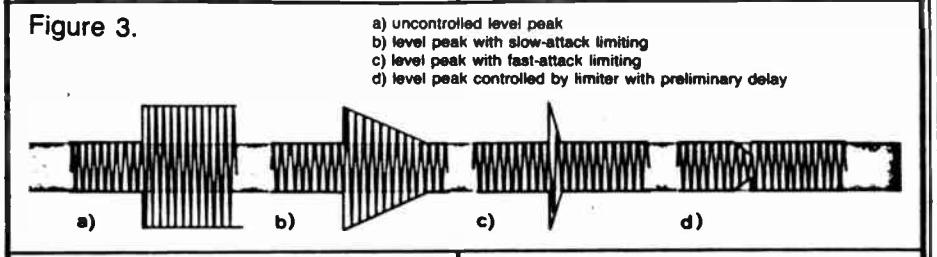


Figure 4.

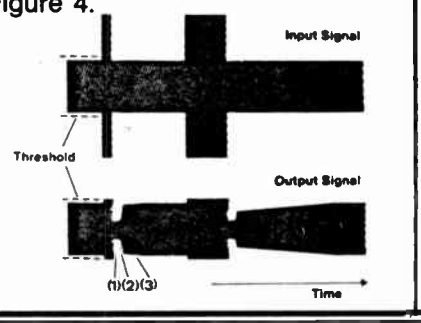


Figure 5.

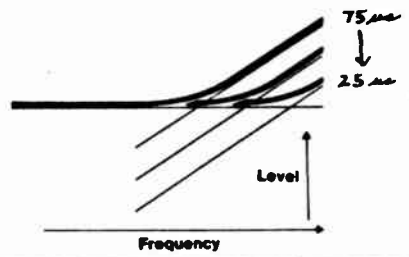
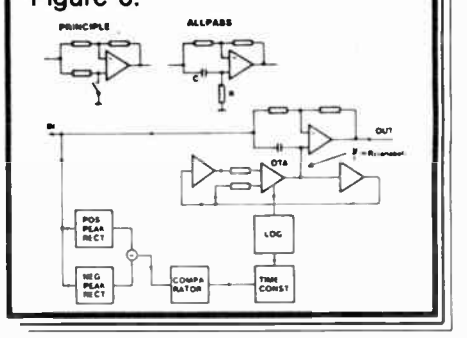


Figure 6.



Buyers Guide

OPTIMOD-FMX Specs Revealed

by Robert Orban, CE
Orban Associates, Inc.

San Francisco CA ... FMX (TM) is an FM stereo companding system which offers up to 20 dB noise reduction in stereo mode, yet is compatible with existing receivers.

To ensure the success of FMX in the mass market, there are a number of potential pitfalls which must be addressed.

Some of these include overmodulation control, noise modulation effects, multipath distortion, system performance in the automotive environment, and the effects of audio processing. We're taking all of these into account in the development of our FMX generator.

Thanks to the novel concept of "adaptive expansion" in the receiver, an FMX receiver can adapt to a wide variety of transmission compression characteristics.

By comparing the existing L−R subchannel to a new compressed L−R subchannel, the adaptive expander in the receiver "knows" exactly how much expansion to apply to achieve correct decoding and high separation. This means that each FMX encoder manufacturer can design the FMX compressor as he sees fit, and that manufacturers' FMX encoders are likely to be highly differentiated.

The CBS "developmental" compressor was designed to prove the basic principles of the system. However, the prototype design caused steady-state overmodulation of up to 126% with certain soundfields.

The usefulness of the "developmental" compressor is thus limited in that average modulation must be reduced by about 2.5 dB to ensure overmodulation protection.

Orban, therefore, embarked on the development of a second generation FMX compressor—one without the prototype's limitation. Our Optimod® -FMX design (patent pending) is a compressor with program-dependent, instead of fixed, characteristics.

L−R compression threshold and ratio adapt to the needs of the program material on a moment-to-moment basis to achieve optimum noise reduction without the danger of overmodulation.

FMX is not a cure-all. It works best when the stereo SNR is already fairly high, and it does nothing to reduce multipath effects.

If a station is highly processed, noise reduction will probably be noticeable only on program material with short periods of silence.

The benefits of FMX increase as processing is reduced. In marginal signal areas, it dramatically improves wide dynamic range program material like classical music. It is also ideally suited for "beautiful" formats and for public and educational stations.

As long as the uncompanded stereo SNR exceeds about 45-50 dB, then noise modulation is unlikely to be audible even with "difficult" program material like solo piano. But, like any other compander system, FMX can produce noise modulation or "breathing" effects when the channel noise level gets too high.

Especially during mobile reception, FM stereo SNRs can deteriorate to the point where the FMX process breaks down and produces noise modulation, or even fails to produce any noise reduction whatever. For this reason, FMX-equipped receivers will also need traditional variable-blend processing to deal with extremely poor signal conditions.

Such variable-blend processing is "single-ended" noise reduction that reduces the level of the L−R subchannel (or rolls off its high frequencies) as a function of received signal strength, dynamically varying stereo separation (possibly in a frequency dependent way) to prevent objectionable noise from appearing at the receiver's output.

The stereo subchannel is much more subject to the effects of multipath distortion than is the main channel (L+R). Because FMX transmissions usually modulate the subchannel region much more heavily than do conventional transmissions, it is necessary to experimentally investigate how much of an additional problem this may cause in both FMX and conventional receivers.

Both Orban and CBS Technology Center are presently performing such field tests. The parameters of our design will be adjusted as necessary to take such effects into account.

The OPTIMOD-FMX is to be a self-powered, standalone unit containing the FMX compressor and a newly designed, high-performance stereo generator, which produces the FMX (quadrature) subchannel, in addition to the normal stereo baseband components. The OPTIMOD-FMX is designed to plug directly into an OPTIMOD-FM of any vintage (including the old 8000A) and to operate without further adjustment.

It can also be used with nearly any audio processor equipped with output attenuator controls, and with a peak-controlled output signal that is tightly bandlimited to 15 kHz. (Older FM peak limiters are usually not sufficiently bandlimited.)

The FMX compressor can increase the modulation in the L−R subchannel (23-53 kHz) by up to 20 dB. The modulation process can thus amplify out-of-band energy due to insufficient audio filtering, thus increasing subchannel-to-mainchannel crosstalk and interference to the SCA region of the baseband. Therefore, bandlimiting the L−R signal is more crucial than in standard FM stereo. Composite clipping (which can cause splatter throughout the SCA region) is particularly inappropriate for FMX.

FMX might be the breakthrough that finally ends the FM loudness wars and increases the overall quality of FM broadcasting.

Although increases in quality have been futilely predicted so many times that most people take such prophecies as seriously as they do astrological prognostications regarding the end of the world, this time there is a carrot: FMX's effectiveness is *improved* as audio processing is backed off.

This means that, on an FMX receiver, stereo coverage area increases as less processing is used.

Given the enormous commercial success of CDs (which offer by far the highest audio quality ever provided to the average consumer), even the toughest PD may be swayed in the direction of better audio when he is told he can finally have his cake and eat it too!

Editor's note: For further information on the Optimod-FMX, contact Orban at 415-957-1067.

Dorrough

(continued from page 25)

80% reading on the mod monitor.

To see the true effect of soft clipping, connect the oscilloscope; better yet, use the relative loudness to the peak modulation meter that is built into the output of the unit. Calibrating this meter to the modulation monitor enables you to set the clipping level for maximum loudness.

The DAP loudness LED meter serves a most important function in the audio chain by giving an instant reading of the crest factor, while also providing duty time.

These functions enable the engineer to consider peak information and RMS simultaneously.

Once calibrated to an accurate modulation monitor, one sees exactly how misleading meter readings done in analog can be.

The Dorrough 610 audio processor provides clean, clear and loud audio without sounding "mushy" or overbearing.

Editor's note: For more information on the DAP 610, contact Kay Dorrough at Dorrough Electronics: 818-999-1132.

Inovonics Enters FMX Market

by Jim Wood, Pres
Inovonics, Inc.

Santa Cruz CA ... The CBS Technology Center and the NAB have jointly developed an important variation on our system of FM stereo broadcasting which may well prove to be of immense benefit to both broadcasters and listener. It's called FMX.™

When FM went stereo in the 60s, required increases in signal bandwidth meant an automatic degradation in received SNR. This created a problem in fringe areas, which translated into loss in a station's coverage area.

Though the Dolby-B noise reduction system did help the noise problem, the Dolby-encoded signal was technically incompatible with receivers that did not include the Dolby-B decoding circuitry.

FMX, on the other hand, is compatible with existing receivers and with FM broadcasting practices.

The system makes use of a second subcarrier (SCA) centered around 38 kHz, but which is transmitted in quadrature (90° out of phase) with the normal L−R program signal and presents the FMX receiver with a choice of normal and compressed L−R information from which to derive a program with optimized SNR.

The L−R channel is additionally modulated with a very low level 10 Hz signal to switch the FMX receiver to the proper reception mode.

There seems to be no performance tradeoffs with FMX, such as additional bandwidth requirements or modulation constraints.

The only investment for the broadcaster is an FMX stereo generator.

Inovonics' development of a stereo generator has followed the line of a standalone unit rather than of an add-on unit.

As the only "box" required between the studio console and the transmitter or composite STL, the Inovonics generator combines audio processing with FM and FMX stereo generation.

Initial gain control action is afforded by a slow, gain-riding, gated AGC. Though AGC correction is slow and unobtrusive, circuit response to program material is peak-weighted for more consistent operation of subsequent stages.

Program dynamics are controlled by a gated three-band compressor/limiter.

Midband program energy determines an average "platform" level for peak reduction, with variable adjustment provided over platform level and response, density within each frequency division and interaction between bands.

Though it's quite comprehensive and has a wide range of parameter adjustability, the processing portions of the generator are easily defeated to accommodate an existing favorite processing chain.

Feedforward pulse-width modulation techniques are used in all processor gain control stages and in the FMX quadrature subcarrier compression circuit.

A precision exponential generator determines processor transfer functions. It is controlled by the same master clock from which both the subcarriers and the 19 kHz stereo pilot are digitally synthesized.

Phase-corrected and overshoot-controlled filters yield flat audio response from 25 Hz to 16 kHz, while giving full protection to the 19 kHz and the 10 Hz pilot signals.

The question on everyone's mind is whether or not FMX will catch on.

It's a "chicken-and-the-egg" situation, whereby broadcasters have little motivation to make even a modest investment in the stereo generator if there are no receivers in the market. Similarly, the manufacturers of consumer equipment must see a demand to warrant introduction of new technology.

As FMX struggles to gain a foothold, keep this in mind; the one factor which may propel FMX into widespread, sweeping acceptance is the real and audible advantage which it provides.

Editor's note: For more information on FMX, call the author at Inovonics: 408-458-0552.

Circle Reader Service 14 on Page 35

Buyers Guide

Aphex Uses Intelligent Circuitry

(continued from page 25)

Since the ALT has a finite reaction time, a soft "catch clipper" follows final summing to prevent brief overshoot transients from escaping to the output.

Audible distortion is not produced by the catch clipper because the ALT response is tailored to maintain minimal and well-controlled peak overshooting.

By this method, the summed signal peak ceiling is guaranteed to remain at a calibrated value.

Several features allow for variations in operating conditions and tailoring of the limiter sound.

The band crossover frequencies are selectable and the relative drive levels into the low and high bands are adjustable to allow intentional static and dynamic equalization effects to be obtained through the limiter.

A release time adjustment allows the user to obtain either more or less density under heavy limiting, as desired, or optimized release time for maximum transparency at different average amounts of limiting.

Finally, a transient enhancement feature called "TEC" restores some of the transient "feel" of the audio after the limiting has removed the significant transient peaks.

Output level is not changed, but a psychoacoustic effect is accomplished through slight envelope shaping of the below-threshold signal components.

To be effective, the above-threshold compression ratio of a limiter must be high (at least 10:1). The Studio Dominator gives a virtually infinite compression ratio above threshold with a sharp knee.

Due to intelligent interplay between the ALT control, the attack timing of the individual bands and the catch clipper, the "come on" of the limiter is extremely smooth, if at all audible.

To accomplish low distortion limiting, the unit uses type 1537A VCAs in each band as gain reduction elements coupled with individual precision-comparator/pulse-charge gain control circuits.

The attack rate is sufficiently fast to prevent audible overshoot clipping, but slow enough to prevent "hole punching" by ultrafast transient input signals such as record pops, etc.

The release time of all bands are equal and programmed by the ALT via a DC control bus. Release time of all the bands is likewise equal and programmed via DC control bus.

In order to maintain clean audio circuitry, all of the user adjustable limiter functions are DC controlled. This means that a single DC line from a front-panel switch or potentiometer is bussed to the VCAs, crossover filters, etc., to produce the control function.

In stereo units, both channels are controlled from each bus; due to precision circuit design, they will track precisely.

If the two limiter channels act independently, greater average loudness can be obtained; to some extent more punch and stereo width is gained at the expense of some amount of center-stage image shift.

A switch is provided to allow the user to select stereo tracking mode when desired. In this mode, the gain control signal of left and right limiters are locked together for each band. Whichever channel has greater level takes control of the tracking gain.

To adapt the Studio Dominator to the widest range of uses, option cards are available to encode and/or decode the limiter input and output.

After limiting, a jumper selectable deemphasis circuit can be inserted to restore flat response, or no deemphasis may be selected to allow direct feed into the station's stereo generator.

For AM broadcasters, either monaural or stereophonic, a matrix card is available to allow L+R and L−R limiting with user selectable de-matrixing. These options are easily adaptable to other standards for special applications.

The output ceiling calibration is adjustable in 1 dB increments from −2 dBμ to +21 dBμ. Accurate calibration to levels in-between any 1 dB increment can be done via an internal calibration trimpot if required.

This setting represents the actual peak voltage limit of the output signal measured as peak voltage, not RMS voltage.

This way, the Studio Dominator is perfectly suited to transmitter modulation control, and to any application where the peak level cannot exceed a given value.

Editor's note: For further information about the Aphex Studio Dominator, call Jon Sanserino at Aphex Systems: 818-765-2212.

Buyers Guide

TEXAR RCF-1 Provides 'Edge'

by Glen Clark, Pres
Texar Inc.

Monroeville PA ... One lament frequently heard from GMs with reference to the purchase of the most recent, competitive audio processing equipment is: "Where will it end?"

The inference is that two years ago the GM just authorized the purchase of what was then the hottest box on the market. If he buys today's best system, will it also be pushed out by another stronger performer in two more years?

Two comments come to mind. The first is that the direction of "processing wars" has changed drastically over the past two years. Efforts to increase service area, and thus potential listener cumes, by increasing modulation have reached their theoretical limits; there is simply no more unused range left on the modulation monitor meter.

Future significant advances in audio processing which enhance radio profitability will have to do with increasing "quarter-hour maintenance." Put differently, these advances will relate to reducing listener fatigue brought on by processing artifacts.

Some stations in the past that sought increased cumes and modulation, with no regard for the quality of the air product, suffered disastrous drops in listener quarter-hours.

The market has responded by placing a higher priority on signal quality. The headline for one article describing the just-past Dallas NAB Convention read "Buzz Saw Processing Ousted." (*Editor's note:* RW, *15 May*.)

This does not infer that broadcasters have given up insistence on high modulation levels in favor of a pure but "wimpy" signal.

It does however, mean that, in addition to the previous game rules requiring high modulation, broadcasters have now added the expectation that the processed audio will lose its original clarity.

The goals of clarity and density are opposed to each other, and achieving them jointly is easier said than done.

While the GM may feel trapped by having to authorize purchase of the next-generation processor, the processor designer is faced with the far more ironic task of having to surpass his own last, best effort.

The *Star Wars* movies depict the Jedi Warrior teacher, Obi-wan Kinobe, who must subdue his former best student gone astray, Darth Vader. That which he created, he must now outperform.

That parallel obliquely explains the evolution of the TEXAR Replacement Card Five (RCF-1).

TEXAR had been getting an increasing number of phone calls, primarily from major market broadcasters. Comments were as follows: "Things are back where they were three years ago, when most everyone ran an (Orban) Optimod 8100 and sounded alike. To stand out from the crowd, we added a pair of AUDIO PRISMs™ between the console and the Optimod. Three years later, everyone in the market has caught on and has caught up. We need another 'edge'."

While TEXAR manufactures a complete line of audio processing equipment for AM and FM, the AUDIO PRISM was designed to be used in conjunction with the station's existing high-quality FM limiter/stereo generator.

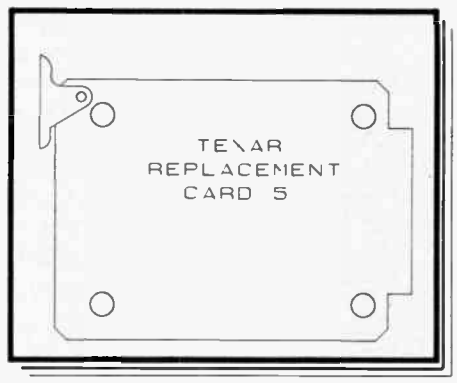
In most instances, FM stations use the AUDIO PRISM in conjunction with the Orban Optimod 8100 or the Optimod 8000.

Even higher performance could be obtained from the AUDIO PRISM/Optimod 8100 combination if the two are tuned as a system. This requires modifying the attack and release functions on the Optimod Card #5.

However, for security reasons, these circuits are cast in epoxy by Orban, and cannot be modified.

For competitive market situations where the edge is important, these attack and release functions can be changed by replacing the original Orban card #5 with the TEXAR Replacement Card Five (RCF-1).

Some who listened to the RCF-1 at the Dallas NAB Show asked if its primary purpose was to have faster attack and release times.



Actually, the more important factor is the control *algorithm*—the rules by which gain changes, not the speed at which they are carried out, are made.

Keep in mind the original Orban Card #5 was intended to receive raw, unprocessed console audio output. This required the Card #5 to keep a certain alertness for those lapses of attention that accompany being a star.

For those stations running the AUDIO PRISM/Optimod 8100 combination, jock indiscretions are stopped in the AUDIO PRISM and the Card #5 can operate in an entirely different manner than before.

For this exact reason, it should also be noted that the RCF-1 should *not* be used in an Optimod connected directly to the console.

The RCF-1 should not be confused with some other replacement cards for the 8100 (from non-Orban suppliers), which simply serve to bypass the active circuits in the 8100 to use its stereo generator.

The RCF-1 installs in less than 10 minutes with no soldering. It includes a new metal operations panel (the brown metal cover inside the Optimod front door through which the control knobs protrude) to allow for the slightly different control layout of the TEXAR card.

The RCF-1 also includes an effective bass boost circuit for enhanced low-end realism, and a proprietary interband coupling system to maximize modulation without producing processing artifacts.

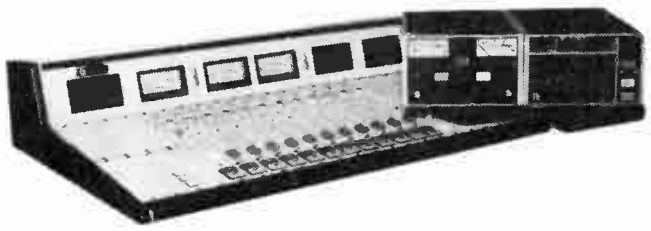
Controls include: clipping depth, interband coupling, bass boost and a proof/operate switch.

Two front panel LEDs, main follow bass and bass follow main indicate the operation of the interband coupling circuit.

Editor's note: For more information on the RCF-1, contact the author at Texar: 412-856-4276.

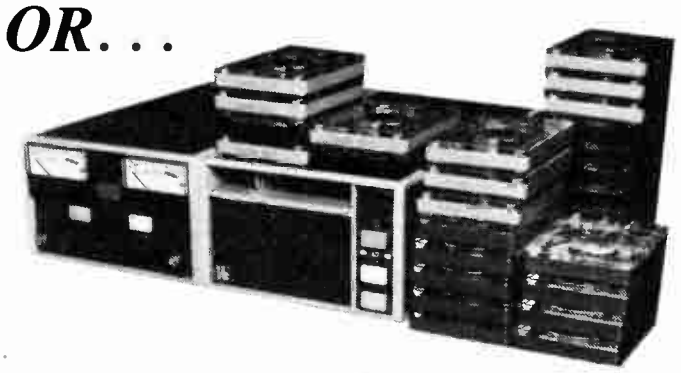
Circle Reader Service 29 on Page 35

SUMMER *SIZZLES*



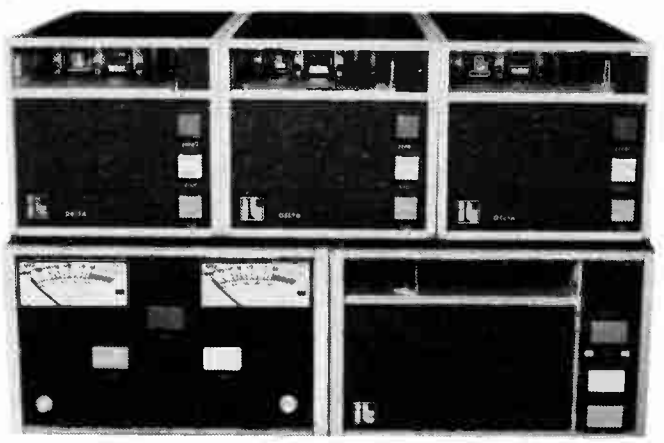
Allied Summer Sale Number ONE*
Every $1000 you spend on Auditronics gets you a $175 credit toward ITC Cart Machines. Add up your savings. Every $1000 gets credit. $35,000 spent on Auditronics is enough credit for a free ITC 99BRPSE.

OR. . .



Allied Summer Sale Number TWO*
Every $1000 you spend toward ITC gets you $150 credit toward Scotchcart,® Capitol Audiopak® or Fidelipac® tape cartridges. Up to 200 carts free with a 99BRPSE.

OR. . .



Allied Summer Sale Number THREE*
The PERFORMANCE PACKAGE. The incomparable 99BRPSE with 3 each Delta I stereo plays. Regular list is $12,460. Summer sale package price is $11,215.
PLUS FREE CARTRIDGES (See Sale #2)

*Certain combinations not available. Check with your Allied Salesperson. Factory List prices apply. This special applies only to Auditronics console systems and ITC cartridge machines/record amps and splice finder/erasers, and Capitol, Scotchcart, and Fidelipac tape cartridges. Sales 1 & 2 good thru 9/15/86; Sale 3 good till further notice. Freight & taxes extra. Dealer participation will assure great savings!

ATLANTA, GA
(404) 964-1464

CHICAGO, IL
(312) 794-0224

DALLAS, TX
(214) 423-8667

LOS ANGELES, CA
(818) 843-5052

RICHMOND, IN
(317) 962-8596

SEATTLE, WA
(206) 838-2705

ALLIED
Broadcast Equipment
P.O. BOX 1487 • RICHMOND, IN 47375

Buyers Guide

CRL Undertakes FMX Design

by Ron Jones, Chmn of the Bd
and Chuck Adams, R&D Eng
Circuit Research Labs

Tempe AZ ... In late 1983, Circuit Research Labs (CRL) reviewed the first paper, written by Emil Torick of the CBS Technology Center and Tom Keller, NAB VP of Engineering, on companding a quadrature S' channel.

In November of that year, CRL, interested in this new technology, held initial talks with CBS regarding the yet-to-be-named system. We found interests to be mutual.

Several more meetings were held with CBS to discuss generator design. In early 1984, CRL undertook the design, development and construction of the first generating units dedicated to CBS' research on S' channel quadrature modulation and other modulation concepts.

These units utilized a new digitally controlled DSB modulator concept developed by CRL to specifically provide laboratory-grade testing capability for the CBS development.

By November 1984, CBS had several laboratory-grade generators from CRL which were being used for the testing programs of a secondary stereophonic subchannel.

By May 1985, CBS had produced numerous advancements and design changes to the yet-to-be-named generation system.

An updated second-generaton prototype research generator was designed and developed to conform to CBS modifications and changes. A half dozen of these units were built and shipped to CBS.

Shortly thereafter, the first FMX generator was born.

We were approached by NAD Electronics, the well-known, high-end hi-fi and receiver manufacturer, for assistance and support for their first FMX consumer tuner, later introduced at the winter 1986 CES show in Las Vegas.

CRL assisted NAD by providing the "real world" closed-loop test transmission system for the CES show.

At the recent NAB show in Dallas, CRL unveiled its preliminary FMX stereo generating system and found an overwhelming interest in both the product concept and the new technology.

The FMX stereophonic transmission system is a companding system which utilizes a special form of "dynamic range compression" encoding of the stereo information signal in an FM transmission. It also utilizes a special form of "dynamic range expansion" decoding of the information signal at the receiving end.

This compressed stereo difference signal is transmitted in a 90° quadrature relationship with the existing stereophonic difference signal in order to provide compatibility with existing receiver technology.

This 90° offset difference of the encoded signal, in comparison to the normal stereo difference signal, prevents existing receivers from "seeing" and erroneously decoding the FMX signal instead of the normal standard stereo signal.

The uniqueness of the FMX system lies in both its specially developed encoding compressor and its decoding expander.

To all incoming low-level modulation signals, the encoding compressor looks essentially like a 20 dB gain amplifier.

When the incoming stereo signal reaches approximately −30 dB from a nominal 100% reference level, the "reentrant" compressor action begins.

From −30 dB to −15 dB input levels (below 100% reference modulation), the 20 dB gain action of the compressor's output is continuously reduced to no gain. This means that the compressor is held approximately constant at −10 dB output while the input varies by 15 dB.

CBS' unique approach to FMX design lies in the next action taken by the reentrant compressor.

As the *input* stereo signal increases in amplitude from the −15 dB level up toward 100% modulation, the *output* of the compressor literally *turns itself off!* This means that at full 100% FM stereophonic modulation levels, FMX essentially does not exist.

The second key ingredient in the FMX system that separates it from other companding systems is the unique and extremely smart "adaptive" expander decoder, which is the heart of the receiving end of the FMX.

At the same low levels of modulation, during which the re-entrant compressor is acting as a linear 20 dB gain amplifier, the "adaptive" expander is acting as nothing more than a conventional summation amplifier in summing both the standard and FMX stereophonic signals.

This accomplishes the nearly 20 dB of noise reduction because the output of the decoder has 20 dB geater stereophonic signal than incoming transmission path noise signal. Mistracking at these levels does not occur because gain adjustments of the expander are neither performed nor necessary.

The key action of the adaptive expander occurs during the transmitted −30 dB to −15 dB "compressed" range and its −15 dB to 100% modulation "turned off" range.

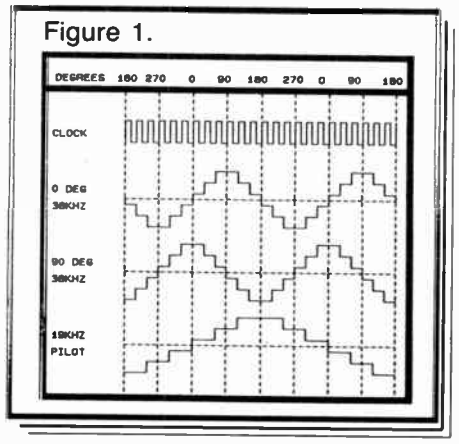
During these periods, the expander begins showing its intelligence by acting as a servo-amplifier-type feedback expander. What does all this mean?

It means that the expander uses the standard FM stereophonic signal as a precision reference with which to compare its output signal. This allows the expander to adaptively cancel its dynamic output level errors through comparison with the linearity of the standard reference signal.

This action essentially results in error-free tracking of the decoded FMX stereo output signal compared to the standard stereo signal.

Changes to the second-generation generator in May 1985 involved a number

Figure 1.



of CBS' changes in design philosophy.

The significant results of these changes were the introduction of the 10 H FMX identification signal (or "FMX pilot") in the quadrature FMX S' channel. This subaudible tone is derived from the same time base as the pilot frequency and is a submultiple of the pilot frequency.

The new companding approach was tailored for the FMX system.

This new re-entrant type of compressor and adaptive expander has many advantages. The two most notable improvements of the new companion system are:

- A great reduction in static measured-overmodulation effects due to the increase of channel loading.
- A system that must, by design, have complimentary tracking between compressor and expander.

Early testing demonstrated that standard compander systems in the secondary L−R channel introduced significant modulation increases that forced reductions in both overall modulation and apparent loudness levels of the standard FM signal.

As we've described briefly, the second thing the FMX system does is allow you to throw out conventional notions about how companding systems should operate.

When you look at any conventional system, you will see a compressor/expander combination meticulously designed to complement each other. They will have one or more compression slopes over the dynamic range of interest, usually between 2:1 and 3:1 slope ratios.

In some designs they will also augment the frequency contour of the audio. From our experience and experimentation with L−R audio processing (as in the BTSC stereo TV system) we have found that, unless everything is absolutely perfect, it is impossible to attain high separation figures with these types of systems.

This is not a problem with the FMX system.

When the L−R channel loading builds up to a point where noise reduction becomes ineffective (when input levels are between 0 and −20 dB) the FMX compressor begins to turn itself off to prevent excessive overmodulation.

No spectral companding is done (other than the standard 75 μsec preemphasis curve already being used).

Note that the FMX modulation is no higher than −10 dB in output level; this means that even though the normal L−R subcarrier may, under certain rare conditions, approach 100% modulation, the FMX L−R subcarrier will always remain 10 dB or more below 100% modulation.

In the region where the receiver needs maximum noise reduction, it needs to only attenuate the secondary L−R channel by 20 dB to properly decode the FMX stereo information (by simple summation described earlier).

There are no time constants, compressor/expander slopes or spectral tracking to worry about.

But what about the region where the FMX compressor begins to turn off (from −20 to 0 dB), you may ask again?

Obviously there are attack and release time constants involved in this region, and any mistracking could cause serious side effects. CBS' clever solution to any possible mistracking problems was the servo feedback control technique.

First, as the FMX compressor begins to turn off, the secondary L−R channel becomes of less use to the receiver.

As the FMX compressor begins this "turn off," the receiver must begin to increase the gain of the FMX expander output in order to maintain high stereo separation and proper program dynamics.

This effectively adds further standard L−R at the expander output until, at approximately 100% modulation, the receiver FMX expander is totally dependent on the standard L−R channel for proper decoding of the stereo information.

The receiver knows precisely how much normal L−R signal to add to the FMX L−R signal by comparing the output of the summing expander to the original standard L−R signal during 99% of the transmission.

The third generation CRL FMX stereo generator, which will soon be introduced to the broadcast marketplace, takes a modular approach to the mechanical layout.

Internally, you will find one large board with several sub-boards. The large motherboard has all of the stereo generation circuitry, including the quadrature modulator.

The generator's operation is similar to our current production stereo generator, with some important improvements, including:

- Selectable preemphasis circuits for use with non-CRL processing;
- Selectable 15 kHz low pass filters for use with non-CRL processing;
- Improved dual (main input/aux input) differential input circuitry;
- Improved high-current output drivers;
- Full bar graph metering; and
- No pilot phasing adjustments.

One of the main reasons why this product will be clearly superior lies in the technique for developing the precision phase lock between the pilot and the two 38 kHz DBS modulators.

(continued on page 35)

Buyers Guide

A + D Calrec Touts Digital Audio

by Tom Gandy, Tech Consultant
Audio + Design Calrec

Bremerton WA . . . The Sony PCMF1/701 digital audio processor takes 20 kHz bandwidth pair of audio signals, digitizes them to 14 or 16 bit accuracy, then packs this information (plus codes for error correction) into a video signal.

Thus, digital audio can be recorded or transmitted over most any system designed to handle video.

Due to the cost effectivenss of this consumer digital system, EIAJ (Electronic Industries Association of Japan) or F1/701 digital has become the *de facto* standard.

Audio + Design has "professionalized" this, initially consumer, digital format with its modifications to the Sony unit.

These mods provide RFI-proof balanced audio inputs and outputs at normal studio levels, decent connectors (XLR and BNC) and access to the digital data stream.

It is traditional to use a 15 kHz leased phone line to ship audio over distance. However, with the breakup of AT&T, broadcasters found their nominal $120/month line charges increased to $1,200/month.

Enter 23 GHz microwave technology—the new frontier with wide open bandwidth, cost effective components and a microwave beam that's only 20' wide five miles out!

Transmitter/receivers that operate on 23 GHz, such as the MA-COM MA-23CC, take video and turn it into 23 GHz microwaves.

The 701 digital audio processor takes audio and turns it into a video signal.

Since many stations already had F1-701 processors in their production departments, it's natural that this combination would be tested.

After the experiments were over and a professionalized, installation-quality EIAJ processor was required, Audio + Design saw a dramatic increase in the sale of pairs of modified 701s.

The further advantage of digital audio in a 23 GHz system is the dramatic resistance of digital to fade. With normal audio on microwave, a 70 dB dynamic range can suddenly drop to 40 dB if there is a 30 dB fade.

With a 16-bit digital processor, the system maintains a constant 90+ dB dynamic range up until the point where the whole system crashes. In short, the system can tolerate 35 dB fades with zero effect on performance. Also, the 701 hangs on right up to system squelch at the microwave receiver.

In an installation, the video low pass filters in the microwave transmitter should be used, as the 701 video output generates out-of-band energy.

In a transmitter such as the MA-COM MA-23CC, the digital audio is placed in the video baseband. However, up to four additional 15 kHz analog channels, which can be used for backup, telephone communications or remote control signals, can be placed in the subcarrier.

Since the 701 has separate record-and-playback section in each processor, digital audio is available in a full duplex installation at no additional cost. This allows the studio to monitor final processing at the transmitter.

Finally, the low cost makes the price of spares attractive. Besides, those spare processors can probably be put to good use in production.

It is possible to use the 701 in field recordings, with full confidence that it can be digitally transferred to 1610 for CD-mastering applications.

For the broadcaster, the modifications to the unit (with the addition of a digital fader) allow fade and voiceovers to be added to digital field recording.

The 701 can be locked to the house sync to allow digital audio in a video production.

Editor's note: For more information, contact Nigel Bramwell at Audio + Design Calrec: 206-275-5009.

Circle Reader Service 16 on Page 35

Buyers Guide

CRL Undertakes FMX Design

(continued from page 33)

All signals are derived from a divider connected to the master clock. The crystal frequency is 3.648 MHz. The pilot and both double sideband modulators have their sine wave structure approximated in 12 steps per cycle.

Both DSB modulators receive their carrier frequency from a multi-phase divider. A nine-phase output is developed by this divider, and both DSB modulators share these phases to create both modulated signals

The pilot generator approximates a sine wave at exactly one half the frequency of the two DSB modulators. Once during every cycle of the 19 kHz pilot, a signal is sent to the multiphase divider that instructs the divider to load a number corresponding to the correct theoretical positions of both the in-phase 38 kHz and the in-quadrature 38 kHz. This ensures that power supply glitches cannot disrupt the operation of the FMX generator for more than one cycle of the 19 kHz or for 52.6 μsec.

Figure 1 shows the approximated waveforms for the 19 kHz and both 38 kHz waves. Since all signals are digitally derived without the use of any analog components or PLL-type circuits, accuracy is superb.

With an adaptive expander at the receiver, the FMX compressor is very module and can undergo radical changes and improvements without detriment to the quality of the stereo signal.

Because FMX is still in its infancy, we also decided to make the encoding compressor portion of the generator modular.

As additional refinements and improvements are made in FMX technology, and since at present the stereo generator far exceeds the typical transmitter/receiver combined specifications, it seemed logical to make an upgradeable system.

Every major building block routes to and from the FMX module, allowing for a wide variety of future enhancements.

During the NAB show there were many people who wanted to know if we or anyone else were planning to release an FMX converter which could easily upgrade an existing generator.

The complexity of the FMX system and precision quadrature modulation precludes any such possibility for a high-quality FMX add-on adapter. To derive the full benefits from FMX, an FM radio station must transmit precise phasing of the 19 kHz pilot and the two quadrature 38 kHz signals.

Any system that tries to use an add-on approach will not match the performance necessary to prevent crosstalk between the two 38 kHz signals over time and temperature changes.

Numerous questions at the NAB were also raised regarding the effect of different types of processing on FMX. We have found that FMX will be compatible with your existing processing system.

Another question was raised regarding FMX's performance at heavily processed radio stations, since the system is "supposed to turn itself OFF." We can best explain this with a brief description of our demonstrations at the NAB convention.

We used our standard FM System 4 with our new FMX stereo generator feeding a Continental FM exciter. The exciter was then connected through a very large attenuator to an NAD FMX receiver.

The attenuator was adjusted to cause a high noise level in normal stereo reception (actually about a −30 dB signal noise ration). When FMX was switched on, the noise level changed to about −50 dB.

If the system was switched to mono, only another 3 or 4 dB were gained. The processing system was adjusted to a light setting and light music was played from a CD player. If we metered the FMX signal level on the stereo generator, we saw a consistently high action.

If the FMX signal level was metered on our stereo generator, we saw consistently high level S' L−R action, indicating that the FMX compressor was working hard.

For the people who wanted to see what FMX did under high processing levels, we adjusted the processor controls for a very dense setting.

With processing set for maximum densities, there were times, (although more infrequent than many thought) when the metering indicated no audio output from the FMX compressor, thus indicating no noise reduction. This is exactly what should happen under very dense program conditions in the L−R domain.

However, during the majority of the demonstrations, the FMX system was indeed providing noise reduction. This is attributable to the fact that most FM broadcast processing systems, while greatly modifying the L and R channel dynamic ranges, do little or nothing to the ratios of the L+R and L−R ranges.

In other words, if the program material is such that the predominant material is in L+R while little is in L−R, or only sporadically, then you have a dense L+R and L−R, while the average energy level of the L−R will still be very low compared with the L+R level.

Only when the program material is heavily processed and contains large amounts of stereo information does FMX "turn itself down or off," since it is not needed at those levels.

These demonstrations showed that every FM broadcasting format (except mono) can benefit from FMX (no matter the level of processing) because the programming will still contain some relatively quiet passages, such as voice periods, program fades and pauses.

As of this writing, CRL is planning both a local and national testing of its preliminary FMX stereophonic generation units. More details will follow on these matters in RW.

Editor's note: For more information on the CRL FMX System, contact Jim Woodworth at CRL: 800-535-7648.

Subscription/Reader Service Forms

Radio World

June 15, 1986 Issue Use until September 15, 1986

FREE Subscription/Renewal Form

I would like to receive or continue receiving **Radio World** FREE each month. YES NO

Signature _____ Date _____

Please print and include all information

Name _____ Title _____

Company/Station _____

Address _____

City _____ State _____ ZIP _____

Business Telephone ( ) _____

Please circle only one entry for each category

I. Type of Firm

1 Commercial AM station
2 Commercial FM station
3 Educational FM station
4 Combination AM/FM station
5 Network/group owner
6 Recording studio
7 TV station or teleprod facility
8 Consultant/ind engineer
9 Mfg. distributor or dealer
10 Other _____

II. Job Function

A Ownership
B General management
C Engineering
D Programming/production
E News operations
F Other (specify) _____

III. Purchasing Authority

1 Recommend 2 Specify 3 Approve

Reader Service

Please first fill out contact information at left. Then check each advertisement for corresponding number and circle below. NOTE: Circle no more than 10 numbers, otherwise card will not be processed.

001	021	041	061	081
002	022	042	062	082
003	023	043	063	083
004	024	044	064	084
005	025	045	065	085
006	026	046	066	086
007	027	047	067	087
008	028	048	068	088
009	029	049	069	089
010	030	050	070	090
011	031	051	071	091
012	032	052	072	092
013	033	053	073	093
014	034	054	074	094
015	035	055	075	095
016	036	056	076	096
017	037	057	077	097
018	038	058	078	098
019	039	059	079	099
020	040	060	080	100

Sales Call Service

Please have a salesperson contact me about these items (list numbers)

Clip & Mail to: Radio World, PO Box 1214, Falls Church VA 22041

Circle Reader Service 4 on Page 35

Dazzle 'm with technical brilliance.

Everybody's talking about CD's and digital. It's as if all analog tape technology and the cart machine were obsolete. Although CD's are a terrific new program source, it should come as no surprise that carts are still the best way to handle the huge quantity of individual program elements that comprise a typical day in radio broadcasting.

What else can play spots, promos, sound effects, news actualities, ID's and music so easily?

Carts have been around for thirty years because they're a great package—easy to handle and store, easy to record and re-record, easy to label and identify. Best of all, they're cued-up from the moment you put them in the machine. Try that with a CD, turntable or reel tape!

The engineer's challenge is not CD versus the cart, vinyl LP or reel tape—but improving all broadcast source and delivery systems. Digital audio technology is here with exciting potential for the future. For today's programming needs though, you can't beat the features and performance of our Tomcat and Micromax cart machines.

Tomcat and Micromax are equipped with our Maxtrax® wide-track tape heads which give you nearly twice the stereo track width. This track format, coupled with our superior recording and reproduction circuitry, maintains the fidelity of master quality sound sources better than any other cart machine.

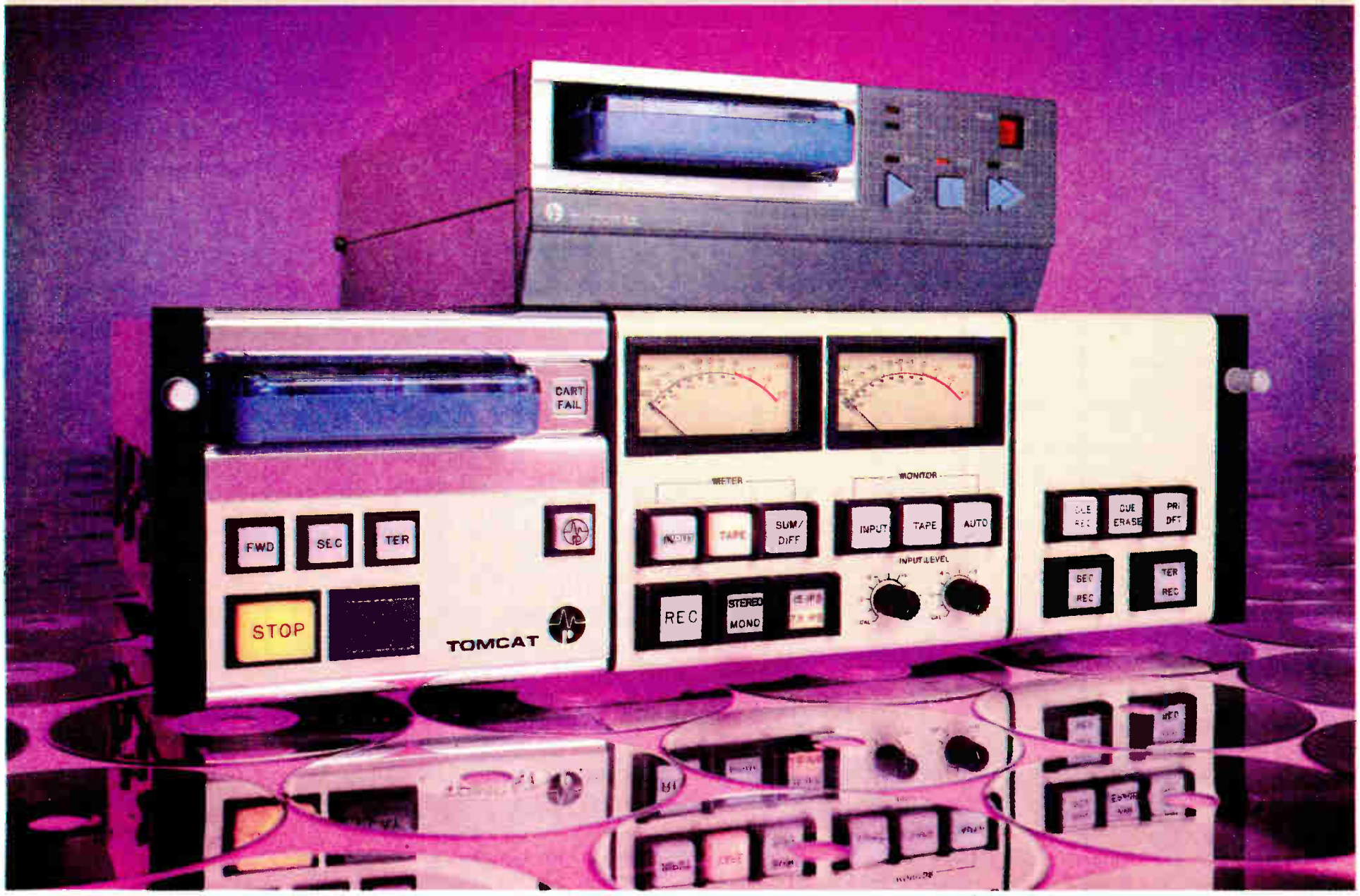
A lot of #1 stations depend on Tomcats. For stations on a tighter budget, our Micromax is the best choice. Both are built rugged to last—designed with the best components money can buy. Both will make your station sound great with everything you cart-up, especially CD's.

Give us a call now for all the technical details on the "Digital Age" cart machines.

Cart 'em-up with Tomcat™ & Micromax.™

The Choice for More #1 Stations.

Pacific Recorders & Engineering Corporation
2070 Las Palmas Drive
Carlsbad, CA 92008
(619) 438-3911 Telex: 181777



Circle Reader Service 6 on Page 35