

## AM Improvement Hot Issue in Dallas

by David Hughes

Dallas TX . . . "Negotiated acceptance of interference," one of the three major new concepts featured in the FCC's AM improvement report, was one of the hottest topics at the NAB convention sessions.

One of the most intriguing ideas to surface from the 100-plus page report, according to many session attendees, involves the plan which would allow AM stations to, in effect, buy and sell interference rights.

NAB Engineer Mike Rau said that theoretically the plan provides a mechanism whereby a Class IV AM station can become a Class I "by buying another sta-

tion's interference and protection rights."

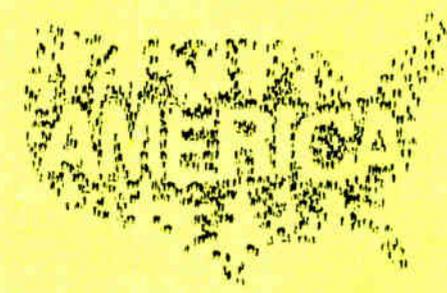
Owing to the large number of stations already operating and the accompanying interference restrictions—described as the current "mature" state of the AM band—the report says opportunities for establishing new AM stations are "extremely limited."

"It may be appropriate to consider whether it would be desirable to give to AM station licensees the opportunity, through mutual agreement, to adjust the amount of interference to be permitted," the report adds.

The report questions whether the agreements should involve "monetary or other valuable consideration."

It also mentions that performing in-

## TUNING IN



## NAB Convention Report: pp. 8-23

terference "tailoring" through a "regulatory agency," such as the FCC, could "overtax administrative resources" with "expensive, lengthy hearings." Instead, the issue could be handled between broadcasters.

However, while FCC Mass Media Bureau Chief James McKinney and others described the plan at the NAB show, some were not quite so sure if the thing

would fly.

FCC Audio Services Division Chief Larry Eads, at one of the NAB Night Court sessions, said he was not speaking for the Commission when he said, "I don't care a whole lot for it. At best, it's a long way away, if we ever see it."

At the same session, Dennis Kahane, of Pillsbury, Madison and Sutro, said that the public could suffer a disservice as stations reduce their coverage areas to sell their interference rights for financial gain.

A second major new concept contained in the report involves the "use of multiple transmitters" to create synchronous or satellite transmitter facilities. Synchronous facilities operate on the same frequency as the original transmitter, whereas satellite facilities utilize a different frequency.

At the NAB show, McKinney said the Commission is ready to issue a number of experimental licenses for carefully synchronized AM transmitters. One such license has been issued to a Nevada broadcaster.

McKinney also said the Commission is looking into the possibility of allowing AM stations to utilize FM translators. For example, a directional AM facility  
*(continued on page 2)*

## FCC Explores Kahn Allegations

by Edward Wytkind

Dallas TX . . . Kahn Communications, Inc. (KCI) has filed a second complaint with the FCC alleging that Motorola Corporation's C-QUAM™ AM stereo system violates FCC type acceptance rules concerning spectrum usage and adjacent channel interference.

The FCC is expected to rule in May on KCI's 11 April complaint, according to FCC Office of Engineering and Technology Engineer Bruce Franca.

"Work is needed to delve into some of the allegations, but we hope to wrap things up once and for all," Franca said.

On 14 March, KCI filed its first type acceptance complaint. However, the FCC dismissed it later that month. The second complaint contains additional information in support of alleged type acceptance violations.

In a 10 April letter to KCI concerning the initial complaint, the FCC stated that, based on the information provided by KCI, "We do not believe that further action against Motorola or any of the parties manufacturing AM stereophonic exciters (Delta Electronics, Harris Corporation, Broadcast Electronics and TFT, Inc.) for the Motorola system is warranted at this time."

KCI President Leonard Kahn refused to comment to *RW* on the matter.

In the first complaint, KCI claimed that an engineer from a C-QUAM equipped station provided measurements indicating type acceptance violations. KCI would not identify the engineer.

KCI claimed that "the Motorola system tests fail both the required 25 dB (15 to 30 kHz removed from the carrier frequency) requirement and the 35 dB (30

to 75 kHz removed from the carrier frequency) requirement of rule 73.44 . . ."

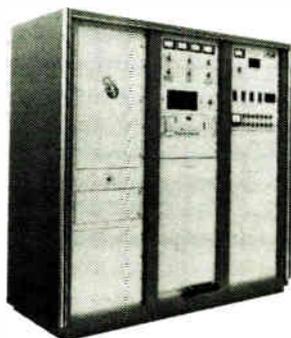
The complaint added that the FCC, "in requiring AM stereo equipment to comply with the spectrum efficiency occupancy rules at 'all possible conditions of program modulation' means modulation at least +100% at all frequencies up to 15 kHz. Therefore, it must be stressed that these tests, which were made at 75% modulation, were far less severe than re-

quired by the FCC rules."

However, in denying the complaint, the FCC said the data presented by KCI to "substantiate" its allegations "relies entirely on tests which purport to show that the equipment fails to comply with the specified rules under single tone modulation conditions . . ."

In developing rules allowing operation of AM stereophonic equipment, the FCC  
*(continued on page 4)*

### Continental's top performing 20 kW FM Transmitter speaks for a station you know\*



- |      |      |      |
|------|------|------|
| WKLO | WPOC | WHFB |
| WIAC | WVOC | KBUF |
| WBYU | WWNO | WTPI |
| KSCB | WBYG | WDJO |
| KVTT | WGER | CKDS |
| WHTC | WZPR | KMNT |
| WIGL | KNFO | KELT |
| KFXE | KQDJ | KOAC |
| WLPX | WITL |      |
- \*Partial list

Reliability and proven performance make Continental's 816R-2A compact FM transmitter a winner. Crisp clear signal, high fidelity, good stereo separation, very low noise and distortion, excellent frequency stability, simple installation, low power consumption make it a great

investment. Combine with duplicate 816R-2A to get 40 kW output. For brochure, call (214) 381-7161 Continental Electronics Division, Varian Associates, Inc. PO Box 270879 Dallas, Texas 75227. © 1985 Continental Electronics/6008



**Continental Electronics**  
A Division of Varian Associates, Inc.



Radio World Newspaper  
PO Box 1214  
Falls Church VA 22041  
USA

LABEL

## Regulatory News

# Snags Delay US/Mexican Pact

by David Hughes

Mexico City, Mexico ... Last-minute snags have delayed the long-awaited US/Mexico clear channel agreement that will allow about 300 daytimers to add nighttime hours.

Meeting in Mexico City, US and Mexican officials were scheduled 22 April to finalize the formal English- and Spanish-language documents that will allow US daytimers located on Mexican clear channels (540, 730, 800, 900, 1050, 1220 and 1570 kHz) to operate at night.

However, FCC officials acknowledged that the agreement had been delayed again. They stressed that the last-minute delays will not affect the final agreement, which has for the most part been formally agreed to by both countries.

"It's very close," said John Wong, of the FCC Mass Media Bureau. "We just need their (the Mexican government's) signature."

At press time, officials were saying the agreement could be signed by the end of April.

When signed, the agreement will also

allow several thousand AM stations, mostly Class IIIs, to extend postsunset (PSS) powers past 6 PM local time. Even though the FCC has already posted specific power levels up to two hours after sunset for those daytimers involved, actual implementation of the new power levels awaits the formal agreement.

FCC Mass Media Bureau Chief James McKinney had hoped to stage the signing ceremony for a week earlier, when he was addressing the Dallas NAB convention via satellite from the Regional Administrative Radio Conference (RARC), but he said the proper Mexican officials could not be rounded up.

Daytimers have awaited the final agreement ever since the preliminary agreement was signed with Mexico last August. That, in turn, was reached after three years of on-again, off-again talks.

The final signing was delayed by the Mexican earthquake last September, which destroyed many Mexican communications authority offices.

Weeks before the final signing was scheduled, FCC officials prepared "show

cause" orders specifying the nighttime powers for the affected Class III daytimers. These will be sent out immediately after the agreement is signed, according to FCC Audio Services Division Chief Larry Eads.

When the document is signed, stations will not need further FCC authorization to expand PSS operations.

Nighttime power levels, NAB Legal Counsel Barry Umansky said, would probably be close to the second-hour PSS authorization.

However, McKinney said that daytimers on Mexican clears will probably receive slightly higher powers than did those on Canadian clears when that agreement was signed last year.

That, he said, is because many of the affected stations are located a relatively long distance from the Mexican border.

Many daytimers on Canadian clears complained that they received relatively useless night power levels, some below 10 W. US daytimers on Canadian clears added nighttime operations last fall.

Daytimers on foreign clears will receive power levels of up to 500 W. Following a five-year period, those stations will be allowed to increase their night power levels by up to 1 kW, if consistent with protection requirements, the FCC said.

FCC docket number is MM 84-281. Contact Jonathan David at the FCC for information: 202-632-7792.

## AM Report Hot Topic

(continued from page 1)

could fill in its null area with a FM translator.

A third new concept contained in the report deals with "fulltime operation by daytime stations." The report proposes two ways to "reduce barriers to the operation of daytime stations during nighttime hours."

One would be to curtail nighttime protection afforded to the secondary, or sky-wave, service areas of Class I AM stations by cochannel Class II stations.

The other would involve the removal of existing minimum power restrictions, which would allow daytimers to make increased use of the band at night.

"Because difficulties with daytime-only station operation may be expected to be compounded by adding to their number, there appears to be little reason to foster the creation of new ones," the report adds.

In other news, the NAB released more information on its AM antenna development project. A site has been selected

about 40 miles west of Washington, DC near the Virginia town of Aldie.

The Dallas show also featured a major demonstration of new radio technologies, including AM antenna designs which accentuate groundwave coverage, receiver designs and information on the NAB's Technical Reference Center, which provides copies of technical articles to broadcasters.

The demonstration also featured a working display of the FMX FM stereo extended range system developed by the NAB and the CBS Technology Center, and the European Broadcasting Union's Radio Data System standard for digital subcarrier transmission.

At the convention, Charles Morgan, Susquehanna Radio Corporation, and Rau presented an update on the NAB's AM Improvement Project, while John Marino of Katz Broadcasting discussed the actions of the National Radio Systems Committee (NRSC), a joint broadcaster/receiver manufacturer group.

## FCC Clips

### New Commissioner

The Senate Commerce Committee held a hearing in mid-April on the nomination of Patricia Diaz Dennis for FCC commissioner. Dennis was nominated by President Reagan in March.

Dennis has been nominated to the remainder of the term held by Henry Rivera, who resigned as commissioner last year.

A Democrat, she has been a member of the National Labor Relations Board since 1983, and before that was a labor relations and legal affairs attorney at ABC.

For more information on the hearing process, contact Macky Ayers at 202-224-1251 or Dale Brown at 202-224-8144.

### "Reach Out and Touch ..."

Got a question for the FCC, but don't know who to call? The latest edition of the FCC Telephone Directory may be of some help.

The publication—which outlines the organizational structure of the various FCC departments and lists the phone numbers of employees in the Washington, DC area—is now available from the Commission's duplicating contractor, International Transcription Services (ITS).

The document provides a "functional listing" of phone numbers by topic, such as engineering rules for AM stations or FM STLs. It also features an alphabetical listing of FCC employees.

Copies may be purchased at the ITS Office, 2100 M St. NW Ste 140, Washington DC 20036 for \$0.59. Copies are also available by mail for \$2 from the above address, or by calling 202-857-3800.

### FCC Meetings on Tape

Audio and video recordings of FCC meetings are now available, as the Commission recently renegotiated with the Small Business Administration for the Prism Corporation to provide audio and/or video tapes of the commissioners' meetings.

Customers may purchase tapes from the contractor or provide their own. Available formats include 3/4" U-Matic (video) and 1/2" VHS (video) and C-90 (audio).

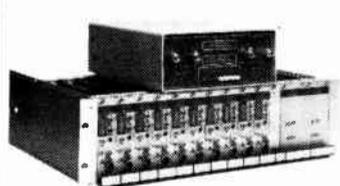
Customers should provide the date of the meeting and, if possible, the agenda item. FCC meeting agendas are published a week before each meeting.

Tapes can be mailed or picked up at Prism, 4400 Jenifer St. NW, Ste 200, Washington DC 20015. For more information, call Prism at 202-686-8250, or the FCC's Kathy Zichi at 202-634-1533.

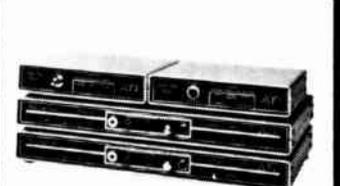
### Featured this issue

NAB Convention Report	8-23
Public Radio Conference Upbeat	
by Mike Starling	24
Foolish Behavior with RFR	
by Floyd Hall	25
Marketing "Situation Analysis"	
by John Cummuta	28
CD Skeptic Recants	
by Bill Sacks	29
FM Fundamentals: Lesson 6	
by Ed Montgomery	30
Buyers Guide	31

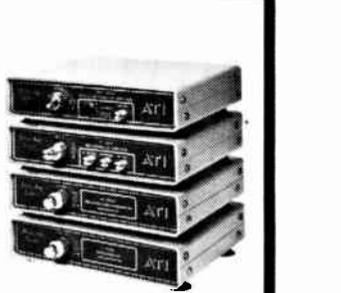
*Micro Amp Series™*  
by  
**ATI**  
AUDIO TECHNOLOGIES INCORPORATED  
328 Maple Avenue  
Horsham, PA. 19044  
(215) 443-0330  
Free Detailed Brochures



**Audio Processors  
Modular Distribution  
Amplifiers**



**Distribution Amplifiers**



**Dual Mike,  
Line, & Power  
Amplifiers  
Rack Mounting**



**Phono Preamplifiers**

# Local Coordination Supported

by David Hughes

Dallas TX ... The future of frequency coordination in the broadcast auxiliary bands does not look particularly bright, according to SBE President Richard Rudman, who addressed an NAB convention panel on frequency coordination.

He and another panelists indicated that band crowding is very severe in many major markets, and that it can only get worse.

"It's a sardine can," he told Radio World. "Even with all the goodwill and volunteer coordination efforts, there is only a finite amount of room in that sardine can."

FCC Policy and Rules Division Assistant Chief Ralph Haller conceded, during a panel discussion, that the FCC did not necessarily have the best answers and that the problem was best solved locally.

He said some Commission attempts to address frequency coordination and band crowding problems by imposing "narrowband incentives" may have "sounded good at the time" but could not match the effectiveness of strong, local frequency coordination efforts.

"The place for decisions is not in Washington, but where you are," he added.

Haller said the FCC was skeptical about releasing additional rulemaking proposals on frequency coordination issues for fear of developing "something so premature that it is doomed to failure," such as a previous FCC idea to allow stations to sell off their excess auxiliary band capacity after switching to narrowband equipment.

"The word 'narrowband' just doesn't necessarily mean greater spectrum efficiency," he added.

Rudman said there is a pressing need to continue volunteer coordination efforts, especially with a national organization helping to give support to local coordinators.

SBE and NAB have been meeting since last winter to develop such a national body to organize 100-plus local volunteer groups and form a database the coordinators could utilize.

“

*Rudman said there is a pressing need to continue volunteer coordination efforts.*

”

Earlier this year, the NAB announced the formation of a frequency coordination subgroup that would work with various organizations and the SBE to set up a national structure for the local coordination groups.

However, Rudman pointed out that the push for more voluntary, local frequency coordination is not without snags. He raised questions about the legal implications of disputes between "licensee-to-licensee" contact.

In a related issue, Rudman stressed that the SBE still stands by a request for rulemaking it filed with the FCC last September requiring broadcasters and other users of the auxiliary bands to work with local frequency coordinating committees, and to perform tests to make

sure their auxiliary equipment does not interfere with that of others.

Commenting on the SBE plan, the NAB maintained that the Commission's rules already require auxiliary users to avoid interference situations. It, instead, asked the FCC to gather additional public comment on the issue.

On the bright side, if there is one, Thomas Stanley, head of the FCC Office of Engineering and Technology, said that band crowding was, at least, "an indication of the health of the industry."

NAB Engineer Mike Rau predicted that "automatic frequency coordination" will exist "someday," but until then a national group to coordinate local frequency coordination is a pressing need.

In related SBE news, Richard Rudman was elected to serve a second term as president of the society, according to election results announced at the NAB convention.

Rudman, engineering manager at KFWB, Los Angeles, ran unopposed, as did the other top officials: KSN Engineering VP Jack McKain was elected SBE VP;

Group W Satellite Communications Operations Director Walter Dudash was elected treasurer, and *Broadcast Engineering* magazine Radio Editor Brad Dick was elected secretary.

The officers serve one-year terms. The results of the board of directors election were also announced. Directors serve two-year terms.

At the April meeting in Dallas, the SBE also awarded fellowships to three members—John Battison, the SBE's founder and first president; Roger Johnson, a former SBE president, and Ed Karl, another former officer.

Rudman also announced that the SBE is starting "a new type of apprenticeship program" to entice engineering school graduates into the broadcasting industry to make a living.

He also said Doubleday Broadcasting Engineering Director Andy Butler has been appointed SBE executive director, a newly created position, and will be responsible for coordinating the SBE's first national convention, slated for October in St. Louis.

## Do You Read Between The Lines?

It's some of the most important reading you can do.

Take a look at your last equipment invoices. If you don't like what you find "between the lines," give us a call next time.

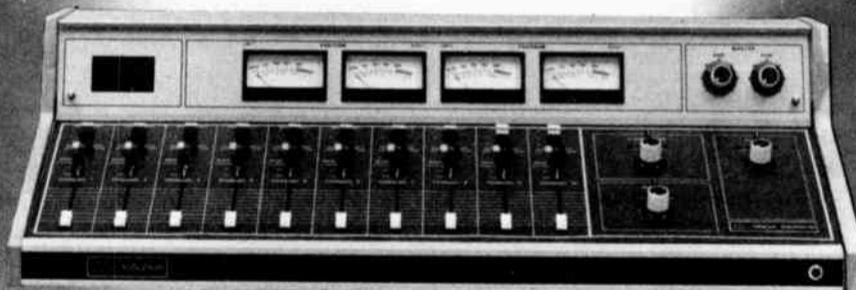
QTY.	STOCK NUMBER	DESCRIPTION
1	ATR17463-01	AUDIO TAPE RECORDER, 7.5 IPS — Unmatched Customer Service
1	MPB15016-NO	MODULAR PATCH BAY, 24 JACKS, STEREO — Extensive parts inventory
2	DMP01651-WO	MICROPHONE, DYNAMIC, 150 OHM OMNIDIRECTIONAL — Experienced, knowledgeable salespeople
1	MAC11000-03	AUDIO CONSOLE, STEREO, 12 INPUTS — Comprehensive product line
1	ACM17286-01	CART MACHINE, PLAYBACK AND RECORDING — Complete Service facilities
1	RFT12057-LP	STL TRANSMITTER, RACK MOUNT, TUNABLE — Strong post-sale support

**BROADCAST SERVICES CO.**

We're easy to do business with.

Neal Davis, Four Oaks, NC, 919 934-6869. Keith Arnett, Front Royal, VA, 703-635-1413.

## SOMETHING NEW UNDER THE SUN...



**10M350A Ten Mixer Mono: \$4995**

**10S350A Ten Mixer Stereo: \$5995**

If you thought that no one would ever make an affordable, ten channel stereo console with four easy to read meters and quality P&G vertical slide attenuators, think again!

The new 10S350A console from Broadcast Electronics is an operator's dream with Penny & Giles precision slide attenuators and independent metering for Program Left and Right as well as Audition Left and Right (four meters total).

Audio performance is exceptional. Every mixer has a preamp selectable for either microphone or high level input, plus a full complement of line, monitor, cue and headphone amplifiers. (all plug-in)

All of these superb features are packaged in an elegant, two-tone technical white and gray cabinet with solid oak end panels. The front panel graphics are protected by a laminated polycarbonate overlay.

For more information contact your Broadcast Electronics distributor or call Tim Bealor at 217-224-9600.

**BE BROADCAST ELECTRONICS INC.**

4100 N. 24th ST., P.O. BOX 3608, QUINCY, IL 62305-3608, (217) 224-9600, TELEX: 250142

# FCC Explores Kahn Allegations

(continued from page 1)

said it "was aware of the fact that, for some of the known systems, under certain test conditions employing a single, continuous tone higher than 7.5 kHz at 85% modulation, sidebands exceeding the limits could be generated . . ."

The FCC added that AM stereo type acceptance rules do not require compliance with "occupied bandwidth limits, L or R only, utilizing single tone tests higher than 7.5 kHz, nor modulation percentages higher than 50%."

KCI's second complaint urges the FCC to expand its inquiry to all C-QUAM licensees. It also disputes the FCC's ruling regarding the use of single tone tests, arguing that they are necessary for "spectrum occupancy measurements."

According to Motorola spokesperson Chuck Sengstock, "We have reviewed Kahn Communication's complaints, and we know of no way that C-QUAM is in violation of FCC type acceptance rules."

Motorola AM Stereo Manager Frank Hilbert added, "There is no way C-QUAM violates any type acceptance laws . . . KCI did this to keep itself in the race, even though it's been stagnant for some two years. Let's let the scorecard speak for itself."

Motorola and its licensees reported 288 C-QUAM stations in the US and 388 worldwide. According to the latest available figures, there are roughly 90 Kahn/Hazeltine ISB stations.

Arguing that KCI's complaints do not "merit consideration," Hilbert said that "C-QUAM complies not only with the FCC's type acceptance requirements, but it also complies with those mandated by the Australian communications authority," which are "much more stringent" than the FCC's rules.

But according to Sage Broadcasting

Executive VP Gerald LeBow, a Kahn-system broadcaster and supporter, "Kahn has brought to the FCC's attention a very serious matter, and they're obliged to do the proper measurements and determine whether compliance with type acceptance has been met."

These regulatory battles have become a "tremendous burden" to the growth of AM stereo, said TFT President Joseph Wu, whose company unveiled its C-QUAM exciter production model at the NAB convention in Dallas.

"Kahn should quit beating on a dead horse. We should find a joint solution," Wu said. "AM stereo should follow the lead of TV stereo, which was solved jointly by the industry."

Citing strong sales at the show, Delta Marketing Manager Bob Bousman said, "In my opinion, Kahn likes to issue such allegations with hopes of clouding the issue and stunting sales."

The ongoing battle hurts AM overall because "ownership is already very cautious about equipment purchase decisions . . . due to the decline of AM radio," Bousman added.

Broadcast Electronics President Lawrence Cervon said, "Kahn has certainly caused a snag in the development of AM stereo."

"It's no longer an engineering issue . . . it's an ownership issue," Cervon maintained, because station ownership is going to invest in the system that consumer receivers can pick up.

At present, about 30 manufacturers produce C-QUAM-only receivers, while Sony and Sansui produce "multi-system" receivers. Sanyo has also recently announced a new multisystem chip.

Motorola officials argue that the latter are actually Kahn-only receivers, because manufacturers have yet to produce a chip that accommodates both systems equally.

Despite the battle between the two systems, BE Engineering VP Geoffrey Mendenhall predicted "a resurgence in AM radio listening" because of the emergence of AM stereo.

Harris Broadcast Group Product Marketing Manager Joe De Angelo agreed that the battle between the two systems has been a detriment to the AM industry

overall.

"Broadcasters must send a signal to the industry showing their commitment to AM improvement," including conversion to stereo, De Angelo said. "We can't allow AM to slip away to a low-fidelity-type medium."

While some—including LeBow and FCC Mass Media Bureau Chief James McKinney—have raised the possibility of Motorola or Kahn buying out the other, Hilbert dismissed the idea on the grounds that "Kahn has nothing I'm interested in buying."

"This buyout nonsense does the industry no good," he said. "Besides, only one system is moving."

LeBow, however, said, "If something doesn't happen, the (AM stereo) industry is going to die real soon . . . It's not going to go anywhere until there is only one system."

Hilbert said that receiver companies have done their share for the time being, but that they need "about 1,000 AM stations on the air in stereo" before they can engage in national AM stereo promotions.

Bousman of Delta cited "listener education and awareness" as the key to augmenting sales and growth of AM stereo. "We want to promote a new technology, not a controversy."

## WINZ Set for Interference Funds

by David Hughes

Washington DC . . . The FCC has recommended granting a fifth monetary award in its program to compensate AM stations for transmitter improvement costs incurred in efforts to override Cuban interference.

In an 11 April order, the Commission said that WINZ, Miami, is eligible to receive \$31,460.51.

The FCC said that the station, which

operates on 940 kHz with 50 kW during the day and 10 kW at night, performed a number of transmission modifications "for the sole purpose of mitigating the effects of interference from Cuba."

However, the Commission noted that the resultant increase in power provided WINZ with "service to limited areas not previously served" prior to the transmitter modifications.

The station has requested and received three special temporary authorizations

(STAs) since 1980 to increase its power and to change its radiation pattern to recover areas lost to Cuban interference.

WINZ joins four other Florida AM stations also receiving recommendations for compensation: WVCG, WNWS, WIOD and WSUN. The program was adopted by Congress in 1983 after broadcasters complained of increasing interference from Cuba.

However, none of the stations has yet to receive any funds. The disbursement is to be handled by the US Information Agency (USIA), which says it will wait until the FCC has made the bulk of its compensation recommendations before it asks for an appropriation from Congress.

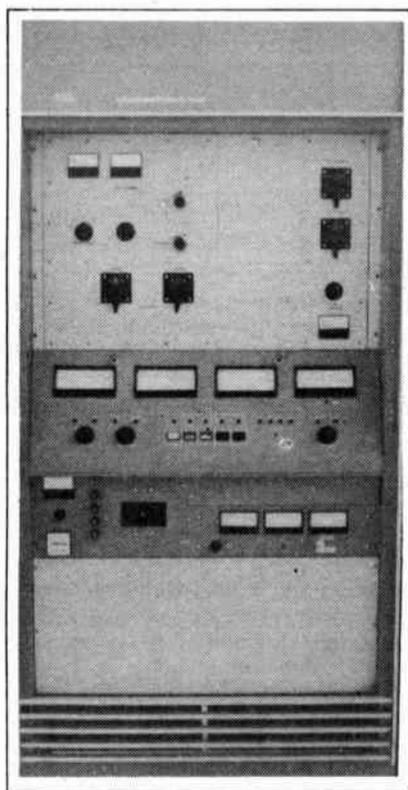
In another Cuban interference case, the FCC has said it will not permit WKAT, Miami Beach, to increase its nighttime power.

WKAT licensee Hernstadt Broadcast had requested a STA in order to prevent its station from becoming a mere "jamming device" for Cuban signals.

However, the Commission said that, at 1360 kHz, the WKAT STA, which proposed increasing the station's nighttime power from 1 kW to 2.3 kW, would increase nighttime interference to co-channel WSAI (now WNWK), Cincinnati.

In related news, FCC Mass Media Bureau Chief James McKinney, in recent comments from the Regional Administrative Radio Conference in Geneva, Switzerland, reported no progress on talks with Cuban authorities to reduce AM band interference.

For more information on the Cuban interference compensation program and the WINZ case, contact Dennis Williams at the FCC: 202-632-6485. For more information on the WKAT case, contact Rhonda Blank-Render at the FCC: 202-254-9572.



Nearly a Quarter Century of

## RELIABLE TRANSMITTERS

AM-FM-SW

- More Meters
- New "State of the Art Relay Logic" Control & Status
- New "User Friendly Meter/Control Panel"
- New "Exciter"
- Same Reliable Grounded Grid Design

**CCA**

Parts & Service: (404) 964-3764

Sales: (404) 964-3530

**CCA Electronics Corporation**

360 BOHANNON ROAD / P.O. BOX 426  
FAIRBURN, GEORGIA 30213 PHONE: 404/964-3530  
TELEX: 543365

# 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).

## Transponder switch

Dear RW:  
Re: Phillip Ramsey's transponder switch (15 February)—great minds must think the same thoughts!

I was faced with the same need to change transponders remotely and cheaply a few years ago, and came to the same solution.

I did find, however, that it is a good idea to re-peak the S-A receiver crystal phase compensation when using such an add-on switch. This improves the receiver stability, especially under marginal conditions.

Instructions for this simple adjustment are in the S-A instruction manual.

RW is much appreciated. Continue your fine work.

Paul Anderson, CE  
KLZX/KFMY  
Provo, UT

RW replies: Thanks for the tip.

## Of Pioneer, PSSAs ...

Dear RW:  
First of all, I would like to say that RW has been one of the best magazines available to radio engineers. Keep up the good work!

I'm the editor for the National Radio Club's DX Audio Service, a nonprofit reading service for the blind covering medium wave DX information and related stories in AM broadcasting. We have 14 people who we read to.

The National Radio Club is a nonprofit DX club devoted solely to medium wave DXers. It has been in existence since 1933.

Although the DX Audio Service has only 14 members, the National Radio Club boasts over 600 members worldwide. Many of the members in the National Radio Club are CEs, engineering directors and technical people in the radio business.

Persons interested should write to The National Radio Club, PO Box 24, Cambridge WI 53523-0024. DX'ing is a real fun hobby!

Mark Person's article (1 January), was right on track about the Pioneer car radio. In addition to the information in the article, I received some information from a friend who has one, and who has taken the time to bench test the frequency response.

This radio is a fine example of what the quality standard should be in car receivers. I hope that Pioneer continues to breed quality products, and doesn't stoop to the mentality of some of the other companies who have a good thing and then strip it down to just what will be acceptable!

My personal feeling is that many AM broadcasters have cut their own throats by taking the attitude of "it's only AM" and have had formats and programming that are lucky to attract even a 0.5% share. I firmly believe that radio is like a movie or a TV show; if you give people a quality act, you'll attract listeners, but give them boring programming and you have nobody to blame but yourself for lousy ratings.

Every CE knows that AM radio can be transmitted with decent quality. Sure, it's not flat to 16 kHz, and there will be some noise in the transmission from both man and atmosphere, but it is technically possible to have receivers that sound good to the average radio listener. Pioneer and others who have at least tried to make radios sound good should be praised.

One other note. Recently on a short-wave DX program an article was read where someone was quoted saying that, "the AM band would be dead in seven years."

This is unlikely, but again I have to point out that at least in my own listening habits, I listen to the best sounding stations, not FMs or AMs. In my area, there are two stations on AM and four on FM. It's the programming that I listen to, not the fact that it's "FM." Think about it ... Couldn't some AM broadcasters do a little better in the programming department?

I would like to ask a question on another subject. Many stations were granted Post Sunset Authority. However, these powers were smaller than

Congratulations are in order to the NAB for another great convention! However, success doesn't preclude trying harder next year.

This year's show proved that ongoing problems continue and are likely to worsen unless concerted attempts are made to relieve or remove the underlying causes.

For attendees, there was the usual quandary of too much to do and see in too little time. Having the engineering conference on Saturday has eased some problems, but the exhibit floor, day sessions, night workshops, night court sessions, special events and hospitality suites pose insoluble scheduling conflicts.

For exhibitors, the severe space problem has been compounded by a perceived lack of equitable treatment of exhibitors by the NAB.

## Insoluble Conflicts?

Exhibit groundrules for 1987 won't improve NAB/exhibitor relations. Unreasonable and dictatorial, the rules minimize most of the NAB's "responsibility" toward filling exhibitor needs. An unwillingness to listen to the suggestions of the Exhibitor Advisory Committee is inexplicable.

Other problems included radio exhibitors lost among TV booths, and a seemingly inaccessible lower level.

In the end, poor treatment of exhibitors will only make the SMPTE, the SBE National, AES and other shows more attractive.

One solution is for the NAB to split the spring show, with TV in the spring and radio in the fall. Then the NAB could direct efforts to making its fall radio show as strong and appealing as possible to all factions of the radio broadcast industry.

If this is impossible, the NAB should schedule the Engineering Conference before, after, or with less overlap with the Convention so that attendees will have enough time for both activities. The NAB should also reconsider grouping radio and TV booths separately to the extent that this is possible.

A great show can always get better, but splitting or lengthening the show in some manner is the only ultimate answer. In the meantime, the NAB must address the needs of both the exhibitors and the attendees or else risk weakening its premier event. That should not be allowed to happen.

—RW

what was expected. On Glenn Hauser's "World of Radio" program, on WRNO, I thought that Glenn said something about stations operating now these new powers. It was during a severe sky fade, so I could hardly hear what he was saying.

Perhaps I missed a couple of the FCC press releases, but hasn't the FCC stated the power of operation, but not yet allowed the stations who have PSSA to operate 'til the Mexico/US agreement is

completely in hand? Also, have any stations challenged the FCC on the power issue?

Fred Vobbe, NRC member  
Lima, OH

RW replies: Though power levels have been assigned, postsunset operation has been limited to 6 PM, local time. Once the Mexican agreement is signed, many daytimers will be allowed to operate up to two hours after local sunset.

## Radio World

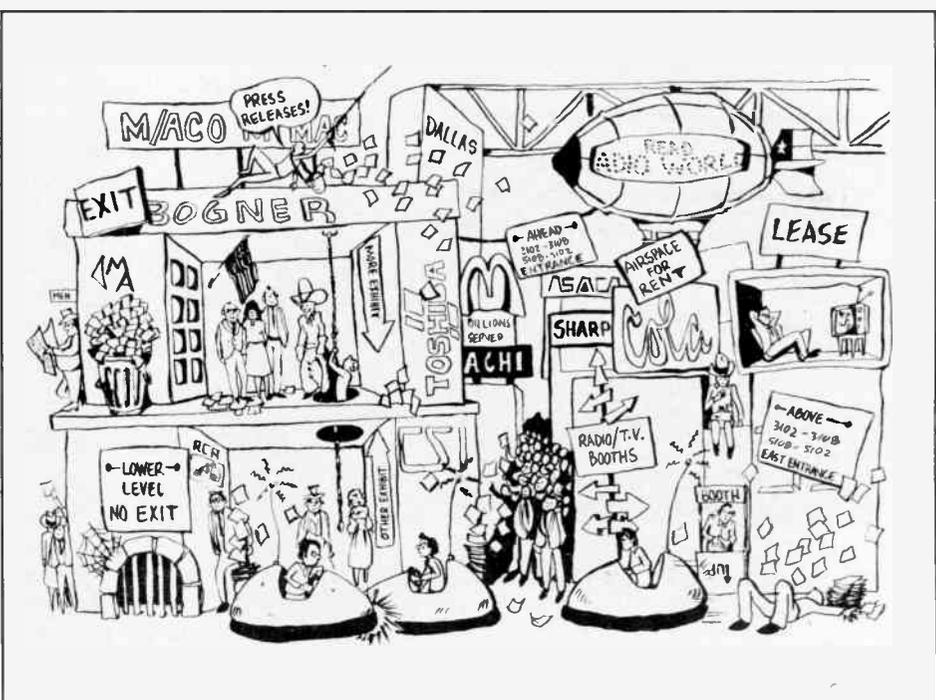
Vol 10 May 15, 1986 No 10



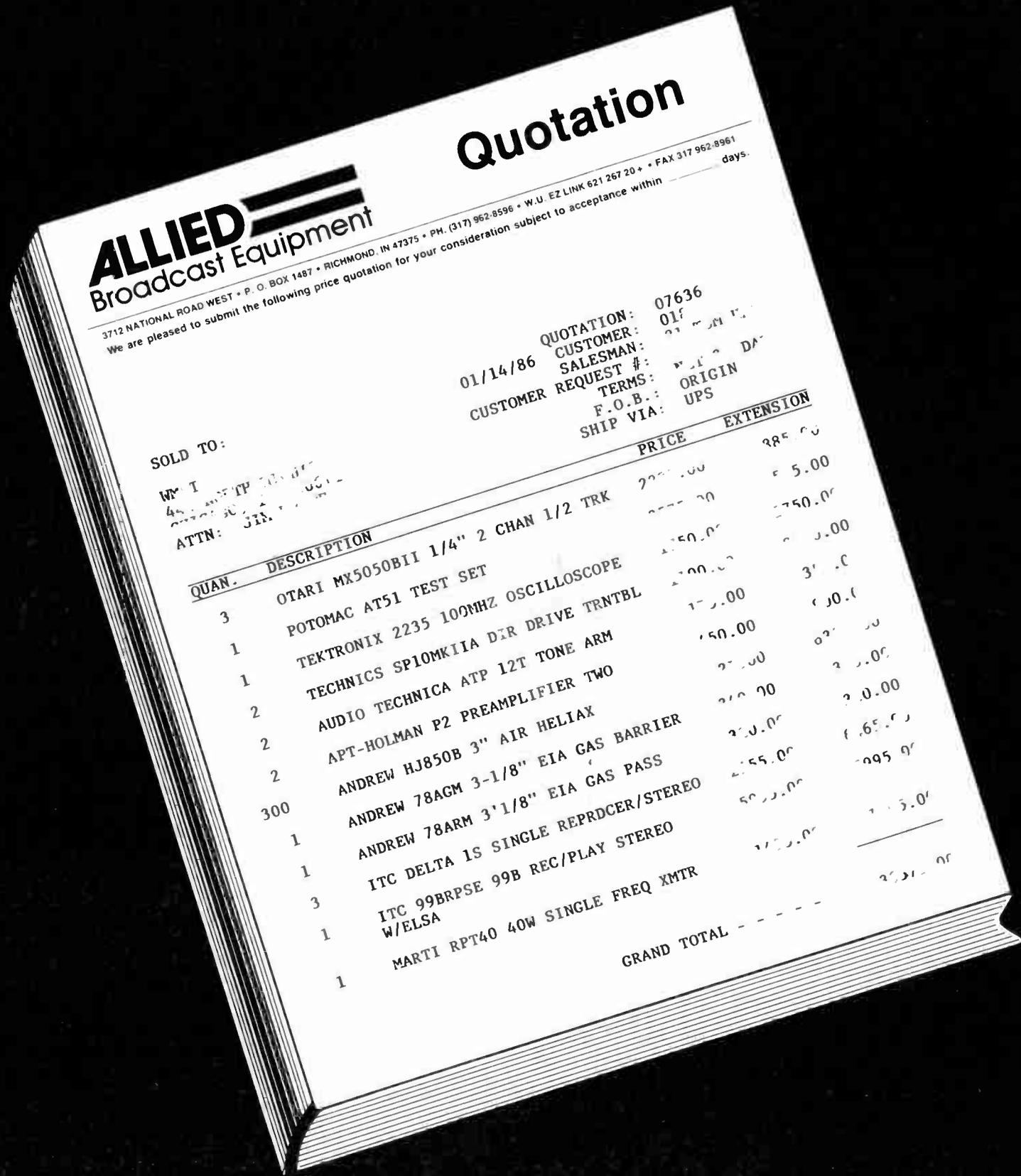
Radio World is published twice a month by Industrial Marketing Advisory Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phone (703) 998-7600. Copyright 1986 by Industrial Marketing Advisory Services, Inc. All rights reserved.

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; Nancy E. Olson/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.



# A "Bestseller" in the Broadcast Industry



Be sure you get our success story . . . MORE STATIONS DO!

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

# NARTE Extends Certificate Date

Salem OR . . . The National Association of Radio and Telecommunications Engineers (NARTE) has extended its deadline to 31 July 1986 in order to receive NARTE technical certification without examination.

The NARTE Board of Directors approved the extension at their annual meeting 16 March. The original date under which technicians and engineers holding FCC licenses could apply for NARTE certification without taking an examination was 31 December 1985.

## Inundated with calls

NARTE said it extended the deadline because many engineers interested in the certification "were unable to get through on the clogged telephone lines" during the last two months of 1985.

NARTE President Ray Thrower said the organization received a "massive inundation" of calls in late 1985 that exceeded the capacity of the system. Since then, new telephone lines have been in-

stalled at NARTE's Salem, Ore., headquarters.

## Alternative certification

Many engineers are only now becoming aware of the FCC's decision (in 1984) to cease testing, and are looking to NARTE as an "alternative certification mechanism," Thrower added.

According to NARTE, persons with experience in radio engineering can be certified without an examination if they submit satisfactory credentials to the NARTE certification committee and the board of directors.

Those without FCC licenses can receive a NARTE certification by taking a test. NARTE has set up more than 100

testing centers at colleges and universities across the US.

"Possession of an FCC license is not mandatory for certification, but experience is," NARTE added.

For more information, including a list of testing centers, contact NARTE at 503-581-3336, or write: PO Box 15029, Salem OR 97309.

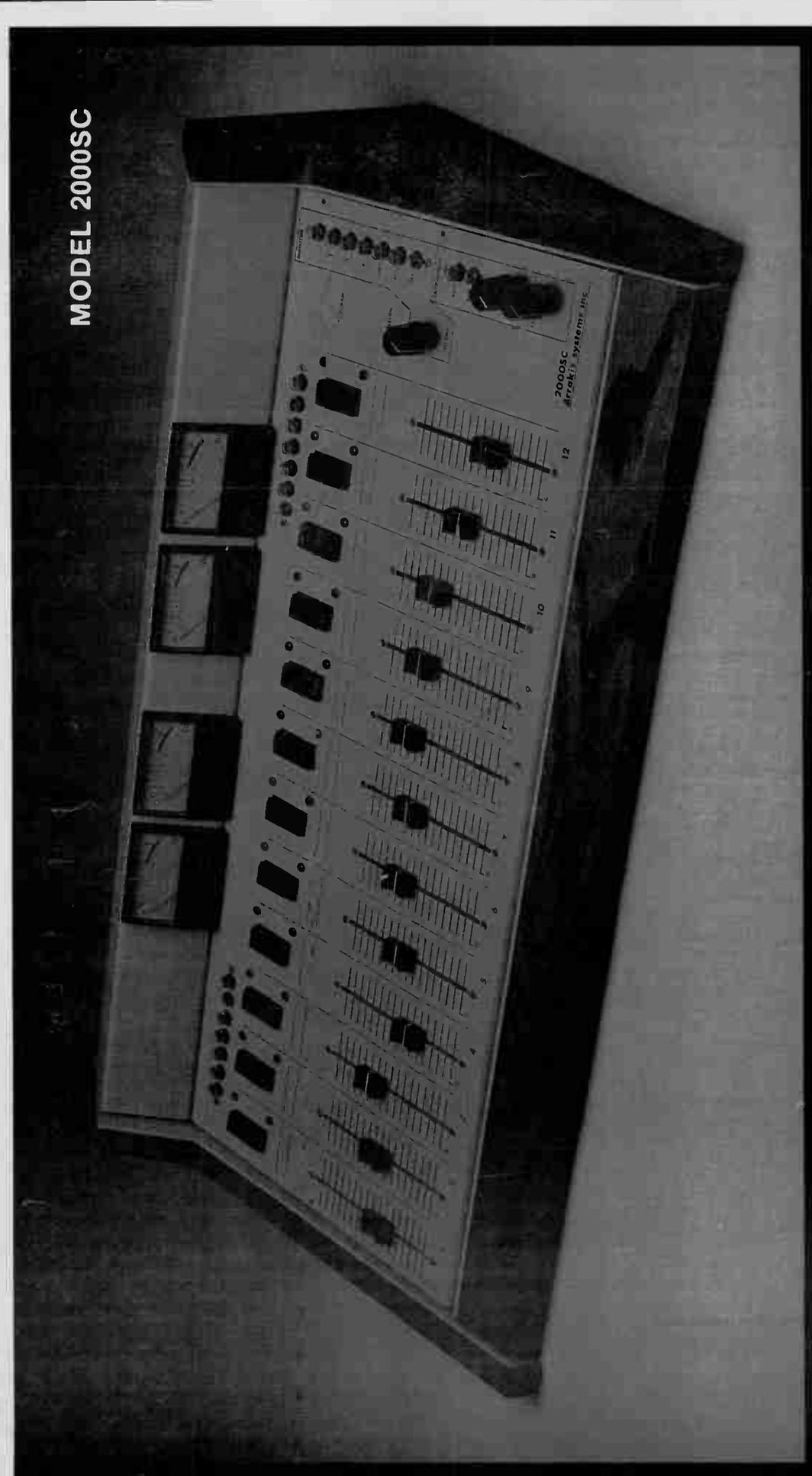
## Cetec Antennas Acquired

Sacramento CA . . . Cetec Antenna management interests have acquired the Cetec Corporation antenna subsidiary from its parent firm, forming a new privately held company called Jampro Antennas. Terms of the agreement were not disclosed.

Specializing in circular polarized antennas for FM and TV stations, Jampro, which named James Olver its new president, plans to expand its product line to include antenna/transmitter packages to be offered jointly with major transmitter manufacturers, company officials said.

Aside from possible expansion, Olver said Jampro operations will remain intact, with no major changes planned. The company sells antennas in the US and abroad.

Privately held Jampro Antennas was sold to Cetec Corporation in 1967. In the late '70s, Cetec changed the name from Jampro to Cetec Antennas, officials explained.



## AUDIO CONSOLE PRODUCTS

Arrakis audio console products are designed by broadcast engineers for broadcast stations at reasonable prices.

Our products sell themselves. Study our features, specs., and prices. Compare and you will find what thousands have found — The Arrakis Advantage —

### FEATURES

- \* VCA Faders
- \* P & G Sliders
- \* .01% Distortion
- \* Solid Oak Trim
- \* 10W/CH Monitor
- \* Remote Start
- \* Mix - Minus
- \* Modular Design
- \* Ultra-Reliable
- \* Mono Mixdowns
- \* Stereo Cue
- \* Full Muting
- \* Dimensions—
- \* 30" W x 17" D x 7" H
- \* Weight—55 Lbs.

### MODELS

- 6 Channel Rotary
  - 150SC-6M \$1895
  - 150SC-6S \$1995
- 8 Channel Rotary
  - 500SC-8M \$3550
  - 500SC-8S \$3750
- 12 Channel Linear
  - 2000SC-12M \$4495
  - 2000SC-12S \$4695
- 12 Channel Linear
  - 2100SC-12M \$5495
  - 2100SC-12S \$5695

**arrakis**  
SYSTEMS, INC.



2609 RIVERBEND CT.  
FORT COLLINS, CO  
80525

## UNIVERSAL SURGE PROTECTOR FOR ALL LINE VOLTAGES!

Never obsolete! Unique resettable strapping protects on all power systems—even 3-phase—if you should change line voltage. "On" all the time, to protect constantly. Immediate shipment. Quantity discounts. Money back guarantee. Order today.



CALL BILL JOHNSON  
(301) 778-3240

EAGLE HILL ELECTRONICS, INC.  
Route 2, Box 354 Chestertown, MD 21620

## NAB Convention Report

# Console/Studio Gear Exciting

by Bill Lemmon

Dallas TX ... The annual NAB spring extravaganza: miles and miles of equipment to look at, and here I am without a checkbook. It is an engineer's nightmare to have so many choices and not be able to take anything home with you.

If any one thing stood out to me, it was the arrival of the multitrack production room. I feel vindicated, as I built my first multitrack studio over 10 years ago. Only recently have other stations in my local market started to move to multitracks.

Auditronics introduced its new 400 series, which can be used either for production or on air. The 400 series replaces the discontinued 110 consoles.

Since it is a modular console, you can choose either production or on-air modules, or mix both in one mainframe.

The mainframe comes in either a 4- or 8-output subgrouping, plus stereo and mono. A console set up as a 4-bus version is field-upgradable to 8 bus later. Incidentally, all modules support the 8-bus design.

Options include monitor setups, different types of meters, and output modules with hidden masters for on-air consoles. Accessory choices are extensive. Delivery is slated to begin in the third quarter. Auditronics has also upgraded its 300 series consoles to reduce the thermal loading. Specs have also been improved.

Wheatstone Corporation was showing its new on-air console, the A-500a. The design is what I call "straight wire" (no VCAs).

Construction is very rugged and uses ribbon cable for the busses. Dry "C" contacts are provided for interfacing to external devices.

All logic programming for modules is done on a matrix located in the mainframe. Therefore, a module can be moved from one position to another without having to make any changes.

Wheatstone's Gary Snow is willing to build any type of custom modules for this board that you might want.

Pacific Recorders & Engineering had their usual impressive lineup of the BMX, ABX and AMX modular consoles set up and shown in several different configurations.

Though you really need to know what your requirements are when laying out a modular, the PR & E gear always allows you to add on later.

The rack-mount NEWSMIXER, though very interesting, might be too expensive for some stations (approximately \$5,000 fully loaded).

Hidden in the TV displays were a couple of other interesting consoles. Sony introduced the MXP-2000 series, which is based on a European design.

The 2000 can be used for either production or on-air use. Modules can be

Bill Lemmon is technical director of WMEE/WQHK, Ft. Wayne, IN. He can be reached at 219-447-5511.

configured into 4 subgroups via thumbwheels. Four separate processors are switchable to any module position, also by thumbwheel.

This console can be interfaced to a video editor with an optional \$500 module. At \$17,500 up and loaded, this is a great bargain.

Panasonic displayed its WR-8616 unit. Primarily a production console, this unit has many capabilities, and the choice of setup is almost limitless.

Also shown was a rack-mount mixer—the WR-M10. Using a mixture of mono and stereo inputs, this mixer looks like a plus for a newsroom operation.

While I have singled out these consoles, there were many others that may fit your needs and budget. Some of the

brands include Amek, Arrakis, ARI, Howe, LPB, Radio Systems and BE.

Accessories available for studio use include the new, modular patch panels using punchdown terminals.

ADC was showing the QCP system with do-it-yourself patch bay kits.

Gentner's Versapatch series is now available with the normals brought out to the rear on a 66 block. You can now choose to make one row breaking and the second row bridging.

Pacific Recorders' patch panels are available with Molex connectors as one option.

While on the subject of patch panels, check out the Patchprints custom labels shown by the Patch Bay Designation Co. of Glendale, CA. You can contact them

at 818-241-5585.

Allied Broadcast is the exclusive dealer for a modular furniture system by Arrakis called Modulux™.

Based on an aluminum-post internal frame construction, these units are shipped flat via UPS.

Delivery of either stock or custom sizes is available in a few days, not weeks, as with some designs.

The Graphic Express Corporation builds an all-wood series of cabinets that has many possible configurations.

New for 1986 are a Slope Face Rack module and a Parking Garage Over-bridge module for use with two-reel-to-reel transports. The latter straddles the reel to reels, thus providing extra space

(continued on page 10)



The NAB's 64th Annual Convention & International Exposition, held 12-16 April in Dallas, drew 1,000 attendees over last year, for a total of 39,000. The show also boasted 702 exhibitors, with booths nearly filling the two-level Dallas Convention Center's 310,000 sq. ft. The Broadcast Engineering Conference included 19 technical sessions and 7 evening workshops, with more than 60 papers presented. Dates for the 1987 show, also in Dallas, are 29 March-1 April. At press time the NAB could not confirm whether 28 March would be devoted to the Engineering Conference.

## Exhibitors Give Mixed Review

by Edward Wytkind

Dallas TX ... An NAB Exhibitor Advisory Committee meeting, held 15 April at the NAB convention, was attended by roughly 125 exhibitors, who voiced a long list of complaints, including "inconsistent" booth assignment procedures.

Although there were many complaints voiced by newer and smaller companies, many exhibitors on both the upper and lower exhibition floor levels reported excellent traffic and sales, and felt this was a marked improvement over some of the past NAB conventions.

Acknowledging that certain problems must be addressed by the NAB in concert with the advisory committee, NAB Secretary Treasurer Michael Harwood maintained that the association "felt real good at the show. Companies reported excellent traffic and sales."

Committee chairman Al Fisher of Ampex Corporation said the seniority issue "will be the first subject on our list."

Fisher also said that although many companies may have reported increased booth traffic, "from an exhibitor's standpoint, Dallas certainly is not as good a location as Las Vegas."

The advisory committee was created after last year's NAB convention as a means of addressing problems experi-

enced by exhibitors at past conventions.

Formation of the committee was also fueled in part by last year's list of exhibitor complaints, which included claims by some companies that there was poor floor traffic in the auxiliary exhibit area in the Las Vegas Hilton.

Among the issues raised at the 15 April meeting, many exhibitors cited inconsistencies in the NAB's method of assigning booth space based on seniority, or tenure, at previous NAB shows.

The advisory committee was scheduled to meet with NAB officials, including Exhibit Director Edward Gayou and Harwood, on 1 May.

Fisher said that while there is a range of exhibitor problems still to address, "seniority is probably the most crucial one facing the committee."

One exhibitor protested the lack of "consistency" by the NAB in applying the "seniority approach" for the allocation of booth space. He cited one case where a first-time exhibitor received a better space assignment than did his company, even though his company had been exhibiting since 1982.

According to Harwood, booth assignments are based on "how long a company has exhibited at the convention." He added that if a firm skips a show, seniority is lost.

Harwood also said that buyouts and mergers create difficulties because a long-time exhibitor might lose some seniority due to name changes. "We need to address these types of situations (with the advisory committee) to make procedures clearer," he said.

Booth space allocation procedures have been a key issue because of increasing demand for booth space.

Continual growth of the show, as well as increasingly limited options on the number of convention centers with enough space to accommodate such continued growth, have made seniority a major concern among companies. In addition, NAB exhibitors had to accept a 10% reduction in booth size this year in Dallas.

Several exhibitors also complained of the NAB's announcement that next year's assignment of booths will be handled virtually the same way as this year.

Fisher said he was informed that companies wishing to exhibit in the same booth next year will have to pay a non-refundable \$500 "reservation fee" by 16 May. Those exhibitors requesting a larger booth, or merely wanting to move to a more desirable location, face the threat of not receiving any booth allocation next year, he added.

(continued on page 10)

## NAB Convention Report

# Harmony Reported by RARC

by David Hughes

Dallas TX . . . FCC Mass Media Bureau Chief James McKinney, addressing the NAB convention live via satellite from the Regional Administrative Radio Conference (RARC) in Geneva, Switzerland, said there was relative harmony among nations about methods of expanding the AM broadcast band to 1705 kHz in the Western Hemisphere.

Expansion of the band is expected by 1990.

Both McKinney and consultant Wallace Johnson, of Moffet, Larson and Johnson, told NAB attendees that things were running smoothly and that even Cuba had agreed with the US on using an allotment allocation method for stations in the new band.

McKinney said the US and many other nations favor the "more flexible" allotment method "because there is nothing else in the band."

The allotment method dictates that stations of specified powers levels be placed at regular intervals from each other. The alternative allocation method, by assignment, would require nations to place stations where they feel they are needed and then begin the often complicated process of resolving interference problems.

While there is general consensus that relatively low-powered stations be used on the new band, there is still a large number of power proposals on the table, McKinney said. The US had recommended a 10 kW ceiling. However, McKinney said that even Cuba has announced a 5 kW limit.

Johnson said the RARC delegates were also discussing procedures to resolve some existing interference problems, and were examining a new set of propagation curves for the new band that take into account a "latitude effect."

McKinney predicted that receiver manufacturers may start making receivers tunable to 1705 kHz by next year. "They may be in cars by the next model year," he said.

A second RARC session is slated for 1988.

## AM improvement

The NAB convention provided ample discussion, both formal and informal, on the FCC's AM improvement report, released in early April. However, since copies of the 100-plus page document were not yet in broadcasters' hands, there was little specific comment on the proposals contained in the report.

However, daytimers seemed pleased that the clear-channel issue was coming under scrutiny.

"The AM improvement report looks like a daytimers' agenda," said former Daytime Broadcasters Association (DBA) President Jim Wychor (DBA merged with NAB last year). "I urge all daytimers to file comments."

He argued against AM skywave protection, reasoning that the majority of

AM stations, which do not rely heavily on skywave service, "should rule." The AM improvement report will examine the skywave issue.

Wychor's anti-skywave position was echoed by others. Former DBA Counsel Gregg Skall questioned why local and regional AM stations should have to protect stations 500 and 600 miles away at night.

Other ideas recommended for study in the FCC document include allowing nighttime-only stations, removing minimum power restrictions and lowering the AM duopoly restrictions.

The report covers the possibility of allowing AM stations to utilize FM translators. If so, an AM daytimer could theoretically continue operations at night using its FM translators.

Johnson said the report marked the closing of the FCC's "deregulatory" phase and the opening of an "unregulatory" phase.

In another issue affecting daytimers, NAB Daytimers Committee President David Palmer praised the joint NAB/Association for Broadcast Engineering Stan-

dards (ABES) request in March for a Commission rulemaking to remove the 5 kW cap on Class III operations, and to allow all Class III daytimers to operate at night with a power level similar to their second-hour postsunset (PSS) level.

The FCC recently removed the 5 kW cap for Class IIIs in Alaska, Hawaii, the Virgin Islands and Puerto Rico.

FCC Policy and Rules Division Assistant Chief Ralph Haller said that night power levels the Class IIIs may receive "may not be reasonable" if the FCC held to the second-hour PSS proposal. He suggested that higher, "more usable powers" would be examined by the Commission.

Remarking on upcoming Commission action on the proposal, FCC Audio Services Division Chief Larry Eads said that it would be "bold" to suggest that the FCC act on the rulemaking proposal by the end of the year.

Eads told convention attendees to expect a slowdown in the Docket 80-90 process because of a hiring freeze imposed by the Gramm-Rudman bill to balance the federal budget. The 80-90 pro-

cess could take five years instead of the projected three, he said.

So far, seven application "windows" have been opened, affecting 11 of the 80 available channels.

"We had originally planned to open a window every month or so," Eads said, "but, because of the hiring freeze, the pace has been slowed. It looks like we'll be opening a window every six weeks instead."

Several FCC officials complained about the effects of Gramm-Rudman, saying that the overall day-to-day workings of the FCC will be slowed considerably. One Commission official said he lost most of his "young attorneys."

## Other issues

Among other hot topics discussed in sessions and workshops at the show was that of translator abuse.

McKinney said the Commission would take a careful look at a recent NAB request for rulemaking on the issue.

In its request, the NAB said that FM translators are being used to broaden the commercial appeal of already successful major market stations into smaller markets, thereby hurting stations there.

"There is a potential for serious abuse," added McKinney, who said the Commission was examining the problem in southern California, where some Los Angeles stations operate translators in the Palm Springs area, a separate market.

McKinney also predicted little change in the Cuban AM band interference issue. "There have been no dramatic changes in the Cuban situation from what I've seen at the (RARC) conference," he said.

He revealed that the Commission is prepared to issue several more experimental licenses permitting the use of synchronous AM transmitters. A license has already been granted a Las Vegas, Nevada station, which will produce a report for the Commission.

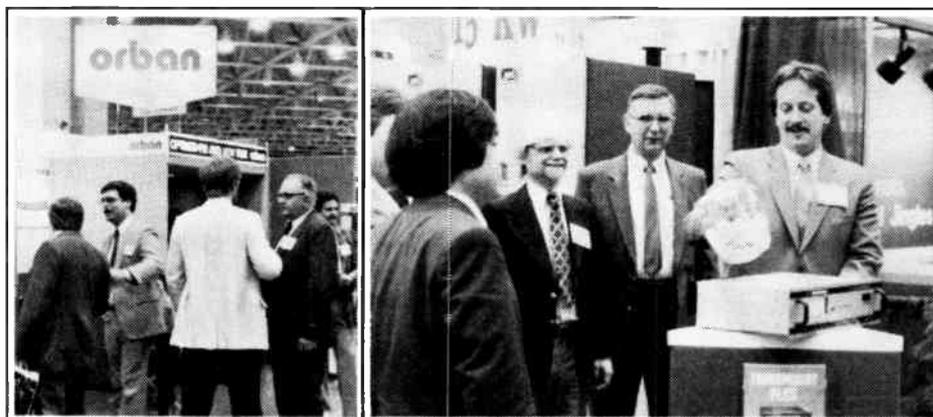
On another matter, NAB Legal Counsel Barry Umansky addressed the issue of the so-called AM "birth control" rules, which were formed in the 1960s to foster the development of FM. The rules were dropped by the FCC last year.

The National Black Media Coalition had filed a petition for reconsideration against the decision, claiming that minority applicants would be hurt without the rules. However, the NAB said the rule deletion actually helps minority applicants.

Umansky said there was "no realistic chance" the rules would be resurrected.

He also said the NAB still opposes a plan to extend daylight savings time (DST) to start earlier in the spring and end later in the fall. Daytimers are fearful that they could lose broadcasting time in the morning.

A recent Congressional attempt to extend DST failed, he said, but there is another such effort connected with another federal bill.



Above, clockwise: Tom Allen of John Fluke Mfg. explains the 9000 Series Micro-System Troubleshooter applications to a customer; Orban Associates' booth; QEI's drawing for a new 695 FM exciter made KFAI, Minneapolis a happy winner; Broadcast Electronics' Kevin Clymer explains the Microprocessor Video Diagnostics System to a potential customer; HEIE Engineering's Bill Shute has a passer-by draw a winning entry for a Revox B225 CD Player—the lucky winner was Lloyd Berg, WIQI/WDAE (Gannett), Tampa.



## NAB Convention Report

# Exhibitor Reaction

(continued from page 8)

The "Procedure for Exhibit Space Assignment" sheet distributed to all companies states: "When the same convention site will be used the following year (next year's show is again in Dallas), exhibitors who request the exact same booth location and size will receive their

assignments first. Exhibitors who request a different location or different booth size will be considered next, based on seniority and available space."

"A company must either accept the space he's offered, or he takes the chance of not getting a booth assignment," Harwood said. "This is the way it's always

been done."

One company representative criticized this approach because it forces exhibitors to either pay \$500 and remain in the same booth, or "take the chance" of trying for a better and/or larger space with the possibility of not receiving any booth assignment at all.

One exhibitor said that companies are receiving "very poor treatment" from the NAB, adding that exhibitors "pay a lot of money here, and the NAB should not

be so complacent in the treatment of our complaints."

Another issue discussed at the meeting was the number of nonbroadcast exhibitors who received booth space, including a gold dealer and a luggage sales booth.

Other nonbroadcast public service exhibitors were granted booth space, including several branches of the military, the National Air & Space Museum, the National Safety Council and the Jewish Museum, according to the published list of exhibitors.

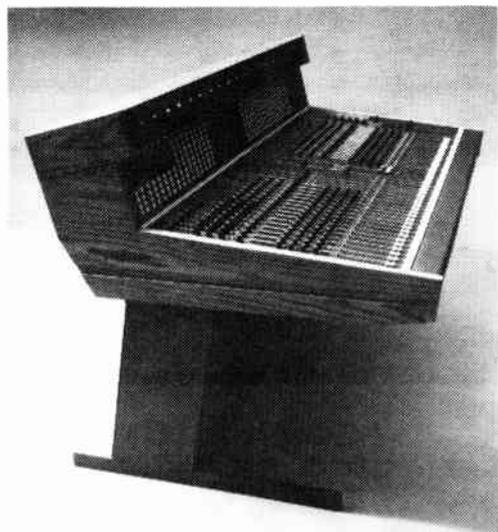
Harwood said the NAB would look "real closely" at the issue of nonbroadcast booth allocations.

For information on next year's exhibit area, contact the NAB exhibit office in St. Louis at 314-721-7717.

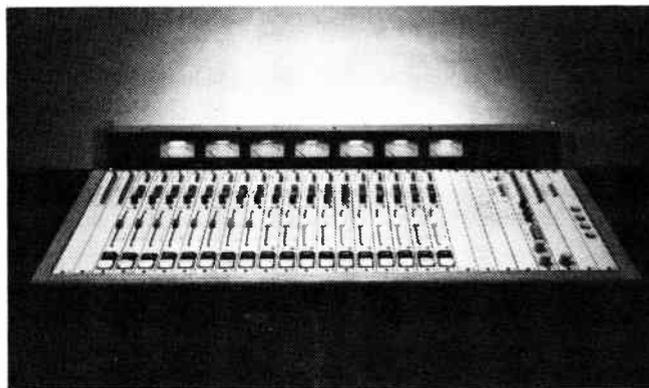
# Multiple Choice:

## What do you need in an audio console?

Every application is different; what are your requirements? Should the input section be stereo or mono, mic or line? What kind of outputs and subgrouping do you need? Is a matrix mix important? Do you require mix-minus capabilities? What about metering, timers, tape remotes, mainframes, future expansion?



A-500 Radio  
On-Air



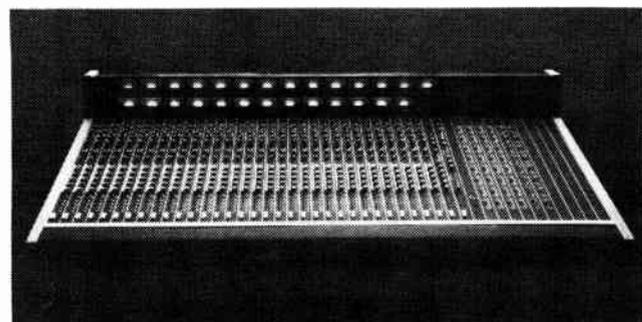
WHEATSTONE consoles give you all the choices. Our sales engineers listen to your requirements, then work with you and plan your console from the first module to the last VU meter. The result is custom-configured equipment built specifically to your needs.

The truth is, there's only one choice when specifying broadcast equipment: QUALITY. There's simply no room in broadcast for cutting corners; when you're on-the-air the phrase "Time is Money" takes on real meaning.

SP-5 Stereo  
Production

TV-80 Television Master

So whatever your application, stereo or multi-track production, television master control, on-air, video edit, or mobile installation, consult WHEATSTONE.



3224 Multi-Track



**QUALITY**  
There's No Better  
Choice.

 Wheatstone Corporation

5 Collins Road, Bethany, CT. 06525 (203-393-0887)

Circle Reader Service 29 on Page 29

World Radio History

## Studio Gear

(continued from page 8)

for equipment above the tape decks.

Audio Broadcast Group designs and custom builds a group of studio furniture that is human engineered. Shown was an Auditorics console in a U-shaped grouping. Everything is within easy reach of the DJs. ABG can and will do turnkey studio setups, including complete equipment checkout and all wiring.

Several exhibitors displayed the new AudioMetrics CD player. One hundred CDs are available in a rotating carriage similar to a jukebox. Start time is 30 msec. Disk-to-disk access is on the order of 14 sec. Adding a couple of these to your automation system or studio could provide an almost unlimited playlist of CDs.

Created for on-air or production use, Philips' Professional Disc Player system, the LHH2000, is designed so that up to three decks can be used with one controller. Multiple edit cue points are also available for each player. Songs can be edited to shorten long intros and outros, etc., while another unit is playing.

Straight Wire Audio introduced a professional CD player, the CDQue, with varispeed, an improved cue system and remote-control interface.

Pacific Recorders showed its new Micromax cart machine. Available as a playback only, this is the coolest-running machine I have ever seen.

You can order Micromax with either TOMCAT MAXTRAX™ heads or the NAB format.

The use of a motor-driven pinch roller and solenoid to pull in the pinch roller is a slick answer to the problem of heat buildup. Six of these machines—in a closed box, with all machines operating—were only one to two degrees hotter than the ambient air. Slick engineering!

Without a doubt, the NAB show is the place to see all the latest equipment. You can—and will—walk your legs off looking at all the equipment and *still* not have time to see all that you want to! Though I have mentioned only a few of the many exhibits that were there, I was impressed by the quality of the show and exhibits. The exhibitors I talked to seemed pleased with both the crowd size and response.

## NAB Convention Report

# FMX Stirs Great Expectations

by Tom McGinley

Dallas TX . . . "FMX is the best thing to happen to FM broadcasting since the invention of stereo." This rather bold claim has been made, or at least implied, by various proponents of the new FM noise-reduction concept.

The same sentiment was frequently voiced around the exhibit hall—by both attendees and manufacturers—at the recent NAB convention in Dallas.

Howard Mullinack of Orban Associates called the response and interest in FMX at his booth "overwhelming," with interest coming primarily from major and medium market stations.

Orban, CRL, Aphex and Inovonics all demonstrated their own versions of FMX stereo generators at the show.

Developed by the CBS Technology Center (from a joint CBS/NAB design) and encouraged by the NAB, FMX was first proposed as a new method to improve signal-to-noise performance of FM stereo reception in 1983. As a noise reduction system, FMX occurs in the multiplexed domain between audio and RF.

FM stereo has been around so long that many of us don't realize what was sacrificed in terms of SNR and coverage when stations converted from mono to stereo.

The FMX system uses the tried-and-true method of companding to improve SNR. To make it compatible with existing FM receivers, FMX generates a compressed L-R signal (2:1), modulating a separate 38 kHz stereo subchannel which operates in quadrature (90° out of phase) with the main 38 kHz stereo subchannel.

FMX-equipped receivers, in turn, demodulate and expand the 38 kHz "Q" channel, which is dynamically summed with the 38 kHz main stereo subchannel. S/N performance is thus improved by as much as 20 dB, depending on processing and available dynamic range.

Existing FM receivers don't respond to the 38 kHz Q subchannel and merely demodulate L-R in a normal fashion.

## Modulation requirements

Although an extra subchannel is being added to the baseband, total modulation requirements and limits are not exceeded with FMX because of a modulation controlling technique derived from the "adaptive expansion" in FMX receivers.

The total amount of 38 kHz modulation varies between the two subchannels as a function of L-R amplitude, but will never exceed 100% normal L-R modulation.

FMX has been tested on a classical station in Connecticut with impressive results. It will soon be tested more extensively on WGBH, Boston, and

*Thomas R. McGinley is director of Engineering for First Media Corp., Washington, DC, and a frequent RW contributor. He can be reached at 301-441-3500.*

WZFM, a commercial station in New York. Though numerous other stations have offered their facilities for FMX testing, several, including KIIS, Los Angeles and KMZK, Sun City, AZ are the most likely to be named next, along with as yet unnamed stations in Chicago and San Francisco.

## Apparent limitations

The noise reduction and extended coverage with FMX appear to be significant improvements for FM stereo reception. There are, however, some unanswered questions and apparent limitations.

The only possible negative side effects foreseen by CBS with FMX include increased multipath distortion in reception areas where multipath is already present, and possible crosstalk distortion in existing receivers having slight alignment problems and which inadvertently "see" some of the 38 kHz Q subchannel signal.

Assuming the FMX/stereo generator is properly aligned, and the entire baseband in the transmission chain has linear modulation characteristics, FMX should be fully compatible with all SCA operations.

The benefits of FMX to classical and lightly processed stations should be obvious. However, the magnitude of real improvement in coverage area with FMX will be dependent on the amount of processing used and the average level of L-R program modulation.

Aggressively processed formats with little dynamic range and/or stations using stereo image enhancement (which increases L-R modulation beyond normal levels) will probably not see their coverage areas increase significantly with FMX. (Editor's note: CRL booth representatives said that CRL had circumvented the FMX/audio processing problem through generator design, and that the link between the two was not an issue except in cases of extreme over-processing.)

FMX by design is only capable of rendering noise-free stereo reception in areas where it would be noise free if transmitting in mono.

Despite these limitations, FMX should prove to be a welcome addition, especially for those stations striving to be clean and dynamic along with those class A 3 kW stations trying to compete in the same markets as class B and C operations.

Adding FMX to the transmission chain requires replacement of the present stereo generator.

Orban offers a separate FMX chassis to be interfaced with any existing Optimod or other processor retrofitted to accept FMX. The Optimod modifications should be easily handled in the field in less than an hour.

CRL, Aphex, and Inovonics will each offer a standalone FMX/stereo generator which can work with virtually any existing FM audio processor.

The real difference among the four units is the proprietary circuitry which

optimizes the compression characteristics of FMX to eliminate overmodulation, loss of loudness and processing artifacts.

Delivery dates and exact prices are still tentative, although it appears that the units will retail in the \$3,000 range, with projected deliveries starting in late fall.

## Receiver availability

The big question being asked by broadcasters is how soon FMX receivers will be available and how long it will take before a significant set count emerges among listeners in general. It's like the chicken-and-egg dilemma encountered with AM stereo—if stations don't broadcast in FMX, why buy an FM receiver?

This time around, however, it would appear that speculation in the chicken-egg market will be much easier, since there is no competing transmission method for FMX.

It will be dramatically cheaper to implement FMX transmission than it has been for AM stereo. FM stations as a group have the resources and the ratings to easily justify adding FMX generators. Most larger market FMs will drop \$3,000 without a second thought just to be the first to get the latest processing gadget on

the air.

Assuming broadcasters will bite, what about receiver manufacturers? Thus far, only two companies have announced plans to introduce FMX receivers: NAD and Apt-Holman.

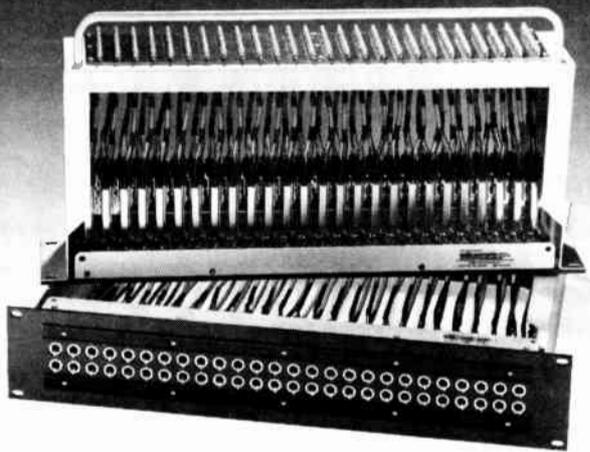
NAD displayed a prototype FMX receiver at the CBS FMX demonstration table, where traffic was running very steady. The NAD receiver should be available later this summer but will be relatively expensive (Editor's note: RW heard that the first 10,000 NAD receivers would be available 3 June.). It uses discrete components to decode and expand the FMX signal.

Several large IC chip manufacturers are presently developing an FMX decoder chip. Assuming the chips become available in large quantities, numerous receiver companies will no doubt offer more cost-competitive FMX sets.

CBS expects such FMX receivers to be commonly available in about one year, and hopes for substantial FMX set penetration to occur within three to five years.

If FMX decoder chips become cheap and plentiful, the FMX transmission standard looks like a good bet for the future of FM broadcasting.

## JACKS BE NIMBLE.



**WHAT ARE YOU WAITING FOR?**

Take a look at your broadcast facilities. Are there empty spaces where there should be jack panels and patch cords? Let Audio Accessories fill those gaping holes with premium pre-wired or unwired jack panels, featuring our exclusive Audio-Line™ jacks.

We have a vast array of audio jack panels and related items in stock, ready to ship within 24 hours. We'll get your facilities upgraded faster than some companies can give you a quote. Give us a call. 603/446-3335.



**audio accessories**  
**audio-line**

AUDIO ACCESSORIES, INC., MILL ST., MARLOW, NH 03456

## NAB Convention Report

# Session Examines RFR, ANSI

by Edward Wytkind

Dallas TX ... Amid increasing interest in the issue of human exposure to radio frequency radiation (RFR), several federal government and private-sector representatives presented talks on the issue at the NAB show.

Topics covered included the FCC-adopted American National Standards Institute (ANSI) exposure standard, which became effective 1 January 1986, RFR measurement techniques and instruments, occupational exposure and controlling RFR levels near towers.

Environmental Protection Agency

(EPA) Nonionizing Radiation Branch Chief Richard Tell discussed time-averaged RFR measurement techniques for determining compliance, while Occupational Safety and Health Administration (OSHA) official Robert Curtis covered the worker exposure issue.

In addition, Robert Cleveland and William Hassinger, both from the FCC, discussed technical and policy issues regarding the Commission's standards.

Concerns about compliance with the ANSI exposure limit were raised by session attendees.

Compliance has emerged as an important issue due to numerous cases around the US wherein broadcasters are faced with local or state governments mandating compliance with nonfederal RFR standards which, in some cases, are more stringent than the ANSI exposure limit.

California, Massachusetts, New Jersey, Washington, Oregon, Connecticut and other states have adopted, or are considering adoption of, RFR standards which could force broadcasters to comply with two RFR exposure regulations.

The emergence of local and state RFR standards has created a controversy that pits the statutory rights of nonfederal government bodies against the rights

granted to the FCC in regulating interstate communications services, said Electromagnetic Energy Policy Alliance (EEPA) President and NAB Counsel Barry Umansky at the convention.

In hope of spurring industry activity, Umansky added, the NAB submitted a petition in April urging the FCC to issue a policy statement preempting all non-federal RFR standards that inhibit broadcasters from operating FCC-authorized stations.

Commission officials had no comment on the petition.

While the FCC's RFR exposure standard is currently the only federally mandated regulation, Hassinger argued that it "is not a standard," but merely an application processing "guideline" for FCC use in considering the environmental impact of a broadcast facility prior to granting a license.

Neither OSHA nor the EPA have adopted RFR exposure standards.

The EPA is scheduled to issue four RFR standards this summer for public comment.

One attendee questioned why so much attention has been given to RFR exposure when little is known about health effects from human exposure.

Umansky said the EEPA is currently funding a \$100,000 study to determine the merits of 32 recent RFR studies which cite health effects from RFR exposure.

## All over the world, you can count on CSI transmitters.

- ✓ Dependable
- ✓ Efficient
- ✓ Cost-effective

More than 1,000 CSI AM and FM transmitters are spread throughout the world, featuring innovative design features for today's broadcaster.

CSI transmitter design is straightforward, using time-proven stable circuits and mechanical design features, assuring many years of superb performance.

CSI transmitters are designed for the broadcaster, with standardization of parts so that all are interchangeable for ease of operation; simplicity of design to control maintenance cost; and proven reliability.

You can count on CSI transmitters for many exceptional features, such as front panel circuit breakers, lighted pushbutton switches, high-low switch and local-remote switch that enables the operator to disable the remote control for safety purposes.

CSI is celebrating its 10th anniversary this year and now is part of the Cutler-Federal family of companies, headquartered in Lakeland, Florida.



**ELECTRONICS, INC.**  
P.O. Box 965  
Highland City, Florida 33846  
(813) 647-1904

## International Tapetronics Corporation/3M The World Leader In Cartridge Machines

More International Tapetronics Corporation/3M cartridge machines are installed in radio stations around the world each year than all other manufacturers' cartridge machines combined ... and for good reason. For almost two decades, ITC equipment has maintained the standard of excellence in reliability, audio quality, and long-term cost effectiveness; backed by ITC's legendary status as the industry's service leader.

International Tapetronics Corporation/3M's professional audio products include the most complete line of cartridge machines featuring state-of-the-art microprocessor based logic for increased operational flexibility, reliability and easy maintainability.

- 99B Cartridge Machines, "The Best," offering the patented ELSA automatic cartridge preparation feature which includes azimuth aligning for maximum phase response performance
- DELTA Cartridge Machines, "Today's Most Popular Cartridge Machines"
- OMEGA Cartridge Machines, "Affordable Performance You Can Trust"

- ESL V Eraser/Splice Locator, combining quick erasing and splice locating into one simple step
- ScotchCart® II Broadcast Cartridges, reel-to-reel audio performance and five times the average life of its nearest premium cartridge competitor
- The FB-1 Interface converts an ITC cartridge machine into a potentially profitable telephone information service

3M's vast financial and technological resources have combined with ITC's proven commitment for delivering uncompromising product quality to insure that when newer technology emerges, it will come from International Tapetronics Corporation/3M, "The Leader in Reliability and Service."

Call today for more information and ask about ITC's new lease purchase plan. In the U.S., call toll-free 800-447-0414, or collect from Alaska or Illinois 309-828-1381. In Canada, call Maruno Electronics, Ltd. 416-255-9108.

**International Tapetronics Corporation/3M**  
2425 South Main Street  
P.O. Box 241  
Bloomington, Illinois 61702-0241



## NAB Convention Report

# 'Buzz Saw' Processing Ousted

by Paul Montoya

Dallas TX . . . As usual, most audio processing exhibitors at this year's NAB Convention in Dallas felt they had the ultimate device in making our stations both the loudest and cleanest.

This year they were not quite as subtle in letting us know that their's was the best processor. Names of products, like the "Dominator," "Super Eagle" and "The Last Word," took the place of more traditional model names, such as "8100," "310" or "LA-4."

But what's in a name? All we want to see are results.

### Aphex Dominator

An item that caught my eye was Aphex' encore presentation to its now-popular Compellor. The new unit is called the Dominator.

The Dominator is a tri-band device that Aphex suggests be used with the Compellor. The unit uses a tri-band limiting circuit, with user-selectable crossover at 80 or 160 Hz for low- to mid-band crossover, and 1700 or 4500 Hz for mid-to high-band crossover.

Aphex President Marvin Caesar told me that "maximum peak output is controlled by peak clipping after summing the three bands." This offers "faster control than feedback-type limiting," he explained.

*Paul Montoya is director of Engineering for Surrey Broadcasting Co. and a consultant for Surrey Consulting and Research. He can be reached at 303-989-9980.*

Other features include user-settable release time, front-panel-selectable stereo tracking and another of Aphex's proprietary circuits, the TEC (transient enhancement circuit), which can be switched in or out of the circuit.

The stereo unit lists for \$1,195. Options include preemphasis cards, matrix/de-matrix cards and a card that is used in the Orban Optimod 8100 so the Dominator may be used with the stereo generator portion of the 8100.

### Texar Audio Prism/8100 card

Speaking of interface cards, if you've "super-charged" your Optimod 8100 with one of Glen Clark's Texar Audio Prisms, you know that having a card for the Optimod to change some its processing characteristics would be nice. Well, Texar has come up with a card to do just that.

The new card replaces card #5 in the 8100.

While a firm price had not yet been set, the card will sell for no more than \$695. Availability is set for mid-May.

Bob Orban tells us not to call Orban for technical support with this card, however!

### AM peak processor

Texar also introduced a new peak processor for, of all things, AM radio stations.

A long-overdue device, this new processor controls input gain, clipping density, preemphasis, telemetry injection, asymmetry, high and low frequency transmitter correction and transmitter drive control with both a coarse and fine

adjustment.

There are actually two processors included in one box. Therefore, when you're driving your "Power Rock" transmitter as a main, you won't have to use the same processor for your auxiliary Gates BTA-5F transmitter.

Front panel metering includes telemetry sense, clipping indicators, VCA action and power supply status. Glen recommends using the Super Eagle with Texar's Audio Prism along with the peak processor.

Shipping will begin in mid to late May, with a list price of between \$1,000 and \$1,500.

### Orban SCA filtering card

Since everyone else seems to be making cards for Orban's Optimod 8100, I guess Bob Orban decided he might as well get on the bandwagon. While his new card, the ACC-22, is not used for main channel audio processing or interfacing, it is excellent for SCA filtering, for which it was designed.

The card simply plugs into a card slot in the 8100.

Howard Mullinack at Orban has more information on this card and other Orban products.

### Data Sidekick

Audio processing of the SCA channel is every bit as important to proper FM operation as is main channel processing. The designer of the well-accepted Modulation Sciences Sidekick SCA processor, Eric Small, has come up with a specialized SCA processor for SCA data.

The new unit, appropriately named the Data Sidekick, is a "direct FM, bipolar, FSK data SCA unit" that actually has an RS-232 input rather than audio inputs. This unit reconstructs the parallel data before converting it to serial format.

The unit will operate asynchronously or synchronously.

Call Eric Small at Modulation Sciences for more product detail and price information.

### Symetrix voice processor

Symetrix debuted its new model 528 voice processor at this year's show.

The input is a good-quality microphone preamp with 48 V phantom power available. Following this is a switchable frequency-selective de-esser and gated compressor with selectable compression ratios and gate threshold.

All of this is followed by a three-band

**(continued on page 14)**

## Sound thinking!

Encore Series™

# P100 PHONO PREAMPS

Everything you really need for superb sound.

\$239 Stereo

- +18 dBm Balanced outputs
- Adjustable R and C cart loading
- Active Subsonic Warp Filter
- ±.5db to old or new RIAA curve
- 90db Signal to noise ratio

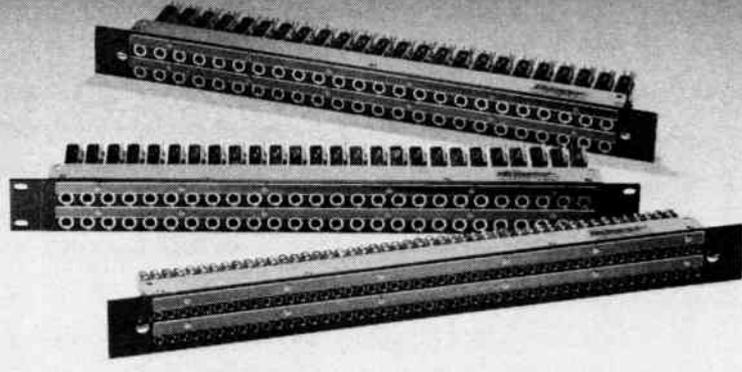
- 750 mVp.p. Input Headroom
- 13V/u Sec Slew Rate
- 10% THD, 20 to 20,000 Hz.
- Triple RF protection
- Socketed IC's, AB pots



Free Detailed Brochure Available

**AUDIO TECHNOLOGIES INCORPORATED** 328 Maple Avenue, Horsham, PA 19044 • (215) 443-0330

# JACKS BE QUICK.



## READY TO SHIP IN 24 HOURS.

MAXI panels with 2 rows of 24 or 26 long frame (1/4") jacks per row. MINI panels with 2 rows of 48 or 52 MINI jacks per row. All featuring Audio Accessories' premium Audio-Line™ jacks. Standard pre-wired MAXI panels are also in stock.

We carry a large assortment of jacks, patch cords, and accessories. And custom panels can usually be delivered within a couple of weeks of your order. Call for more information. 603/446-3335.



**audio accessories**  
**audio-line**

AUDIO ACCESSORIES, INC., MILL ST., MARLOW, NH 03456

## NAB Convention Report

# Test Gear Meets Any Budget

by Barry Mishkind

Dallas TX ... The NAB show brought out the usual horde of engineering types to gape at the various test instruments offered to help keep our stations operating at their peak. So, before Management brings us back to reality with the eternal, "Sorry, no money in the budget," let's reflect on the aids available that might make our lives easier.

Stereo is rapidly becoming as important for AM and TV stations as for FM. RAM Broadcast Services and B & B Systems have recognized the need for high quality stereoscopes to see the signal clearly. Ranging from \$700 to \$3,000, they offer various diagnostic features.

The RAM Broadcast Phasescope has a calibrated graticule for accurate, direct readout of signal levels and, with a chart, phase error. B & B Systems' units offer VU indication, peak reading LEDs and a CRT display of the signal.

There was also a wide range of audio

Barry Mishkind, aka RW's "Eclectic Engineer," is a station consultant in Tucson, where he is building "yet another" radio station. He can be reached at 602-296-3797.

generators and analyzers on display. It was good to see a greater emphasis by some manufacturers on units that can feed and measure both channels at the same time, including phase and level comparisons.

Newly featured this year were programs by several manufacturers to interface a PC to the test gear, providing custom, field-written, automatic test sequences.

Sound Technology displayed a program that interfaces the Model 1510 to a PC, and also showed the new Series 3000 test system.

Audio Precision also had a PC-based system, and the venerable Potomac Instruments showed the AT-51, a system that continues to fit the needs of many stations.

Have you got a problem in interfacing the parts of your chain? There were several firms offering ways of getting in and out of semi-pro and professional equipment without mismatches and hums/buzzes/etc.

The Sescom booth, for instance, featured many of its 40 low-cost interface boxes to get the job done.

While we are in the studio, Wireworks showed its \$99 TE-3 cable tester, a unit

that quickly checks for continuity, phase integrity and shorted leads.

Tentel introduced a tape tension meter for tape cartridges. It's a nice way to weed out tight carts before they fail. Barrett Associates had a unit for \$700 that checks for phase errors in tape systems.

Both engineers and program directors will find the Potomac Instruments QA-100 "Quantaural" audio analyzer very useful. This unit can take audio from any source, including receivers, and can provide several displays of the audio to indicate modulation density, tonal balance, preemphasis, stereo image width and more. At \$3,500, it's not on everyone's budget, but there are few, if any, tools that can immediately compare two stations' audio better than this one.

Whenever I get delusions of grandeur, I think of ordering a spectrum analyzer. After the GM stops laughing, I return to

the more moderate standby, the trusty oscilloscope.

Leader Instruments has come up with a dandy unit if you have to move your unit around a lot. The LBO-325 weighs only 9 lbs. and yet is a full, two-channel/four-trace instrument. Both that and the LBO-516 seem to be good, reliable, modestly priced units.

Finally, there is one type of test instrument that few of us have ever used, or even thought about, that is now becoming important: the RF radiation test set.

Holiday Industries' new HI-5000-SX Exposure Measurement System is very useful to find whether or not your station meets all the myriad of federal, state and local laws that are starting to bug us. Available for sale or rental, this unit can make the measurements, store them, and later dump them out to hard copy.

Now, how can I get the GM to let me buy one of each? When I figure that one out, I'll get back to you.

Better yet, if you figure it out, let me know!

## 'Buzz Saw' Processing

(continued from page 13)

parametric equalizer to tailor the sound for your particular application.

Indicators include one for output level, a clipping indicator that indicates clipping anywhere in the unit and gain reduction metering.

Most of these features can be bypassed with a switch if, for example, you don't wish to use equalization or de-essing. The mic preamp can even be bypassed for line level use.

The unit will list for \$629 for standard output and \$699 for transformer output. The 528 will be available in the third or fourth quarter of this year. Contact Dane Butcher at Symetrix for details.

CRL, dbx, EMT, Titus

CRL has been busy with its FMX generator this year, so the only product change I saw was in its SEP-800 four-band processor. This went from two monaural units to a new, one-rack-space stereo unit. The unit now lists at \$2,250.

Dbx introduced a new compressor/limiter with noise gate and de-essing circuitry. This unit, model 263X, is a new,

lower-cost alternative to the company's other processing devices.

I also talked to Peter Engel of Gotham Audio, which distributes EMT products.

EMT, a West German company, showed a new AM broadcast limiter, the EMT 277. The device uses a program delay system to react quickly to peak control. Compression/expansion are also used.

An optional preemphasis card is available. The unit is configured as a card cage, so card options are easy to install.

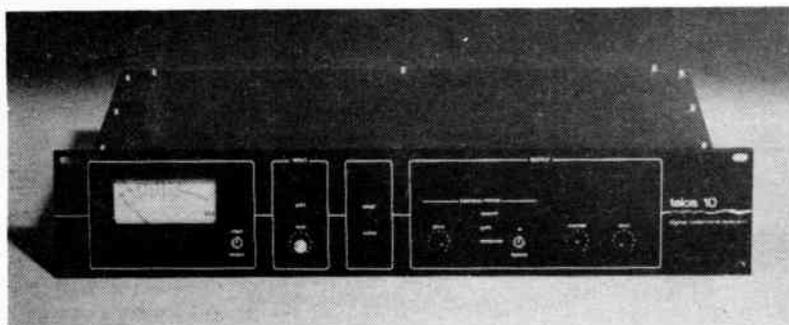
A new company showing its processing device was Titus Technological Laboratories.

Its new "The Last Word" is a post-processing device. It lets you know everything wrong with the processing you've already done—sort of an audio processing big brother. This unit is being distributed by Allied.

Overall, it's nice to see a trend toward quality-conscious processing versus "buzz saw" processing. I think many managers and engineers are realizing that quality is every bit as important as quantity in audio processing.

## TELOS 10

### The Major Market Telephone Hybrid



Networks and stations in New York, Los Angeles, Chicago, Detroit, Washington DC, Philadelphia, Atlanta, Denver, and other Major Markets now have the state-of-the-art in telephone interconnection. They chose the Telos 10 for its superior hybrid performance, full duplex capability, and simplicity of operation. Above all, they know—ITS THE BEST!

**BRADLEY  
BROADCAST  
SALES**

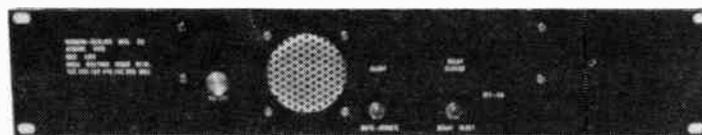


Find out for yourself—  
Call:

**TOLL-FREE  
800-732-7665**

## WEATHER RADIO

### Model CRW



**Price \$475.00**

Sensitivity .28 microvolts for 12 dB quieting. All 3 frequencies. Alert tone demutes receiver, closes relay and gates audio to 600 ohm rear terminals. Another set of rear terminals has continuous 600 ohm audio output. Double conversion crystal controlled, crystal filter in first I.F., ceramic filter in second I.F. Dual gate MOS FET front end. 50 ohm coaxial input. Adjacent channel (j25 kHz) down 70 dB. 19" rack mount, 3 1/2" H, all metal enclosure. In stock—available for immediate delivery.

**GORMAN REDLICH MFG. CO.**  
6 Curtis St • Athens OH 45701 • 614-593-3150

NAB Convention Report

# Telco Gear Features Versatility

by Frank Foti

Dallas TX ... "Versatility." That would be the best way to describe the different telephone interfacing and coupling devices that were shown at the NAB Convention April 13-16 in Dallas. Despite the many different and multi-faceted applications required in using the telephone or telephone line, there was equipment shown that should perform the job.

Normex, a company located in Montreal, Canada, introduced the Telnox L-O, a complete telephone system designed specifically for broadcast use.

This system is like a normal PBX telephone system except that it performs the phone interfacing in the phone switch. This makes conference calling much easier. It also will provide the ability to conference all 10 lines, if needed.

There are many other attractive features that are included within the system: it can handle calls on a priority basis, so that calls are answered by priority in the order that they reached the switch; Auto Hold automatically answers calls and places them on hold (an optional vocal card can answer the call and place a custom message to the call before putting the call on hold); and Program On Hold (same as music on hold).

The system is configured to handle up to 10 lines from the local telco central office. The switch will accept up to eight telephone control units.

These control units can be custom

Frank Foti is CE of WHTZ (Z-100), New York and a frequent RW contributor. He can be reached at 201-867-5000.

user-programmed so that they can perform different duties for different needs.

The control units can be remotely located, so that remote operation can be performed while doing remote broadcasts from a local or distant location.

This system has been operating at least a year in Canada, and the company has installations in Detroit and Nashville as well.

Further information is available by contacting Agnes Eder at 514-744-1785.

### TC-100 coupler/hybrid

Gentner Engineering Company has been busy with some new products as well, as with another yet to be introduced. In an area where there is a need for a versatile coupler/phone interface, it has created the TC-100 coupler/hybrid. The use of a hybrid along with a coupler can provide the ability to play back audio to a caller while being able to record audio from the caller. One of the features that the TC-100 will provide includes automatic, one-way recording of caller audio.

The TC-100 can auto-answer a phone line and put a tape or cart machine into record.

Another application allows a caller to receive a prerecorded message from the station and then leave a message, much like an answering unit would do.

With the addition of an optional touchtone decoder card, the TC-100 will allow a caller the ability to select remote audio. By using the touchtone pad on the phone, the caller could select different audio feeds to listen to.

The unit can be used as a basic hybrid

telephone interface for direct on-the-air broadcasts.

In the area of frequency extension, Gentner introduced the EFT-900. This is a lower-cost, single-line frequency extender that has the added feature of being a duplex system.

The EFT-900 can provide two-way frequency extended audio from a remote location to the station, and from the station to the remote location. Thus, the same type of unit is used for both transmitting and receiving the extended signal.

The use of Aphex processing serves to enhance the high frequency content.

### Gentner Teleprocessor

Concerning telephone audio, Gentner also debuted its new Teleprocessor. This is an audio processor that will enhance telephone audio received from a coupler, hybrid interface or frequency extender.

The unit call-conditions in two directions. It performs AGC on send-audio to

the caller or to a remote location, and provides equalization, along with adjustable Aphex processing, on received audio.

Listening with telephone audio received through a single-line frequency extender and routed from a remote location, I felt the device provided very good, quality audio.

The Teleprocessor proves that frequency extension is another good alternative to expensive equalized radio links.

In the area of "soon to be released," Gentner is working on the DPH-5, which will be a digital signal-processed telephone hybrid interface. For more information, contact Russel Gentner at 801-268-1117.

### Comrex STLX

Comrex keeps moving forward in adapting frequency extension for broadcast. Its STLX is a self-contained remote *(continued on page 16)*

## SPENCER BROADCAST

"YOUR SOURCE FOR BROADCAST EQUIPMENT"

\*\*\*\*\*NAB "86" SPECIAL\*\*\*\*\*





**BROADCAST CONSOLES**  
with a pair of 4406 Speakers

**Priced from \$2495**

**1-800-221-6941**  
(602-242-2211)

SPECIAL

# HUNDREDS\$ & HUNDREDS\$ LESS!



## KEY-CART...THE NEW LOW COST PERFORMERS.

- Low profile—front loading
- Modular, plug-in electronics
- Full remote control
- Play and record LED metering
- Toroidal power transformer
- Excellent audio specifications

Model KC1000-MP mono play	<b>\$595.00</b>
Model KC1000-MRP mono record/play	<b>\$795.00</b>
Model KC1000-SP stereo play	<b>\$795.00</b>
Model KC1000-SRP stereo record/play	<b>\$1,095.00</b>

Contact Your Favorite Distributor or Call:

**RADIO SYSTEMS INC.**  
5113 W. Chester Pike, Edgemont, PA 19028 • 215/356-4700  
Call 800/523-2133 (in PA call 800/423-2133)

## NAB Convention Report

# Telco Gear Features Versatility

(continued from page 15)

mixing console that provides two-line frequency extension.

The mixing console is flexible enough to provide a variety of monitoring selections for talent, engineer and producer/director.

The microphone inputs have selectable AGC circuits, with mic/line inputs and headphone outputs provided.

The same remote mixing console can be purchased as a single frequency extender, known as the SLX unit.

For those on a budget or looking for cost-effectiveness, Comrex introduced the LX-T and LX-R, which are lower-cost, single-line frequency extenders. The LX-T is the transmit unit and the LX-R is the receive unit.

For stations already having a PABX telephone system installed and needing the ability to broadcast interface into it, Comrex introduced the Diverta Coupler.

The coupler is inserted between each trunk line and the trunk input to the PABX system. The coupler will either route telephone audio to the station audio console for "air" usage, or route the telephone line to the PABX for normal business use.

One coupler is needed for each trunk line that would be needed for broadcast application.

Control of the broadcast side of the coupler can be done with a control panel manufactured by Comrex. The coupler also provides enough status information so that computer controlled management of the telephone system can be used.

For more information, contact Lynn Distler at 800-237-1776.

### Symetrix

Symetrix remains in the telephone interface field with the 108 interface system. This is a unit that is wired to 1A2 equipment to provide versatile control of telephone applications.

With use of a control unit, eight lines can be routed to air or audition use. Calls can be grouped for conferencing or auditioning use as well.

With the use of an additional control unit, a producer/director in a call-in show situation could preview or select calls simultaneously with the airing of calls by the talent/host.

The control unit groups calls together and switches between three hybrid units so that conferencing is made easy and provides the best audio results.

The control unit also provides a profanity button that will remotely control a profanity delay system.

Other manufacturers introduced equipment that is telephone oriented.

### HEIE Commander

HEIE Engineering has brought out its new Commander audio console. This could possibly be the most versatile broadcast console yet to reach the broadcaster.

The console provides a module that will interface to two telephone hybrids. The output of this module can then be connected to any designated input on the board.

By operating the control of either the line input module on the board or the control from the hybrid module, caller routing is made both easy and flexible.

The following features are standard

equipment and not additional options: programmable auto sequencing of sources between any of the modules, no matter what the module sequence is; tele-hybrid interface for the use of two telephone interfaces; equalized 30 W equivalent headphone amplifier; micro-processor-based time-of-day clock; stop watch and thermometer; tape/cart/turntable remote controls; and capability of handling logic and both momentary switched or continuously switched control functions for remote control.

If it is an older Ampex reel machine or a newer ITC cart machine, no special remote control interface is needed. Switchable audio ducking off the mic channel is also included. In addition, all audio sections are balanced and lightning protected.

That is all standard equipment, along with gold-plated contacts on connectors, VCA operation of all level controls, (monitor sections, too), opto-isolated control interfacing and Lexan top panels to resist heat and chemical damage.

Electronic specifications are kept to a premium, while pricing is surprisingly very competitive with major console manufacturers on the market.

I would recommend this to be a look-see for any station considering console replacement or construction. For more information, contact Bill Shute at 904-629-7000.

### Telos Echo

Last year an interesting digital signal processed telephone interface was introduced by Telos Systems.

This year, Telos has introduced a dig-

ital audio storage device that would replace the use of a cart machine for audio messages.

The Echo will provide four minutes of 3 kHz audio bandwidth for the purpose of storing an audio message that may be used for contest, concert or station information.

The unit operates like a normal cassette machine except that digital storage is used instead of audio tape.

The unit provides mic or line inputs and has an AGC section for correct level during the record mode.

Audio level and elapsed time are shown on the front panel, along with a call counting indication.

An internal monitor amplifier and speaker provide for auditioning messages.

The unit presently will operate on one telephone line, but later this year an option will be introduced that will allow four lines to be tied into the unit for usage. With this option, any of the four lines when answered will hear the message complete from beginning to end.

The unit is fully remote controllable.

For more information, contact Art Reed at 800-732-7665.

### DSI Communications

DSI Communications showed the CC-101, a solid-state, microprocessor-controlled automatic answering device to be used for call-in or contest situations.

The unit can be programmed by the use of a front panel thumbwheel switch to select the desired number caller for a contest winner. The unit will answer the calls up to the desired number caller with an announcement that tells the caller what number they were (example: "Z-100, you're caller number 62.>").

The unit will then route the winning caller to an output port that can then be routed to a phone or hybrid for broadcast use.

After the contest, the CC-101 will then answer the phone and tell callers "thank you, we have a winner." These announcements can be customized with an option on the unit.

There is also a front panel indication that will show the number of calls received, as well as a printer port so that calls can be logged and contest winner and call-in patterns can be monitored over a period of time.

The unit will accept up to 10 lines, but additional lines can be accepted with the addition of another unit.

The device will be available shortly. More information can be had by contacting Fred D'Alessandro at 201-746-9307.

One interesting tip that I picked up at the Comrex booth—they were showing how well the frequency extension systems work over cellular telephones. This is, again, another creative alternative that can aid the broadcaster in remote situations or during feeding of news actualities, and is a good idea to think about.

As one can see, the broad range of needs in the telephone interfacing and/or coupling areas has brought the broadcaster a vast array of equipment that should be able to fulfill those needs.

## ANALOG METERING WENT OUT WITH SLIDE RULE HOLSTERS.

If you've decided to go digital this year, why not do it now? You'll not only save money, you'll prevent all the hassles brought on by misreading your existing analog remote controls.

Hallikainen and Friends' TEL Digital Telmetry with programmable decimal points will provide you with the add-on accuracy you're looking for. It's simple to install, monitor and calibrate. And, it's available *now*.



pictured: TEL 171 for the Moseley TRC-15A \$800  
TEL 172 for the Moseley PBR-30A \$920

### Hallikainen & Friends

141 SUBURBAN ROAD SAN LUIS OBISPO  
CALIFORNIA 93401 805/541-0200

## NAB Convention Report

# Good Sound Needs Good Gear

by Tyree Ford

Dallas TX ... Over the last few years, the call for sharper audio production has grown louder and louder.

Stations that have accepted the responsibility for better production have the most to gain.

There were several "must see" devices this year in Dallas. Though not necessarily new, each of these items serves as a valuable production tool, and leads to higher quality sound.

At the top of the list, and way out of most budgets, were The Droid Works' SoundDroid and Spotter. In demonstrations, both were impressive.

The SoundDroid is a digital console, recorder, on-board effects unit and total automation system. The software-run console handles EQ, filters, faders, panning, mixing, metering, limiting, Doppler-shift, string synth, fly-bys and routing. All of it—every bit—is stored in automation.

In its most basic configuration, the SoundDroid is capable of retrieving, processing and storing 8 to 16 channels of sound in real time.

Input and output may be digital or analog. Since all of the work is done in the digital domain, there is no generation loss.

Sound may be retrieved or recued almost instantly. You can slip-sync, edit, re-edit, cut, adjust and move at will, previewing in real-time without cutting one piece of tape.

The SoundDroid console has a touch sensitive screen, eight motorized faders and a collection of "soft" buttons and knobs that control everything.

One magnetic disc holds two hours of mono or up to 15 minutes of eight-track audio.

### The Spotter

The Spotter is a separate storage device for all of your soundtracks and sound effects. The basic Spotter system includes a central computer, an optical disk recorder/player and a user station (up to nine stations may be used) with a display, keyboard, and amplifier and speakers for auditioning.

The sample rate of both the SoundDroid and the Spotter is 48 kHz. The SoundDroid is also capable of 32 kHz, 44.1 kHz, or up to 60 kHz sampling.

The Spotter's data is stored in 16-bit form, while the SoundDroid stores in 24-bit, with 16 bit optional. Summing busses use a 56-bit accumulation register.

Maintenance contracts include preventive maintenance, component swapping and continuous software upgrades. There are built-in diagnostic programs and modem for telephone trouble

*Ty Ford, a radio audio production consultant, works with stations on optimizing their production equipment and airstaff skills. He is also RW's new production columnist. Look for his byline in the 1 June issue.*

shooting.

The price for the SoundDroid alone starts at \$175,000. You can add on the Spotter for about another \$30,000.

Sure, it's a lot of money, but this system offers the ultimate in operational flexibility, and the console's built-in. I promise to do a story on the first radio

station on the block with one of these.

For more information, call The Droid Works at 818-505-0044.

### Fidelipac's CTR100

Now that you know where the cutting edge is, let's settle back into budget reality. Ask most people what the weakest

link in a station's production chain is and, after they tell you it's the person behind the mike, they'll tell you it's the cart machines.

Fidelipac, the the CTR100 series, has come up with some inventive solutions to several long-standing problems.

Their Cartscan system uses a variety of reflective foil strips that adhere to the side of each cart and activate up to four optical switches. One of these switches  
*(continued on page 18)*

## IN SEARCH OF EXCELLENCE.

Long before it was a popular management theory, broadcasters were searching for excellence. Excellence of Sound.

The search is still on, but the goal is now within the reach of every FM broadcaster.

The 695 is an exciter without equal ... in quality sound ... in versatility ... and in value. Any type of distortion you can name (THD, TIM, IMD) is less than .025 percent. This isn't an environmentally controlled lab figure, but rather one that is measurable over the operating temperature range of the equipment. Moreover, noise is so low that it's virtually impossible to measure.

QEI's 695 offers features that the competition has never even dreamed of. A peak counter with LED display, modulation measurements on the front panel, and a measurements grade linear demod built in. It is synthesized, has wideband circuitry, a 3-color LED bar graph for modulation display, a 10-position meter, and many other features that are best described in our new brochure.

For more information on QEI and the 695 Exciter just write or call us. You'll see why our search for excellence has produced the best value on the market today.

## QEI Corporation

One Airport Drive □ P.O. Box D  
Williamstown, NJ 08094 □ (609) 728-2020



## NAB Convention Report

# Good Sound Needs Good Gear

(continued from page 17)

allows the use of two different tape formulas on the same machine with no level changes.

Incidentally, Fidelipac plans to have a 400 nWb/m tape available shortly.

The Cartscan mono function automatically switches a stereo or mono source to the left track of its stereo recorder while recording, and splits the left track back to right and left for playback. This reduces phase error, and eliminates the need for a mono recorder in the production room.

The Cartscan matrix function uses an on-board encoder/decoder to put a L+R on the left channel and a L-R on the right channel. This system reduces phase error, and is mono compatible, but cannot be reproduced on other stereo cart machines.

Fidelipac suggests the matrix be used in stereo TV applications, where a phase-stable mono signal is demanded.

The fourth Cartscan function triggers a collector-to-ground output at the remote plug, and can activate noise reduction gear, tally lights, or even a variable speed mode for music carts. Pitch control, via external oscillator, activated by this fourth function switch, can also be

useful in production.

The 9.6 kHz reference frequency may also be useful in syncing the CTR100 to SMPTE devices using the same frequency.

The CTR124 with stereo record/play lists at \$3,465. The CTR112 stereo play lists for \$2,060. Mono units are available for less. For more information call Fidelipac at 800-HOT-TAPE.

### VCA fader debate

There were over 24 different console manufacturers, each with at least two or three consoles in their line. Two groups emerged: one in favor of VCA faders, one against.

The pro-VCA group was as sure about keeping audio as isolated as possible as the con-VCA group was that the extra circuitry for VCA posed an equal number of its own problems.

At the beginning of each console demonstration, everyone said, "This is a very straightforward design, and is very simple to use."

This was not the case. As more and more of the recording studio technology filters down into broadcast, two things will have to happen.

First, the operators must be made

more comfortable with more complicated signal flow.

Second, operators must learn how complicated signal flow can help their creative production. To be accepted by the average airperson, the consoles must be less intimidating and more friendly.

Until these provisions are met, the high-tech console market will remain sluggish in broadcast.

Consoles I admired included the SSL SL5000. It's a bit pricey at \$70,000, but that's the price you pay for flexibility. SSL wisely offers ongoing training sessions so you can learn how to run this beast.

If cost is no object, and you have at least an associate degree in EE, you could almost justify its use in radio.

However, even with the most demanding radio use, you would probably never use more than half of its capability. Operationally, it is in the domain of the specialist.

Find one and let them take you for a spin. The New York office number is 212-315-1111; in LA, 213-463-4444.

The Wheatstone SP-5 production console and the Ward-Beck both came in at about \$10,000 for eight-channel stereo models. The Wheatstone THD+N figures of 0.003% line, and 0.005% mic were impressive.

Both consoles can be ordered in many configurations. Check with the parent companies—Wheatstone at 203-393-0887, and Ward-Beck at 416-438-6550—for more information.

### Air consoles, mics

The most simple-to-operate air consoles were: the Electronic System Lab SBM series (11 inputs for \$5,000, expandable to 16, 305-791-1501); the new Tape-caster Stationmaster 1000 series (12 channels/36 inputs for \$8,000) designed and

built by Auditronics (800-638-0977); and the Broadcast Audio System 12 (8 channels expandable to 12, 3 inputs per channel \$9,950, 916-635-1048).

Certainly there were many other consoles of merit. These caught my eye because of ease of operation.

There were a few new mics designed for broadcast use. In an upcoming issue, we'll make a side-by-side comparison of some old favorites and the new contenders.

### Reel-to-reel gear

Top-flight reel-to-reel tape recorders included the AEG M21 series. It boasts a microprocessor-controlled transport, with user-programmable speed, EQ and logic;  $\pm 10\%$  varispeed in play; spot erase capability and amorphous metal heads with a seven-year guarantee. For more information, contact AEG at 201-722-9800.

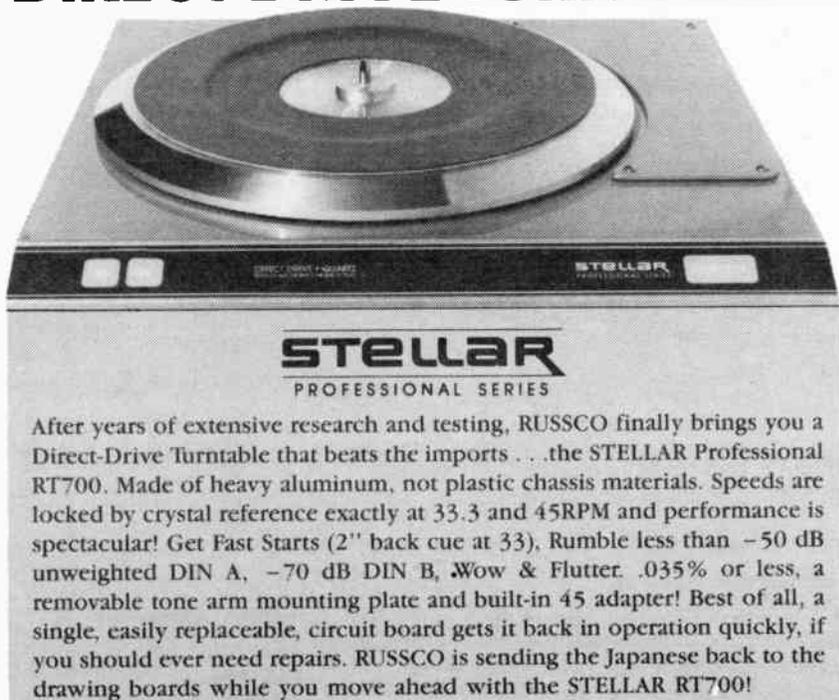
Despite the strange head assembly, I found myself very comfortable with the Sony APR-5000 series. It, too, is microprocessor controlled. You can encode the headstacks so that the circuitry is automatically adjusted when you switch to a preadjusted head.

Highlights in this line include: varispeed by  $\pm 50\%$ ; easily accessible, digitally controlled electronics; optional center track SMPTE; parallel and series ports; and ease of operation. In stereo with SMPTE center track, the APR-5003 costs \$9,500. Without SMPTE, the APR-5002 is \$7,500. Call Sony for details at 213-537-4300.

As I said before, there were many fine pieces on the exhibit floor. If I wrote about everything I saw, I'd still be writing by next year's convention.

If your company markets production related equipment, I would appreciate it if you would contact me with any upgrades or breakthroughs. The home office number is 301-889-6201. The address is TSF, 3804 Ednor Rd., Baltimore MD 21218.

## NOW THE U.S.A. MAKES A BETTER DIRECT-DRIVE TURNTABLE!



After years of extensive research and testing, RUSSCO finally brings you a Direct-Drive Turntable that beats the imports... the STELLAR Professional RT700. Made of heavy aluminum, not plastic chassis materials. Speeds are locked by crystal reference exactly at 33.3 and 45RPM and performance is spectacular! Get Fast Starts (2" back cue at 33), Rumble less than -50 dB unweighted DIN A, -70 dB DIN B, Wow & Flutter .035% or less, a removable tone arm mounting plate and built-in 45 adapter! Best of all, a single, easily replaceable, circuit board gets it back in operation quickly, if you should ever need repairs. RUSSCO is sending the Japanese back to the drawing boards while you move ahead with the STELLAR RT700!

Call or write today for the low introductory price.



5690 East Shields Avenue / Fresno, CA 93727 / Phone (209) 291-5591

Circle Reader Service 38 on Page 29

## AKG Acoustics Buys Ursa Major Assets

by Edward Wytkind

Stamford CT... Austrian audio equipment manufacturer AKG Acoustics has acquired the assets of Boston-based Ursa Major for an undisclosed sum, AKG officials announced in April.

Ursa Major's staff will head a new AKG digital products subsidiary (division), to be based in Boston, which will be in charge of product research and development, AKG VP S. Richard Ravich said.

Management and staff of Ursa Major, manufacturer of digital audio gear, was retained due to Ursa Major's expertise in research and development, Ravich explained.

Former Ursa Major President Chris Moore was named executive VP for the new Boston-based AKG digital products

division.

AKG, which manufactures microphones, headphones, reverb and delay systems, phono cartridges and other audio-related products, will base its US sales, marketing, export and administration from its Stamford, CT headquarters, officials said. The company already operates a research and development division at its international headquarters in Vienna, Austria.

Establishment of the new US subsidiary will enable AKG to better respond to the demands of the US market without being affected by international monetary fluctuations, officials added.

Ravich maintained that this acquisition "will enhance AKG's position in the world digital-acoustical market."

For more information, contact S. Richard Ravich at AKG: 203-348-2121.

# NAB Convention Report

## Tape/Cart/Reel/CD Areas Grow

by Hank Landsberg

Dallas TX . . . Many new tape, cart and reel-to-reel recorders were debuted at this year's NAB show. In addition, new developments in CD players were introduced into the equipment repertoire.

Digital Broadcast Controls introduced its new "Astre" digital storage system.

Astre stores digital audio using 380 megabyte hard discs. It is intended primarily for storage of short events.

Up to 80 minutes of 15 kHz mono audio (or 40 minutes of stereo) can be stored on each disc drive.

Radio Systems introduced the Key-Cart series of cartridge recorders and players.

*Hank Landsberg is director of Engineering for Drake Chenault, and owner of Henry Engineering. He can be reached at 818-355-3656.*

The line is based on a low-cost transport which utilizes a belt-driven capstan. The Key-Cart is lightweight, compact, available in stereo or mono, and as record-play or playback-only. The exceptional low cost (\$1,100 for a stereo record-play) will make the Key Cart line very popular.

The Key-Cart is in stock. Compusonics introduced the DSP 1500, a digital audio "cart" machine that uses 5¼" floppy discs as the recording medium.

Up to four minutes of stereo digital audio with at least a 15 kHz bandwidth can be recorded on each floppy disc.

The DSP 1500 can record up to three "cue tones" for end-of-message signaling, starting other machines, etc.

An LCD window displays the title of the disc, running time and other parameters.

The machine uses a 322 and parallel control port, and can interface with most

personal computers.

The stereo recorder costs \$2,995; the play-only deck is \$2,595. Deliveries will begin in May.

Bradley Broadcast Supply introduced the Telos all-solid-state digital audio storage system, a unit intended for storage of voice messages for playback into phone lines or similar applications.

The unit occupies 3½" of racks space, and can store up to 4 minutes of mono audio with 5 kHz bandwidth.

An auto-answer feature plays messages automatically. An LED displays the number of answered calls.

The unit will be available in May for \$1,595.

Bradley also showed the Uher 4000 Series Report Monitor portable reel-to-reel recorders. The units use up to 5" reels and operate at four tape speeds, from 7½ ips down to 15/16 ips. Stereo or mono versions are available at a price range of about \$1,500.

Barrett Associates showed the new Tascam model 42B reel-to-reel recorder, which has the added feature of "Self-Sync," a means of synchronizing the machine with outboard equipment.

The 42B also features a digital tape timer, and return-to-zero and return-to-cuepoint functions.

Nakamichi showed the new MR-2, a two-head, premium-quality cassette recorder. The unit includes Dolby B and C, adjustable bias tuning and automatic dual-speed audio fading. The unit is now available at a cost of \$499.

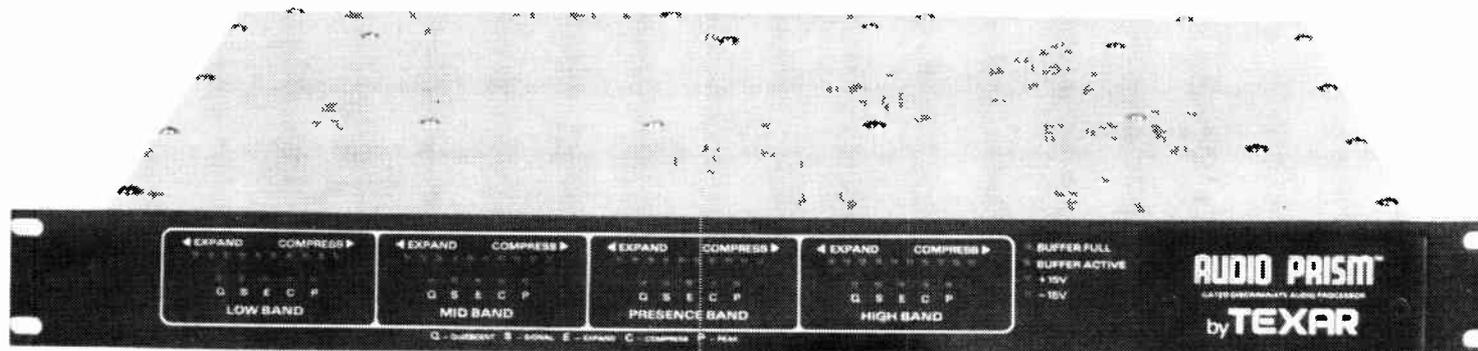
Inovonics debuted its "XTRA" tri-band audio processing system, which also includes an FMX stereo generator.

The generator section uses digitally synthesized SCA and pilot generation.

Allied Broadcast Equipment debuted Sono-Mag Corporation's (SMC) "CD Jukebox," a multi-CD playback unit. Over 2,500 units have been in actual jukebox use in Japan for two years. The unit is not a consumer product.

The system can store 200 CDs, retrieve any disc and cue to any cut. It auto-  
*(continued on page 26)*

# PLAYING 'TAG' FOOTBALL IS FINE, EXCEPT WHEN...



You find that your competition is starting to play rough. Then you need to fight back . . . get 'rougher' . . . be smarter . . . WIN the game!

Radio stations play much the same way: Perhaps your station and the competition both run bare Optimod's.\* Then all of a sudden one morning you tune to the 'other guy' and he's rushing, tackling, and running away with the hot spot on the FM dial! You retaliate . . . twisting and cranking on every conceivable knob on your Optimod, but to no avail, the competition just stopped playing 'tag' . . . and now YOU'RE IT!

Fighting back and WINNING is easy . . . if you have the tools to do the job. Enter TEXAR

and the digitally controlled AUDIO PRISM™ processing system. There's no better way to SUPERCHARGE your Optimod! In fact, TEXAR wrote the book on touchdown passing Optimods to the goal line. Over 500 PRISMS around the world prove that! From the smallest market in the country to the biggest, boldest radio market in the free world . . . New York City. (By the way, TEXAR PRISMS are the choice of the top 3 New York FM's\*\*), TEXAR leads the way to increased ratings and better signal penetration in every market we're in.

Sound a little like we're bragging . . . blowing our own horn so to speak? Darn right! We've worked real hard to make an unbeatable line of Audio Processing equipment for AM and

FM and the results speak LOUD and PROUD for our efforts.

It started years ago, when we sat back and watched the competition and saw state-of-the-art slowing to a crawl. TEXAR huddled and the play was called . . . DIGITAL CONTROL was pioneered and implemented in the TEXAR AUDIO PRISM. The results, simply stated, we're AMAZING. Since that time more and more radio stations are effectively playing against the competition and WINNING!

So, you have but two choices: Wait till someone yells 'TAG, you're it!' and then get serious . . . or do the yelling yourself!

Call TEXAR today, ask for Barry Honel or Glen Clark. We'll take the ball from there!

# TEXAR

616 Beatty Road, Monroeville, PA 15146-1502

(412) 856-4276

(412) 85-MICRO

\* Optimod 8000 and Optimod 8100 are registered trademarks of ORBAN ASSOCIATES INC., San Francisco, California.

\*\* Summer and Fall 1985 Arbitration Ratings, Total Persons 12+ Share, Mon-Sun, 6A-12M. (Used with permission.)

## NAB Convention Report

# Updated RF, STL Area

by Tom McGinley

Dallas TX . . . Despite the frustrations of transportation problems, co-mingled radio and TV exhibits, and the lack of exciting night life, the 1986 Dallas NAB show was by all accounts an overwhelming success.

Jesse Maxenchs of TFT echoed the sen-

timents of many of the exhibitors by proclaiming this show as "the best NAB we've seen in six years." Perhaps the absence of gambling and nightlife diversions (of Las Vegas) is more conducive to concentrating one's time and energy on the business of the convention itself.

The hottest new products and technol-

ogies shown in the area of RF and transmission systems included: new power levels and improved FM transmitter designs; narrowband STL systems; RFR-optimized FM antennas and miscellaneous new products.

Three transmitter manufacturers—Harris, Continental and BE—each intro-

duced a 35 kW FM model this year.

Research has indicated that a good number of stations need between 30 and 35 kW to develop 100 kW for full class C power with 6-bay CP antennas.

More stations appear to be moving away from larger antennas (those with more than 6 bays) in favor of higher transmitter power and smaller antennas to solve multipath and coverage problems. Until now, 35 kW was only available by combining two 20 kW units.

### Harris "Power Star"

The Harris FM-35K "Power Star" features a redesigned, 80% efficient PA stage, using the new Eimac 4CX-20000D.

The PA cavity, adapted from Harris' VHF TV transmitters, simplifies tube replacement; one merely has to pull the tube out of the socket. It is no longer necessary to disconnect or remove anything from the anode.

The 4CX-20000D was developed to fit this cavity, and the Harris specifications are 80% efficiency from 14 through 35 kW. This new tube has a smaller anode and lower inter-electrode capacity than does the 4CX-20000A, so the two are not interchangeable.

The FM-35K incorporates automatic VSWR power foldback to protect the transmitter during icing conditions.

It uses broadband solid-state RF preamp and driver stages with 50 ohm input/output impedances. The "FlexPatch" capability allows the engineer to jumper around defective stages while remaining on the air at some power level.

The "ColorStat" front panel signal flow diagram immediately identifies the problem stage with the appropriate red and green LED status lights.

The exclusive "StatusPlus," a micro-processor-based controller with memory, records and stores the exact date and time of a breakdown or overload to aid in troubleshooting and repair.

All of these improvements and refinements should make the transmitter very easy to operate, maintain and repair.

Unfortunately, Harris does not plan to incorporate these impressive new diagnostic features into its existing FM transmitter line very soon.

### BE's FM 10A, FM 35A

Broadcast Electronics introduced two new power levels to its family of FM transmitters at the show.

The FM-10A 10 kW unit uses the new Eimac 4CX-7500A PA tetrode and is available for 45- to 60-day delivery.

The new FM-35A 35 kW transmitter features the proven folded half-wave PA cavity, using an Eimac 4CX-20000C PA final.

This tube is electrically the same as the 4CX-20000A used in the FM-30, but with a slightly longer stem.

PA efficiency averages about 76% at midband. Output power is automatically folded back under increased VSWR.

All BE transmitters now incorporate a new, improved solid-state IPA design us-

**SENTINEL**

A Beacon pointing towards the future.  
 Unsurpassed reliability designed-in.  
 State-of-the-art, user-friendly controls and electronics engineered-in.  
 Ease-of-maintenance and dependability built-in.  
 Auditorionics 200 series on-air console lights the way to broadcasting's brave new world.

 auditorionics, inc.

3750 Old Getwell Road  
 Memphis, TN 38118  
 (901) 362-1350

Write or call for free brochure and technical information.

## NAB Convention Report

# as Mirrored at Show

ing power MOSFETs. The IPA modules are easily serviceable from pull-out access drawers.

All stages operate at 50 ohms and can be patched around to maintain operations at reduced power levels.

The transmitter's basic control functions are handled by CMOS IC logic. A microprocessor-based diagnostics and supervisory control is available as a \$3500 option for all of the new "A" model transmitters.

The MVDS (microprocessor video diagnostic system) diagnoses and reports in plain English via a video monitor inside the transmitter, the operational status and failure/overload conditions of the various subsystems throughout the transmitter. If desired, MVDS can be enabled to provide direct, ATS-like control via the basic transmitter control card.

The control and status/metering circuitry is so extensive that BE transmitters equipped with MVDS are virtually complete with a built-in remote control system. Geoff Mendenhall of BE feels that the next logical step will be to offer a complementary studio control unit. While the new BE line of transmitters incorporates some fairly sophisticated technology, the primary design criteria are still reliability and ease of maintenance.

Blower noise in the high power units has been substantially reduced with a half-speed motor which uses a new back-curved, high-efficiency impellor design.

### Continental's new 35 kW

The Continental Electronics model 816R-5 35 kW transmitter is the new high-power member of the 816R family, with power levels of 10, 20, 25, 27.5 and now 35 kW.

These rigs are all basically the same, except for the final PA and size of HV power supply.

All use SCR power control, continuously variable from almost zero up to full power. They also feature automatic VSWR power foldback and protection; automatic overload and power failure recycle; automatic RF power output control and filament voltage regulation.

The new 816R-5 uses an Eimac 9019 PA tube, a new power tetrode similar to the 4CX-20000 family, but specially developed by Eimac for Continental for use at 35 kW.

Continental has chosen to stick with its proven design of 4CX-250B drivers rather than going solid state, and chose IC control logic rather than a microprocessor-based control system.

Continental showed yet another new addition to their FM transmitter line. The model 814B offers 4.3 kW power output with the new Eimac 4CX-3500A tetrode. It uses a solid state driver stage and incorporates all of the control functions and features found in Continental's other transmitters.

This new power level runs on single-phase primary power and should be of interest to new 80-90 operations and existing class A stations using 2-bay or half-wave spaced antennas.

Several other transmitter manufacturers were showing all-solid-state FM transmitters at power levels up to 10 kW.

Larcan of Canada and Thomson-LGT of France both offer several different models from 1 kW to 10 kW, using 250 to 500 W

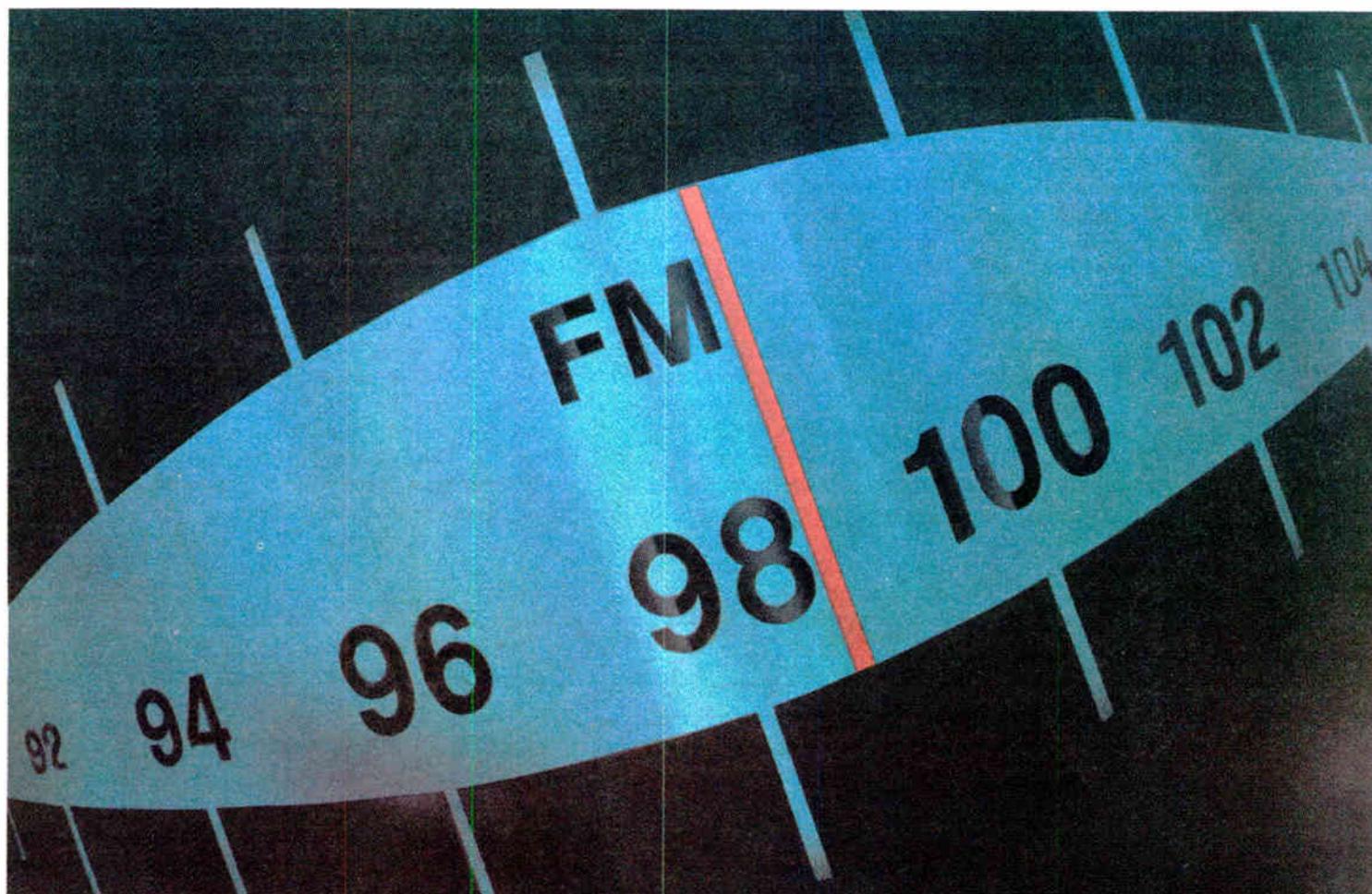
building-block modules combined to achieve the desired output. Both companies adapted the technology from their 25 and 30 kW all-solid-state TV transmitters.

The Thomson-LGT units feature very broadband design, with no tuning re-

quired, and use bipolar devices capable of 300 W each.

According to Greg Morton, sales engineer, over 1,000 of the Thomson-LGT FM transmitters have been sold worldwide.

*(continued on page 22)*



**CRL**  
**makes your sound**  
**stand out from the crowd**

You can't compete effectively for listeners if your station sounds just like everyone else's. And the way to stand out is with outstanding sound of the kind you get with CRL's outstanding FM-4 system.

CRL's FM-4 gives you the spectral shaping flexibility you need to sound different from other stations using the single unit processor. The CRL advantage comes from our intelligent building block approach. An approach that gives you the options you want.

Begin with our SPP 800 Stereo Preparation Processor and our SEP 800 Spectral Energy Processor for individually selectable four-band compression. Then add our SMP 800 Stereo Modulation Processor and our SG 800 Stereo Generator and you are equipped to stand out on the airwaves as never before.

If you haven't heard what CRL technology can do, you don't know what you're missing. For a 10-day free trial at your station just call CRL toll-free at (800) 535-7648 and we'll make immediate arrangements for your local CRL dealer to give you a demonstration.

Call CRL today for sound that stands out tomorrow.




**CRL Systems**  
 2522 W. Geneva Ave., Tempe, Arizona 85282  
 602-438-0888; Telex: 350464 CRL TMPE UD

# NAB Convention Report

## RF/STL Gear Shown

(continued from page 21)

They have not been competitive in the USA as yet because of the pricing structure. The 1 kW model runs about \$30K and the 10 kW lists about \$82K.

Elcom-Bauer introduced what is perhaps the most innovative use of space-age technology to be incorporated in FM transmitter design. The model 6100 1 kW unit utilizes a liquid coolant known as "fluorinert."

Developed by 3M, fluorinert is circulated by a magnetically driven pressure pump in a closed, direct-contact, vapor-tight system to provide a superior method of heat transfer for optimized cooling and operation. Elcom-Bauer will introduce 2.5 and 5 kW models using this technology later this summer.

Another interesting and useful product offered by Elcom-Bauer was "ET" (emergency transmitter).

Packaged in a rugged, portable case and weighing only 85 lbs., ET provides 300 W of broadband output at any FM frequency you want to select. All you do is plug in the AC cord, audio and an antenna. Paul Gregg, president of Elcom-Bauer, felt that ET was a great value at only \$8,350, adding that it can serve as a quick backup for any station operating

in a multistation facility.

CCA transmitters appeared at this year's show for the first time in several years.

Ron Baker of Broadcast Parts Company purchased what was left of CCA and is now building redesigned and updated versions of the entire AM and FM CCA line. Because of low overhead, Ron states that his firm is providing competitive and reliable transmitters at a very substantial savings.

### Narrowband STL systems

In response to the FCC's recent rule-making to subdivide or "stack" existing 950 MHz channels, STL manufacturers introduced new narrowband, spectrum-efficient STL systems.

The new bandwidth and spacing limits allow two stereo channels to operate within 500 kHz, where previously only one channel would fit.

Narrowband operation is achieved by merely turning down the deviation in the transmitter and replacing the IF filters in the receiver with ones having sharper bandpass characteristics. As a result, actual system SNR and high-frequency distortion performance can degrade slightly, but probably not noticeably.

Marti Electronic demonstrated a narrowband STL-10 discrete stereo system using a compact disc music source for A/B comparison. It was virtually impossible to tell whether it was CD alone or CD plus Marti.

Later this year, Moseley Associates will offer a narrowband version of its PCL-606C composite system with 300 kHz total bandwidth . . . just a bit wider than its current PCL-606 mono unit. Existing systems will be field convertible, with retrofit receiver modules available in the \$600 range. Hardware should be available in about six months.

Vince Mercendantti of Moseley stated that baseband performance of the narrowband version will still meet the current wideband specs. SCAs can be accommodated through 110 kHz, but 185 kHz will not be usable.

TFT introduced its model 8303 composite system, which is an updated version of the 8301.

The 8303 will feature front-panel-switchable bandwidth, with 500 kHz wide and 250 kHz narrow.

The 8301 can be retrofitted to 250 kHz in the narrow position as a factory modification at about \$500.

Jesse Maxenchs of TFT stated that the 8303 narrowband system will still support all subcarriers up through 190 kHz, and will meet all published specs of the former wideband version.

In addition to the 8303 system, TFT introduced a new STL series.

The model 8600 is a high-performance but economical STL which has been optimized for spectrum-efficient mono applications. It features a built-in 39 kHz SCA channel. Two 8600s can be used in a phase-matched discrete stereo installation.

Harris introduced the "MicroStar 23," a 23 GHz STL system designed for video relay but usable for radio STLs as well. With its 12 MHz of available bandwidth, broadcasters who have no options in the 950 MHz band can use MicroStar 23 with digitally transmitted audio to make STL hops up to about 10 miles.

Broadcast Audio Corp., an audio console manufacturer, has entered the STL field with the introduction of its model BA-10T/R aural STL system.

Designed as a narrowband mono unit, a dual discrete configuration can be used for stereo.

For now, the BA-10 is only supplied to the export market in the 110 to 500 MHz bands. As soon as FCC type acceptance is received (expected in about 6-7 months), 950 MHz versions will be available.

Other new STL-related equipment on display included heterodyned STL repeaters, shown by both TFT and Micro Controls. These units allow one to use an IF frequency through up conversion to a different output channel.

Marti's new STL booster amplifier, the model MW-500 STL booster, delivers 60 dB of power gain, or 1 W output with a 3 mV signal input on the same channel. The unit features a 12 V lead/acid maintenance-free backup battery which will power the unit for up to 36 hours. It is type accepted and available now at

\$1,995.

As of January 1986, broadcasters must comply with the FCC-adopted ANSI standards on RFR limitations.

Most of the manufacturers supplying FM antennas are now offering half-wave-spaced element designs which substantially reduce the levels of radiation directed straight down; instead, energy is redirected into a broader horizontal beam.

Jampro, ERI and Dielectric all provided information on their respective designs, which use a modified branch feed system so that all the close-spaced elements are fed in phase. Jampro was able to provide both even and odd numbers of bays with their design, while Dielectric only specified an even number.

Shively Laboratories showed a reduced-scale model of their half-wave spaced design, which uses a novel series-feed method for any number of bays. This reduces the extra branch feed transmission lines and coupling hardware normally required, which may be important for installations requiring minimum wind loading.

All of the antenna manufacturers showing hardware can offer various spacing configurations to achieve specific horizontal gain and downward radiation patterns, as well as null-fill requirements.

For multistation applications, both Tennenplex and LeBlanc and Dick showed new multistation combiner systems and broadbanded panel antennas.

ERI, which sells through Harris and Continental, showed the new "Cogwheel" broadband FM antenna and the series 1000 panel antenna.

### Miscellaneous products

Johnson Electronics, the industry's largest supplier of SCA receivers, introduced its new model AT-4A tuner, featuring an "addressable" module, allowing the SCA head-end to remotely control the tuner via signalling tones.

Bird Electronic Corp. introduced a nifty collection of building-block-type RF adaptors. The interseries adaptor sets encompass BNC, UHF, N, TNC and SMA type connectors. All combinations of sexes and connectors are possible. It's sort of like an "RF socket set."

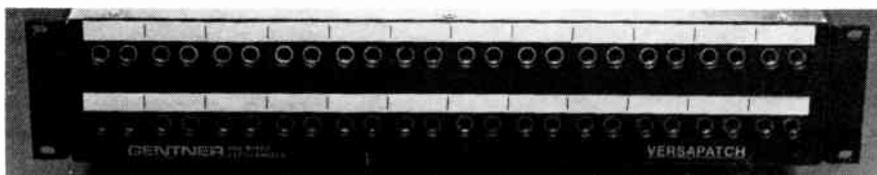
Amp Products showed a new BNC-crimpable connector which works with the Kings crimper. You'll never solder together an old style BNC connector after you've seen this.

Kintronics introduced a new STL isocoupler, called the model FMC-0.1. The unit is rated at 12 kV, which is substantially higher than other commonly available STL isocouplers. It will pass 100 W for transmitting with 0.7 dB insertion loss from 700 to 960 MHz.

This year's Dallas NAB Convention was packed with more to see and learn than ever before. While I'm sure I'll miss the occasional opportunity to wager a bet or two, I actually look forward to next year's show back in the "Big D."

Thomas R. McGinley is director of Engineering for First Media Corp., Washington, DC. He can be reached at 301-441-3500.

## VERSAPATCH



Now more versatile than ever!



### VERSAPATCH/FB

- Flexiblock stranded wire punch block gives you a high density of connections 8 per circuit.
- Normals wired at Bay - half normalling available.
- Use with solid or stranded wire.
- Price \$529.00.



### VERSAPATCH/66

- Telco-type punch block termination.
- Normals are brought out, may be jumpered as desired.
- Circuits are clearly labeled.
- Solid wire use recommended.
- Price \$499.00.

**GENTNER**  
ENGINEERING COMPANY, INC.

540 West 3560 South  
Salt Lake City, Utah 84115  
(801) 268-1117  
EasyLink 62852790  
Telex II 910-380-6909 GENTNER UD

The Clear  
Choice.

## NAB Convention Report

## New Blood in Remote Control

by Mike Callaghan

Dallas TX ... Judging by what was shown at this year's NAB convention, most of the advances in remote control systems this year appear to have been made by small, upstart companies, while the mainstream manufacturers appear to feel their reputation and current market shares will keep them busy.

A definite trend toward the use of microprocessors has finally eliminated all other types from the market; all the systems I reviewed at this year's show are computer based.

In the Allied booth, Peter Burk of Advanced Micro-Dynamics showed his new TC-8 remote control system.

Designed for a broadcaster with minimal remote-control needs, the unit emphasizes value, costing just \$2,195, and features eight metering channels, each with a raise/lower function, eight status channels and a full, four-digit readout.

Burk will supply software as part of

Mike Callaghan is CE of KIIS-FM, Los Angeles, and a frequent RW contributor. He can be reached at 213-462-6211.

the package should a user desire to interface it with a personal computer.

Front-panel controls include a maintenance override switch which allows metering to continue with control disabled, a calibrate button with which each metering channel can be run up and down (like setting a digital clock), and a setup button which sets the decimal point in the metering channels and can invert the status-LED indications.

Metering can be anything up to  $\pm 4.5$  V, and the control open-collector outputs are current limited above 250 mA. The status inputs accept anything from CMOS up to +28 V.

If you feel more comfortable using fail-safe, the unit switches a pair of "C" form contacts 45 seconds after control is lost. In addition, alarm outputs at both ends operate if data is lost in either direction.

The studio and transmitter unit hardware are identical, making maintenance easy. The only difference is in the PROMs that plug in. Power failures cause no anguish, as setup and metering factors are stored in EEPROM.

An optional \$495 interface relay panel provides barrier strips for all connec-

tions, and additionally includes relays driven by the internal power supply to provide 1 A dry contacts for control functions.

For further information, contact Peter Burk at 617-456-3570.

John Leonard of Gentner RF demonstrated his new VRC-1000 "dial-up" remote control system.

This 16-channel system eliminates the studio control unit as we know it; instead, the system is controlled by DTMF tones from a standard telephone. The transmitter answers the phone, and a specific passcode must be keyed in before the system will respond further.

Control functions are sent with the keypad, and metering values and channel verification are returned by a voice synthesizer. Electrical units such as volts, amps, watts and degrees are included in the vocabulary.

Limits may be established in the setup procedure, and the transmitter unit will initiate a call if these are exceeded. This means the transmitter could conceivably call the engineer at home without bothering the studio operator. (Whether this complies with the Rules has yet to be clarified. At this juncture it appears the "operator" should preferably be the per-

son at the studio.)

The VRC-1000 provides open-collector outputs for control. The unit is really compact, considering all it does, and fills just a single-rack unit. It's reasonably priced at \$2,795.

Gentner RF may be reached at 408-926-3400.

Hallikainen & Friends showed a touch-screen display terminal that interfaces with its DRC-190 remote control system. The company also exhibited a low-cost, personal-computer-based system that provides color graphics, autologging and limit files for the ever-popular TEL-171 digital upgrade for the Moseley TRC-15.

The touch-screen display graphically depicts current transmitter, audio link, limiter and antenna pattern status, and any other parameters included in the program. Any of these may be changed by just touching the screen. After the changes are made, the display then reflects the new status.

The system is extremely easy to use, and should be ideal for stations needing the simplest operational commands available. Adding it to an existing DRC-190 involves a new RAM board and the additional display.

(continued on page 24)

## CD R&amp;D Venture Set

by Edward Wytkind

Dallas TX ... Netherlands-based Philips, parent of the US-based Philips Televisions Systems, and the Swiss firm Willi Studer announced plans at the NAB convention to jointly research and develop professional CD player studio systems.

In addition, the companies announced that Studer Revox America, the US marketing arm of Studer, will market the existing Philips LHH 2000 CD player system and the LHH 0425 CD Subcode Editor.

The new venture is an effort to "pool" each company's experience in broadcast product engineering, Studer Revox spokesperson Bruce Borgerson said. Officials projected a joint product release by the 1987 NAB show.

Borgerson said "at this point" there are no plans to exchange funds. Financial contribution by both firms will be divided on a "50/50" basis, he said.

Philips Television Systems, which markets Philips broadcast products in the US, has not been involved in the preliminary stages of the venture, Borgerson added. Citing Studer's reputation in the US broadcast market, any jointly developed products will probably be marketed by Studer Revox America, he said.

Studer said its marketing of the Philips CD system will not affect sales/marketing of the Studer A725 CD system because the "two devices are positioned in very different market slots."

For more information, contact Bruce Borgerson at Studer Revox: 615-234-5651.

## Moseley, IMS Sign Pact

Goleta CA ... Moseley Associates, a manufacturer of STL and remote control equipment, has signed an exclusive license agreement with Integrated Media Systems (IMS) to take over the manufacturing and marketing functions of IMS' line of audio and industrial switcher and analog-digital-analog converters.

With this agreement, the San Carlos, Calif.-based IMS has relinquished the manufacturing rights of its switchers and converters, according to Moseley Marketing Director Paul McGoldrick.

McGoldrick explained that IMS wants to continue work on new product development, which will be fueled financially in part by Moseley's infusion of capital

into IMS as part of the license agreement.

"This is the first in a series of steps to consolidate Moseley's position in the broadcast and industrial markets," he said. "There will be many exciting spinoffs from this agreement, and the marketplace can expect Moseley to diversify quite dramatically in the next two years."

McGoldrick would not elaborate on these spinoff and diversification plans, but said the company will continue to evaluate the broadcast equipment industry and will consider manufacturing other types of product lines.

For more information, call Paul McGoldrick at Moseley Associates: 805-968-9621.

NEW

Maximize your  
telephone audio...  
with Gentner's

## TELEPROCESSOR



- Use with any telephone hybrid or frequency extender.
- High and Low Band EQ adjustments improve phone line sound, reduce line hiss and hum.
- Aphex® processing improves high end content.
- Maintains consistent send level to caller.
- EASY installation - XLR connections, no internal adjustments.

Suggested list price \$499.00.

**GENTNER**  
ENGINEERING COMPANY, INC.

The Clear  
Choice.

540 West 3560 South  
Salt Lake City, Utah 84115  
(801) 268-1117  
EasyLink 62852790  
Telex II 910-380-6909 GENTNER UD

# Public Radio Confab Upbeat

by Mike Starling

San Diego CA . . . "Decidedly upbeat" is the most apt description of the 16th annual public radio conference held 13-17 April in San Diego. This year's sessions were characterized by a markedly positive atmosphere, in stark contrast to the preceding conferences.

Without exception, the activities reflected the prospective nature of the "Hear the Future" theme.

Although sharing an uncertain funding picture with other public arts/communications entities, public radio was far more concerned with molding its marketing and promotional logistics with the goal of successfully doubling its collective audience over the next four years.

Most of the scheduled sessions featured exchanges of promotional and programming ideas on what is and isn't working at the local station level. Fueling this thrust seemed to be an internalized perception that the public radio system is offering compelling programming that needs better promotion and audience awareness to increase its market and funding reach.

The keynote speaker for the conference, former Representative Lionel Van Deerlin (D-Calif), emphasized the alternative role of public radio, calling the stations "a rock against the stormy seas of commercial broadcasting."

Corporation for Public Broadcasting President Martin Rubenstein echoed that sentiment by referring to public broadcasting as a "national treasure."

Evidence of the new-found cohesion within the system was abundant:

- This year's conference was attend-

ed by more than 600 station representatives, the largest turnout in recent years.

- Whereas last year's conference was consumed by a controversial and dismal seven-hour membership meeting, the San Diego conference had a one-hour session with little substantive discussion on any major issue.

- At the 1985 PRC, the network's worst fears centered on the possible number of member stations that might leave the system as a result of the net dollar increase in the dues structure.

In reality, only a handful of stations have left the system. The only poolside talk heard in that regard centered on some smaller stations facing severe state funding cuts, such as the Alaska public stations. To date, KUSC-FM, Los Angeles is the only major-market station to pull out of NPR.

With final payment on the \$9.1 million debt engendered in 1983 scheduled for 30 September, attendees all seem relieved to have that chapter ending.

NPR President Doug Bennet told RW he felt the restoration of member confidence was the single most important element in the network's steady recovery from the staggering \$9.1 million debt discovery.

He felt the basic reason for the turnaround was a full sharing of information regarding the financial mechanisms at NPR. According to Bennet, the resulting atmosphere provided the basis for solving the deficiencies cooperatively with the membership.

Responding to the problem in scheduling the Public Radio Conference concurrently with the National Association of Broadcasters Convention, Bennet said, "That was an unfortunate error and will not be done again."

A number of conference speakers literally had to cut short their post-presentation availability to catch planes bound for the NAB show in Dallas.

## Regain lead in technology

Bennet acknowledged that NPR's early technological lead in the '70s was a fundamental ingredient for the network's national performance.

"We now have a facility that's basically a very fine, 10-year-old Cadillac, he said.

Bennet added that he hoped to see NPR regain the lead in broadcast technology by upgrading the network and member station facilities.

NPR's FY 87 budget is set at \$25.9 million, of which \$15.8 million will come from membership, with the balance derived from outside corporate fundraising and foundation grants.

Some 95% of this budget will go to maintenance of existing programs and services, with the remaining 5% allocated to the proposed Sunday expansion of "Weekend Edition," along with funding for independent programming and audience research.

While the figures don't appear to represent any significant monies for facility upgrading, Bennet insisted that the network's outside fundraising activities

were continuing to grow and that NPR's financial future is dramatically brighter than it has been in recent history.

He was quick to point out, however, that the greater unknowns—future Congressional and state funding support—will ultimately frame the portrait of the system's upcoming activities and evolution.

## Sessions

The sessions included: a major focus on the current state of and approaches to audience measurement; demographic definitions; and case histories of successful programming, positioning and development strategies that have met with notable success or failure.

Other topics discussed included trade-outs for public broadcasters, not only for acquiring goods and advertising, but also as a means of garnering incentive premiums as a key ingredient to successful pledge drives.

Perhaps the most compelling of the limited number of engineering sessions was Environmental Protection Agency Electromagnetic Chief Richard Tell's dissertation on the methodology and findings in field tests of possible nonionizing radiation hazards at broadcast transmission sites.

A number of engineers pointed to perceived flaws in the assumptions that led to adoption of the 1982 ANSI standard by the FCC.

When questioned about the EPA's role in assessing the underlying validity of the limited studies on the subject, Tell acknowledged that significant, ground-level research on valid cause-and-effect relationships is needed. However, he ex-

(continued on page 26)

## Remote Control Gains New Blood

(continued from page 23)

Package cost has yet to be finalized, but will be under \$2,500.

The \$300 upgrade for the TEL-171 makes use of the already-present front-panel "D" connector, and interfaces to a Commodore C-64 computer. The screen reveals the transmitter plant parameters.

The keyboard will initiate control functions if the BASIC program takes advantage of some additional "remote-control" words included in the package.

When the system is first turned on, an "install" menu allows selection of channel labels, operating limits, autolog intervals and control functions. A printer may be connected to the C-64 for autologging functions.

Adding up the costs of the computer, display and printer to that of the system, a complete autologging remote control system, programmable in BASIC, may be added by a station already using the TRC-171 for less than \$1,000.

For further information, contact Harold Hallikainen at 805-541-0200.

Harris again showed its Sentinel 16, a microprocessor-based system with 4 digits of metering, 16 channels, and dry relay contact control functions.

Revised software now allows for remote PC handshaking using an outboard interface. It lists at \$4,595. A new multi-site version, to be called the Sentinel 48, will be available later in the year. This system uses a single 48-channel studio

unit and Sentinel 16s at the transmitter site.

Further information is available by calling Harris at 217-222-8200.

Moseley Associates has addressed the increasing trend toward dial-up phone lines by adding that capability to the MRC-2.

If the main control link fails, simple pushbutton commands at the studio automatically dial a link to the transmitter site, restoring control and metering functions.

The basic MRC-2 unit provides 32 channels of control and 16 of metering, and sells for \$12,095.

Moseley's mainstay radio remote system, the MRC-1600, is still available at \$4,395. Moseley is in Santa Barbara at 805-968-9621.

TFT has expanded its 7610 remote control system to include 10 channels of status in addition to the original configuration of 10 metering channels, each with raise and lower. It may be further enhanced through up to 42 status and 70 metering choices.

The basic unit sells for \$3,625, with metering options costing \$1,610 for each extra 20 channels, and \$1,460 for the 32-input status expansion. The unit uses UARTS for data transmission, and avoids the use of microprocessors.

TFT of Santa Clara, CA may be reached at 408-727-7272.

For those of us who need control func-

tions without metering channels, Symetrix continues showing its simplified Model DCS-16 remote control system.

Selling for \$1,750, the DCS-16 has no return metering.

Using either a two- or four-wire circuit, it has a set of 16 raise/lower dry contact closures which are controlled from the studio. Each contact is rated at 3 A. It also provides 16 status channels which are independent of the control functions.

Symetrix may be reached at 206-624-5012.

There are two areas where remote control can grow. Many new technological developments—voice synthesizers and microcomputers, for example—can offer appreciable cost savings and improve operational effectiveness.

After reviewing what was available, I was disappointed that more of the traditional remote control suppliers didn't address either of these areas. Rather, it appears that smaller enterprises, such as Gentner and Advanced Micro-Dynamics have quickly entered the market with equipment using these tools.

Small market stations with minimal control needs are undoubtedly going to take quick advantage of these newer, more cost-effective developments. I hope the traditional, larger remote control manufacturers will be able to institute similar cost savings and new technology into their future systems.



## FCC Database

### FLAG<sup>SM</sup> SERVICE

- Daily/Weekly report for your broadcast markets
- FCC Alert on all release items that impact your facility
- Full service & Auxiliary interference/mileage checks
- Applications, actions, PRM, dockets, grants & dismissals
- Comprehensive, easy-to-read low cost
- By mail or online 24-hr access

**dataworld**<sup>®</sup>  
A Service of DW, Inc.

P.O. Box 30730  
4827 Rugby Avenue, Suite 200  
Bethesda, Maryland 20814  
(800) 368-5754 (301) 652-8822

Circle Reader Service 43 on Page 29

# RFR Novelty Led to Foolish Behavior

by Floyd Hall

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

RFI is as old as any form of radio transmitting equipment?

Some of you may remember the experience my kid friend and I had with the old Dutchman down the alley from our radio shack (*Editor's note: NOT the store.*), when our 1 kW spark transmitter blew out his light and lit up his brass bed with green fire!

Well, many years later, in the '30s, Kenny Ormiston, CE of KNX in Los Angeles, built a composite 50 kW transmitter and fed the output into a four-wire flat-top antenna strung between two 200' towers.

The station in those days was way out in the country ... in the San Fernando Valley!

The station owners (not CBS then) built him a nice, big, stucco building in which to put the transmitter, which consisted of several units on open frames, with two huge water-cooled tubes in the PA, all surrounded by an interlocked chain-link fence.

## Old Timer

We tested out the driver, a couple of 212Ds, and that worked fine, so we decided to try out the final. So we hit the high voltage switch, and everything looked pretty good. It tuned nicely, and measured about right for output, and we put some audio on it. It sounded good, and modulated nicely.

About that time one of the guys let out a squawk! He saw smoke coming out of the walls! It turned out that our nice stucco building was made with metal lath, which was getting hot from circulating RF!

Well, it took many days to tear this stuff off the outside of the building and resurface it with wood siding. In the meantime, Kenny ran with 5 kW.

Came a time, finally, when all these problems seemed to be solved, and he put the thing up to 50 kW. Now, as I said before, this was way out in the country. All there was out there in the Valley was an occasional farmhouse.

About a quarter of a mile north of the KNX transmitter was a small farm, with a neat little farmhouse near the road. About 7 o'clock the night on which Kenny fired up to 50, the farmer and his wife turned on their lights and sat down to supper.

About that time, KNX hit a good modulation peak. The farmer's lights all flared up to twice normal brilliance, and in a few minutes all burned out! After several days of this, and the farmer's many frantic calls to the power com-

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

pany, somebody finally figured out what was happening, and all descended on the KNX transmitter.

Many light bulbs and many filters later, all was forgiven and the farmer and his wife lived happily ever after!

One other incident happened which was of interest, I think. Kenny had rigged up a method of neutralization of the PA, which required adjustment inside the fence with a long piece of dowling connected to the neutralizing condenser.

Paul was elected for the job, and was duly fenced in with his long stick. We fired up the final, and Paul was instructed to turn it slowly while we all watched the meters and stood by the switches.

All of a sudden he let out a shriek, and yelled out a bunch of incoherent and vile language. We all hit the switches and ran around to the back, prepared to scrape him off the PA coils.

Instead, we found him hopping up and down, grabbing his jaw, and then his pockets, yelling bloody murder. It seems the fillings in his teeth were hot, the keys and money in his pockets were hot, and a metal pen/pencil in his shirt pocket was smoking!

He cooled off pretty quick, and we figured out a different way of neutralizing the PA.

As far as I know, this amount of RFR never hurt any of us.

### The "Tesla Coil"

Speaking of RFR—and some of the foolish things we all do which might have caused us severe injury, or even death—I'll tell you of some of the stupid things I have done, in the hope you may avoid some of them.

First of all, let me tell you a little about the behavior of RF. Many years ago, I saw a demonstration at a Chautauqua (I wonder how many of you know the meaning of that word?) by Nikola Tesla of his then-famous "Tesla Coil."

He got a young girl to volunteer from the audience, sat her in a chair onstage, and placed a metal band about 2" wide around her head.

After a lot of mysterious hocus-pocus, throwing of switches and flashing of lights, he took a long metal wand and touched it to the metal band on the girl's head, drawing out an arc about a foot long!

Strong men quailed; women screamed and fainted, and the little girl in the chair sat and smiled.

### Important lesson

Now, this simple, old-time trick carries a very important lesson. When any part of the human body comes in contact with a source of RF voltage, the low resistance to ground of that body provides a path for the RF.

The most conductive part of the human skin is the pores, and this is where the RF enters and burns the skin. This burning is caused by what is known as "skin friction."

(continued on page 27)

by Howard Mullinack

### FMX improves stereo coverage

FM stereo reception suffers from significantly increased noise as compared to mono reception—typically 23 to 26dB. This noise increase restricts the coverage area of acceptable stereo reception to approximately one-fourth the coverage area of acceptable mono reception. FMX was developed by CBS Technology Center and the National Association of Broadcasters in an attempt to solve this problem.

Stations equipped with FMX can increase their stereo coverage area—up to about that of their mono coverage area—for those receivers equipped with FMX decoders. Yet FMX broadcasts are completely compatible with non-FMX receivers, which will continue to receive stereo or mono normally.

### How FMX works

FMX is a companding system: The L-R audio (which is the source of the noise increase in stereo) is compressed before transmission and expanded at the receiver.

To assure compatibility with existing radios, the L-R stereo subcarrier is transmitted at 38kHz in the normal manner. In addition, a second L-R subcarrier (the FMX subcarrier) is transmitted at the same frequency in *quadrature* (90° out of phase) with the original subcarrier. The FMX subcarrier is *compressed*, and includes a 10Hz pilot tone.

In the FMX-equipped receiver, both the "original L-R" and "FMX" subcarriers are detected. The receiver sums the "original L-R" and "FMX" signal, and then ex-

pands the audio on this sum to match the dynamics of the "original L-R" audio. Since the receiver uses the "original L-R" as a reference, it can accurately reconstruct the FMX signal without the FMX generator's having to maintain

precisely defined compression characteristics. This is called "adaptive expansion": the expander adapts to match a wide variety of compression characteristics.

The noise reduction is achieved when the FMX L-R audio is expanded: low level signals, and the noise, are reduced in level. Typically, up to 20dB of noise reduction can be achieved.

### FMX compression characteristics vs. "real-world" radio

CBS, in their design of FMX, introduced a "developmental" compressor to permit initial field trials and to prove the basic FMX principles. But the compression characteristics of this "developmental" compressor are not applicable to many stations. Fortunately, "adaptive expansion" allows Orban to optimize the compressor characteristics of FMX while maintaining full recovery of the original signal on standard and FMX-equipped receivers.

The first area of concern in the design of the OPTIMOD-FMX compressor is *overmodulation*. Under certain sound field conditions, the CBS "developmental" compressor can create continuous overmodulation—not just overshoots—of up to 26%.

Another factor is *loudness and audio processing*. The FMX system adds an additional subcarrier (and additional modulation) to the composite signal. Normally, modulation must be reduced to accommodate an additional subcarrier. The CBS "developmental" compressor has a reentrant characteristic: As the level of the "original L-R" subcarrier increases toward 100% modulation, the level of the "FMX" subcarrier decreases. With full modulation of the "original" L-R subcarrier, the "FMX" subcarrier actually disappears, with all of the benefits of FMX disappearing with it.

The advantages of FMX become less and less apparent as more processing is used to load the composite more and more heavily. If the composite always looks like it has been shaved with a buzzsaw, there won't be any room for the added subcarrier. The FMX compressor will stay in its "reentrant mode" much of the time, and little or no noise reduction will be available (except possibly when the announcer pauses for air). Of course, with high modulation levels, the noise will be somewhat less apparent.

### OPTIMOD-FMX—our approach

It's clear that the design of a "real-world" FMX compressor is quite a complex endeavor. FMX encoders will be highly differentiated according to the skills of the various manufacturers.

At Orban, four goals were foremost in the design of the OPTIMOD-FMX Stereo Generator: (1) It cannot produce overmodulation; (2) the on-air sound must not suffer from audible loss of loudness; (3) compression characteristics that produce audible processing artifacts will not be acceptable; and (4) the design must not degrade SCA performance.

### Real-world on-air testing

So far, FMX has been on-air tested by CBS at only a few "public" stations using very conservative processing. We feel that if FMX is to be successful, it must work with all types of formats and processing preferences, with various exciters and STLs, and on stations with and without SCA. It must not significantly increase the deleterious effects of multipath.

If FMX encoders are released prematurely, without thorough research of potential drawbacks and extensive on-air testing to assure that those drawbacks are overcome, FMX will be doomed to failure. First impressions are lasting impressions. We are now beginning our *own* series of extensive on-air tests.

### Availability of FMX receivers

IC manufacturers are just starting development of FMX decoder chips, so receivers for the mass market will not be available before mid-1987. Two high-end hi-fi manufacturers, NAD and Apt, expect to have a limited supply of receivers available later this year, with FMX implemented using discrete circuitry.

### Availability of OPTIMOD-FMX

Orban may be first to market, but only if we have a finely tuned product that will satisfy the needs of our customers. The necessary design and field testing must be done carefully, and will take some time.

OPTIMOD is a registered trademark of Orban Associates Inc. FMX is a registered trademark of CBS Inc.  
Orban Associates Inc., 645 Bryant Street, San Francisco, CA 94107  
(800) 227-4498 or (415) 957-1067 Telex 17-1480

OPTIMOD-FMX:  
AN INTRODUCTION

# Public Radio Confab Upbeat

(continued from page 24)

pressed doubt on the EPA's ability to play a key role in such research, given the overall funding climate in Washington.

NPR's Skip Pizzi gave a comprehensive overview of current techniques, standards and products in digital audio.

Pizzi indicated that there is wide disparity in the pricing, standards and results achieved thus far, but added that digital is growing exponentially and will begin its anticipated dominance of broadcasting in the near future. He predicted a breakthrough may result when the first cost-effective digital replacement for analog cartridge machines is introduced, a product which a number of manufacturers are now scrambling to prototype.

## APR price increase

The most prominent concerns during the four-day conference centered on American Public Radio's significant price increases, which appear to be a result of the curtailment of seed money funding the administrative costs at the Minnesota headquarters.

The expansion of support services for "A Prairie Home Companion" has also resulted in an acquisition increase for that program.

Unlike NPR, APR has "unbundled" program offerings wherein, after payment of the basic affiliation fee, only programs actually aired are separately purchased. "A Prairie Home Companion" has undergone dramatic growth since host Garrison Keillor's launch on the national scene via the cover of *Time* magazine and a special on public television.

Whether the existing APR subscribers will continue their financial commitment may be as dependent on their individual

financial condition as on the appeal of APR's program offerings.

The National Federation of Community Broadcasters also met at the PRC. According to President Carol Schatz, the NFCB agreed that a crucial issue for its members will be basic economics. The NFCB is keenly interested in the funding criteria that will be implemented in the CPB's newly created National Programming and Acquisition Grants.

She also indicated that talks with the Pacifica stations are underway to determine if significant economies of scale can be realized in a cooperative distribution

effort addressing taped programs.

Shatz emphasized the negative impact many stations will experience by impending reductions in state support for public broadcasting in several regions.

WOSU General Manager Dale Ouzts was unanimously selected as this year's recipient of the Edward E. Elson award for significant contributions to the advancement of public radio. In characteristic homespun style, Ouzts indicated he was only doing what he believes in and, like most of his colleagues, would keep with it in the future.

An unannounced award of apprecia-

tion was presented to NPR Director of National Affairs Mary Lou Joseph for her tireless efforts in working on the crucial CPB and Public Telecommunications Facilities Program authorizations. The award was jointly bestowed by the regional network and station organizations.

Whether public radio can achieve its self-imposed goal of doubling its audience by 1990 remains to be seen, but some trends may be evident at next year's Public Radio Conference in Washington, DC.

From all appearances, the stations seem determined, and will concentrate their efforts in the key area of programming, promotion and development to achieve the measure of their expectations.

## New Tape/Cart/Reel/CD Gear Shown

(continued from page 19)

atically cues to the beginning of audio, rather than to the PQ encoded start point.

End-of-song cueing is user adjustable in 1/2-second increments, referenced to the actual end of the tune.

The unit provides outputs to start other equipment, as in an automation system. A controller is also available for entering sequences of tunes to be played from one or more machines. It is available currently for about \$12,000.

Fidelipac introduced its new ESD splice finder/cart eraser. The unit uses two erase heads, rather than an erase coil, to reduce tape noise 75 dB below operating level. It is designed for continuous duty, requires no adjustments and can process 144 40-second carts per hour.

Fidelipac also showed the new CTR-10 cart machine line, which features built-in audio switching, enabling several cart machines to be paralleled and fed into one input on a console. It accepts A-size carts only, and can be programmed to mute at the end of a 150 Hz cue tone.

ITC introduced the ESL V, a new, improved cart eraser/splice finder with microprocessor control, servo motor and high-output erase coil.

The splice finder utilizes a Hall-effect sensor to reduce the chance of false cueing on splices.

Studer introduced the B 203 Timer-Controller, a control interface for its A725 CD players that allows RS-232 computer control of up to eight CD players and/or cassette decks.

Studer also showed the new A 812, a two-channel analog reel recorder that uses keyboard entry for all adjustments of bias, EQ, level, etc. A resolution of 0.1 dB is claimed, and some keys can be user programmed for special functions.

The unit, available with SMPTE center-track time code on 1/4" tape, is \$8,500. The A 807, a smaller, "portable," self-contained recorder with many of the same features as the A 812, costs \$5,000.

Kodak unveiled a new 8 mm video recorder that also records stereo digital audio. The MVS 5000, only 8" x 6" x 2"

in size, can record up to 12 hours of stereo digital audio on one 8 mm cassette!

It's available now, for about \$1,000. An AC supply/battery charger is also available for about \$300, as well as a tuner/timer unit for about \$400.

Otari introduced the new CTM-10 broadcast cartridge cart machines, which feature very high audio performance and optional matrix recording. The unit is available in mono or stereo, and in either playback-only or record playback. Fast forward cueing is also standard. (Note: the unit on display was a prototype, so the Otari rep wasn't able to demonstrate most features.)

MEI Microprobe introduced its digital audio recording-playback system, which uses an 8" Winchester hard disc drive for storage of up to 76 minutes of mono (or 38 minutes of stereo) program with a 15 kHz bandwidth.

The system is intended for storage and playback of short events. Up to 400 tracks can be stored on each disc drive. The system can control up to four drives for a maximum of over 300 minutes of mono or 1,200 individual tracks.

A video screen is used to display the location of each track.

With one disc drive, the cost is \$27,950.

Ron Schiller Associates introduced the industry's first (and only) computer controlled CD playback system capable of software manipulation of CD track start cueing and EOM cueing with one-frame (1/75th second) accuracy.

The system uses off-the-shelf CDs, and permits the user to create a database for each CD. The computer can identify which CD is in each CD player, then retrieve the complete song index, with all pertinent data on cue points, tune length, EOM points, and almost unlimited text or logging functions.

A sequence of tunes can be programmed, and the system can operate in either live-assist, automated source or fully manual modes.

Multipoint control is possible, as the software will run on most PC-compatible computers. The software package sells for \$6,500.

Straight Wire Audio unveiled its CDQue, a balanced output CD player that can be tightly cued, controlled remotely, and featuring the new Speed Demon microprocessor varispeed.

The CDQue will be available this summer.

## This new QuantAural™ QA-100 Audio Program Analyzer gives you the advantage in competitive broadcasting

Simply put, the QA-100 quantifies what you hear. Your station sound can now be electronically monitored the way you hear it. Exactly. And, you can monitor the competition too!

Real time analysis of any audio signal. From a receiver, tape recorder, or processing equipment. You see the measurements as you hear the sound. Changes in processing or variations in system performance are immediately shown on the QA-100 panel meter or bargraph display—using program material as the signal source.

The QA-100 hears like a program director and talks like an engineer. With it you can monitor maximum peak level (relative peak modulation), overall

processing effectiveness (average level), tightness of sound and processing control (peak density), tonal balance, consistency and preemphasis (four band real time analyzer), stereo image width (L + R to L - R ratio) and "punch" (special "aural intensity" measurement).

Interested? To learn more about how the QA-100 will help your station compete, call Potomac Instruments today.

QuantAural is a registered trademark.



**POTOMAC INSTRUMENTS**  
932 PHILADELPHIA AVE. SILVER SPRING, MD 20910  
(301) 589-2662

# Novelty Led to Foolish Behavior

(continued from page 25)

But how about the girl Tesla drew an arc a foot long out of her head? Ah, but the metal band was in contact with a large surface area of her skin, so the current flow was not through a small spot where a burn would occur.

I would not be afraid to tightly grip a large, shiny Crescent wrench in my hand, touch it against a 50 kW tower and pull an arc out about 6". But if I stuck my bare hand against such a tower, it might burn the thing off!

When I work with a tower man on a hot tower, I always caution him not to wear gloves. If he does, and takes hold of a hot tower with enough RF voltage present, it may arc through the thick leather and give him a nasty burn.

If, on the other hand, he just reached out and grabbed the tower with his bare hands, he would have felt nothing.

Now, I said I would tell you of some of the foolish things I have done.

An old-time brass pounder and I were working on a 4-tower nighttime antenna,

and I finally said, "Tom, it's got to be in that sample line from the No. 3 tower." So, I switched back to non-DA—we were working in the daytime—and we went out to the No. 3 tower.

In those days, we brought the sample line from the loop off the tower through an isolation coil—a bakelite form about 10" in diameter and about 18" long, and wound with sample line.

This coil had enough inductance so

that it had little shunting effect on the tower impedance. The one we were working on was contained in a metal box, low at the base of the tower.

I squatted down and took the cover off, unscrewed the connector at the bottom of the coil; cleaned it a little and connected it back up. OK. Then I reached up to unscrew the connector at the top, and the fire flew!

This was the 5 kW non-DA tower!

Well, I came out of there real quick, and Tom said, "Hell, you're not old—your reaction time is terrific." I had a pretty good burn on my thumb and finger!

By the way, any of you who have ever had a good RF burn know that it heals on the outside first. If it is a pretty deep one, you may have to open it up to get it to heal properly.

Moral: Don't stick your fingers in the buzz saw!

## Consultants

### R.L. HOOVER

Consulting Telecommunications Engineer

11704 Seven Locks Road  
Potomac MD 20854  
301-983-0854

Member AFCEE

### UPLINK

ENGINEERING, INC

Engineering Consultants

Studio, Transmitter, Antenna  
Systems Design, Analysis,  
Construction

Doug Holland P.O. Box 1688  
(305) 920-6438 1635 S. 21st Ave  
(305) 522-3303 Hollywood FL  
33020

Robert M. Lund  
Broadcast Consultants  
Auburn, Massachusetts

Applications -  
Field Engineering

617/832-2611

### W. LEE SIMMONS & ASSOC., INC.

BROADCAST TELECOMMUNICATIONS CONSULTANTS

14 Archer Road  
Hilton Head Is., SC 29928  
(803) 785-4445

Contact: Radio World Newspaper,  
PO Box 1214, Falls Church VA 22041  
for availabilities. Phone 800-336-3045.

*KNOCK TELEPHONE LINE CHARGES IN A COCKED HAT!*

## WITH LOW COST STL & REMOTE CONTROL

MARTI Electronics, Inc.

ADVANCED MICRO DYNAMICS



**STL - 10/950  
TRANSMITTER &  
RECEIVER  
Complete System**

Mfg. list ..... Mono - \$2,990.00  
Mfg. list ..... Stereo - \$6,095.00



**Model TC-8  
REMOTE CONTROL**

Features

- 8 Metering Channels
- 8 Status Inputs
- 8 Raise, 8 Lower Outputs
- Delayed Failsafe Outputs

Mfg. list ..... \$2,195.00

### CALL FOR THE BSW PACKAGE PRICE

Or Lease The Works - Mono \$134.00 mo. Stereo \$214.00 mo.

## TOLL FREE ORDER NUMBER

# 1-800-426-8434



BROADCAST SUPPLY WEST • 7012 - 27th ST. WEST • TACOMA, WA 98466

# Analysis Good Marketing Tool

by John M. Cummuta

Chicago IL . . . The greatest contributing factor to most business failures is the lack of a conscious marketing process.

This third part of our marketing series will cover one of the most critical phases of a properly executed marketing effort: gathering facts with which to make effective decisions. It's called the "Situation Analysis."

## Engineering— Manager

Actually, last month's column covered the first element of the Situation Analysis, that being the "Identification of Your Business." Remember that the identification must be made from the customer's perspective. That's the only one that counts.

I won't try to tie everything to the operation of a radio station. The advan-

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

tage is that you can give a copy to the Sales Manager or GM to use it to broaden the horizons of your salespeople. This insight will help them help their clients to better market their businesses.

### Major Products/services

The next phase, after identifying your business and your target market segment, is a listing of the major product or service lines you offer. A complete analysis should be done—separately—for each product or service area because each could meet a completely different need for a completely different target market.

For example, K-Mart stores meet the needs of different target markets in their automotive and children's wear departments. Though it's the same umbrella business, each department has to be market analyzed individually.

Why should people do business with you for a particular product of service, rather than with someone else—maybe someone closer to their home, or someone, for some other reason, more convenient.

This is possibly the most critical element of the analysis, because if you can't

answer this question effectively, neither can your potential customers. Hence, they will likely become someone else's actual customers.

There must be something unique about your business, from the customer's perspective. There must be some emotional motivator to make them *want* to patronize you.

Watch the big advertisers to see what I mean. The large supermarket in town offers bread at five loaves for a dollar, or canned ham at cost. Are they losing money on these items? Yes. Are they losing money overall? No!

They know that on your way to pick up the bread or ham, you'll pass a dozen other things that'll catch your eye. Before you leave the store, they've made a profit. That's great marketing. They realize that the loss they take on the "loss-leader" item is a part of their advertising expense. But they also understand that it's an investment that pays solid returns.

That's why we never let one of our advertisers just say that they've got a "friendly staff, great selection, comfortable atmosphere," or any other non-statement—because *everyone* has a "friendly staff, great selection, comfortable atmosphere," etc.

There must be a real reason for your potential clients to become clients, and the reason must be real to them—not you.

I mentioned last month that you must get a specific handle on your target market. A definition should include at least location, age, sex, income level, educational level, ethnicity, marital status and recreational preferences.

### Identify the competition

This section of the Situation Analysis, "Identifying the Competition," is closely linked to the Identification of Your Business function. If you're not clear on what business you're in, how can you define who's in it against you? Or, better put, who's out after the same customers to provide the same or a similar service?

For instance, in the commercial radio business, the competition is everything from MTV to portable cassette players—from the audience's perspective. However, from the advertiser's perspective, it's everything from TV to newspapers to direct mail to billboards.

You can easily see how important it is to have identified both your business and the target market before you can readily distinguish the competition, which is trying to project a similar business image to the same market.

While you're identifying the competition, list their strengths, weaknesses and their individual shares of the market in question.

Now that you've considered the market shares of each competitor, you should have little trouble determining yours. Remember, you must do it individually for each department, or product, or service you're offering, because each will have its own target market and its own competitors.

When you've decided on your market share, consider whether there is room for growth.

I'm going to introduce you to four terms here: *Stars*, *Sweepstakes*, *Cash Cows* and *Dogs*.

Stars are your products or services with which you enjoy a high market share in an expanding market. An example might be video equipment. That marketplace is still growing. If you already own a large share of your community's video business, you have a Star on your hands.

Sweepstakes are products or services of which you currently have a relatively small share in your local market, but the market itself is growing.

Cash Cows are products or services from which you enjoy a large market share, but the market itself is shrinking. An example might be 8-bit CP/M micro-computers.

Dogs are products or services in which you have a relative low market share, and the market is stagnant or dwindling.

The rule of thumb is to kill (or let die) the Dogs, milk the Cash Cows of resources without putting any promotional money back into them, and put the Cash-Cow money into promoting the Sweepstakes and Stars—they are your future.

### Life-cycle analysis

Businesses, products and services all go through life cycles: *Introduction*, *Growth*, *Maturity*, and *Aging* or *Decline*.

In the Introduction stage there is little competition, but promotional expenditures are natural to explain the new product or service to the target market.

A relatively high price for the product or service is natural as well, because there is little competition to which customers can make comparisons. This helps the business recoup startup costs more quickly. Some debugging or other modifications frequent the Introduction stage.

The Growth stage is the heady one, where most of the promotional money is expended. Market expansion is rapid; the product or service has really caught on. Price usually falls off due to new competition coming into the picture on a daily basis. Not much modification can take place here; it's usually just a matter of trying to keep up with demand.

The Maturity stage is when things have leveled off. The market demand isn't growing much, and each supplier has more-or-less secured its share of the market.

This is usually the Cash Cow stage. The strategy here is to simply try to keep the product or service from slipping into the Decline stage. Sometimes an innovative modification or marketing strategy (repositioning) can move you back into Growth.

Decline is just that. The product or service is on its way out and you're usually making decisions about cost cutting or abandoning the line altogether.

You should be able to clearly see how all of these different analyses give you the complete picture you need to determine how best to approach the marketplace with a given product or service (or, indeed, whether to bother approaching it at all).

When dealing with one of your station's clients, using this marketing analysis approach on their business gives you

(continued on next page)

**THE VERY HEART OF YOUR TAPE MACHINE**  
Can you trust it to just anyone?

**JRF**  
**MAGNETIC SCIENCES**

JRF is proud to offer a complete laboratory facility consisting of the latest in state of the art magnetic head refurbishing and optical alignment equipment.

Our staff represents over 20 years of involvement in the design manufacture, and precision service of magnetic recording heads; and it is dedicated to the continuous updating of techniques and procedures to meet the everchanging demands of the industry.

Our studies show that in most cases worn, unserviceable magnetic heads for RECORDING STUDIOS, TAPE DUPLICATING, MASTERING, AND BROADCASTING can be restored to original performance specifications for a fraction the cost of replacement. If in our FREE EVALUATION heads are found to be unrepairable, JRF maintains one of the largest inventories of premium quality direct replacement heads, as well as heads for custom and modification applications.

## JRF/Magnetic Sciences, Inc.

The audio magnetic professionals with the track record to prove it.

101 Landing Road • Landing, NJ 07850 • 201/398-7426 • Telex: 325-449

# CD Convert Swayed by Peers

by Bill Sacks

Arlington VA ... A few years ago on this page I went on record as saying, "CD players sound like transistor radios." I got a lot of flack for that statement.

Fred Crock of San Francisco called me a "luddite" for throwing rocks at digital audio. Marc Finer of Sony said that "tweaks like you don't like these things because they can't be modified or hot-rodged" (ha!). A lot of my friends said that I'd just finally lost it.

We've now had four generations of CD players, and the first-generation players *still* sound like transistor radios (even the most expensive professional version).

Listen to the Steely Dan cut, "Do It Again." This is one of the best commercial analog recordings ever made. About 40 seconds into the tune are some wind-chime sounds. The noise representing those sounds as it comes out of a Japanese first-generation player resembles the proverbial champagne glass hitting the fireplace.

A notable exception is the Nakamichi player, which seems to be the only Japanese player of merit (they've always had their ears close to the ground—and to their equipment).

## Peer pressure

Good friends have been trying to convince me of the sonic integrity of CD players for the last several years. I'd like

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

## Marketing

(continued from previous page) the knowledge to make intelligent recommendations about how your client should handle a given product or service area.

The last bits of information you need to complete the picture on how to market a given product or service for a business are all in the area of promotion.

What has their promotional budget been? What media have they used? What have they done in the media, such as ad size, schedule length, etc.? Was co-op used? Whose/how much? What were the results?

Armed with this detailed information, a good businessperson should be able to decide which areas of his business deserve to be promoted, to whom they should be promoted, with what media they can reach that target and what message will clearly make the connection.

Once these decisions have been made, every area of the business must be controlled to send the same message to the same target market. All efforts of the business must be focused toward the same marketing goal.

This conscious effort could be the difference between success and surrender, or at least between magnificence and mediocrity—and what an important difference that is.

to thank Dick Cassidy, John Kean, Pete Kukura, Steve Kaufman (all former NPR engineers) and John Reiser of the FCC both for their gentle browbeating and preselection of the best software for auditioning.

My most heartfelt thanks go to Walt Jung (whose ears I trust implicitly). Walt called me about six months ago with news that he had found a good-sounding, inexpensive player—a Philips consumer deck marketed in the USA under the tradename Magnavox.

The player has four times oversampling: that is, a 176 kHz clock, digital filtering and, most important for broadcasters, dual D/A converters (this eliminates the mono summation problem caused by trying to multiplex a single converter for both channels).

## Straight Talk

Walt said when he first got the player that it sounded much better than the rest of the pack. After he had removed the electrolytic capacitors from the audio chain and replaced them with film capacitors (we all understand the commercial price performance pressure on large manufacturing firms). After a few more tricks, the player started to sound real nice.

I replicated the experiment with the same type of player, and *voila!* The "champagne glass hitting the fireplace" phenomenon disappeared. I was amazed at the relative smoothness of the high end. The player sounded real close to a good record with a high end phono preamplifier.

## Cued in

I thought, "Now here's something we can really commercialize. We'll put together a rack mount, balance the outputs, and we'll have the least expensive pro player on the market." But then Dave Burns from Allied Broadcast Equipment saved me from myself.

I called Dave. "Dave, I've got the best-sounding player with balanced outputs on the market; I can sell it for half the price of the nearest pro competitors, and I'm taking it to the NAB."

Dave interjected, "I'm sure it sounds great, Bill, and the price is right—most people think they all sound good enough—but can you *cue* it tightly?" I hadn't thought of that. Back to the workbench, and a breadboard full of CMOS chips.

I was able to take intimate control of the player and developed a friendly cueing system. Then I borrowed a player made by the competition and fine-tuned the cueing system to make sure that ours was an improvement on the existing available product. I thought I was finished. I even had a name for it: the "CDQue."

In talking with friends who are Chief Engineers, the question of remote control came up. It turned out that the "professional" CD players on the market had no convenient way of making use of the bank of normally open pushbuttons

found on consoles, but instead required some sort of fancy remote controller.

A few optoisolators and a DB-25 connector were thus added to the design.

I knew I had to be finished, after all there comes a point in every commercial project when it's time to take off the engineering hat and put on the production hat.

I missed one thing.

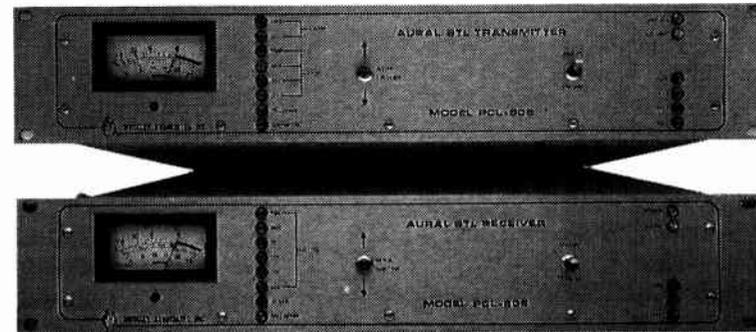
Chip Fetrow, CE of WAVA (our friends and neighbors here in Arlington),

asked me if I was going to install a socket so that the clock crystal could be changed easily. I said, "Chip, I've been beating hell out of these things, and haven't managed to lurch a crystal yet."

He replied, "The crystals don't go bad; the Program Director wants to speed up the music a little bit."

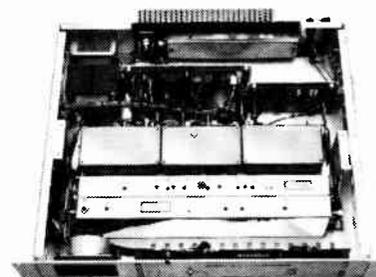
So I took the crystal out of the player, ran a cable to a back-panel connector, and designed a printed circuit board to be plugged into that connector with the original crystal, a toggle switch and a footprint for a second crystal. Well, that did finish the player.

(continued on page 30)



## The Moseley PCL-606/C

# Totally Transparent



- Ends telco line charges
- Ultra low noise and distortion
- Unequaled selectivity
- Outstanding linearity and frequency stability
- Selectable IF bandwidth
- Built-in diagnostic metering—received signal reads in true microvolts
- Digitally synthesized transmitter—no crystals
- All service adjustments through top covers
- Two multiplex inputs, individually adjustable
- 115 kHz extended baseband available at no additional charge
- PCL-606/C is composite stereo. For mono, specify PCL-606.

Looking for the best? Call us for the complete Moseley line.



For great deals on all your needs call:  
NORTHEAST BROADCAST LAB, INC.



PO Box 1176  
South Glens Falls, NY 12801  
800-227-1093 (NY call 518-793-2181)

# Encoding FM Stereo

by Ed Montgomery

## Lesson 6

Annandale VA . . . FM stereo transmission officially began on 1 June 1961 at WEFM in Chicago. The Zenith-owned station employed the Zenith stereo encoding system approved by the FCC.

The FCC permitted FM stereo transmission as a means of providing a future for FM in the United States. Throughout the 1950s, FM broadcasting lost the battle in attracting listeners. Many broadcasters gave up their FM frequencies when the time came for license renewal.

By 1956, equipment manufacturers had stopped making transmission equipment, and only one company was making receivers. The future of FM appeared bleak.

As a last resort, FM stereo transmission was approved. At that time there were several proposals to permit AM stereo broadcasting, but the Commission denied these to give FM a competitive edge.

### Creating stereo signals

FM stereo employs subcarrier transmission to transmit multichannel information.

The stereo transmission system had to provide the complete left and right channel information to existing monophonic receivers to satisfy FCC requirements.

In order to do this, the stereo information was encoded into sum (L+R) and difference (L-R) channels, rather than transmitted in discrete left and right

*Ed Montgomery is a professor of Broadcast Engineering Technology at Northern Virginia Community College. He is available at 703-323-3248.*

channels.

The difference channel was encoded into a superaudible signal that would have no effect on a monophonic receiver. The sum and difference channels had to provide equal levels of loudness and fidelity.

Recall that the frequency deviation in FM is directly related to the loudness level of the modulating signal. For FM monophonic broadcasting, 100% modulation equals  $\pm 75$  kHz deviation. FM stereo reduces the sum channel loudness and deviation to less than half of that to provide space for the difference information and a control signal.

### Encoding the signal

Left and right audio signals are supplied to a matrix circuit that produces a sum and difference channel output (see Figure 1).

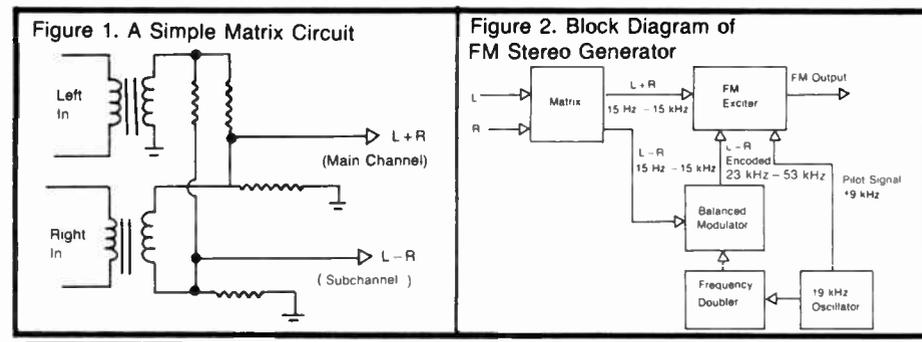
The sum channel is supplied directly to the exciter of the FM transmitter, and is modulated as a conventional FM signal. The L-R signal is encoded and transmitted superaudibly.

A 19 kHz "pilot" signal is transmitted continuously at 19% modulation as a control signal for detection purposes in the receiver. It is injected directly into the exciter.

The 19 kHz signal is also doubled and supplied to a balanced modulator, resulting in the production of two AM sidebands without a carrier. This process moves the L-R channel into the 23 kHz to 53 kHz range, well above the spectrum of human hearing.

This method of L-R transmission is required to control the wide frequency swing, equal to the main channel deviation, enabling both channels to have equal fidelity and loudness (see Figure 2).

As previously mentioned, loudness



levels of both channels are reduced below those of FM monophonic broadcasts to accommodate the difference channel. Maximum modulation for both channels at any instant cannot exceed the following parameters:

Channel	Modulation
L + R	45%
L - R	45%
Pilot	10%
Total	100%

Since stereo FM was introduced, the noise resulting from the lower modulation levels of the sum and difference channels has reduced the overall coverage area of an FM station.

Over the years, several ideas have been promoted to address the signal loss, while others assumed that the lost coverage area was irretrievable. Individuals accepting the latter thought have proposed allocating additional FM broadcasting facilities in the areas where the signal is lost due to stereo transmission.

### FMX system

Recently, a new transmission system known as FMX has been jointly proposed by CBS Technology Center and the NAB.

FMX uses technology that was not readily available when FM stereo was developed. To reduce noise, the L-R signal is compressed at the transmitter and expanded at the receiver.

The new signal is encoded within the

same frequency spectrum as the conventional FM stereo signal, but is separated through a 90° phase angle.

Conventional stereo receivers will only respond to the standard difference channel signal. Receivers with the FMX decoder will receive the FMX signal and operate at a lower noise level.

Preliminary tests of FMX transmissions have demonstrated that almost the entire monophonic coverage area can be recovered while transmitting an acceptable stereo signal. FMX should also improve acceptable stereo signals in a mobile environment.

FM stereo has been the success story for all FM broadcasters. It is hard today for anyone to comprehend the situation FM was in during the 1950s.

FM stereo was also important in promoting other media: stereo records and tapes.

Stereo disc recording was introduced in 1957 and was not immediately accepted by record collectors. Many individuals had invested a lot of time and money into home-built, high-fidelity systems, and were not interested in immediately making a new investment in stereo.

FM stereo provided listeners with the opportunity to listen to stereo recordings before purchasing them. It was a great sales force for the recording industry, as well as an innovation that probably saved FM broadcasting from extinction.

## CD Convert

(continued from page 29)

Well, there was this jack for a clock on the back of the player. It just seemed to want to have a varispeed control accessory plugged into it. Having a drawer full of crystals for production effects could be a bit of a hassle. So the "Speed-Demon" microprocessor varispeed controller project evolved.

The SpeedDemon front panel has a digital display of the percentage of speed offset, and up/down controls. It also has a display mute so that not everyone who wanders through the studio can note your speed offset. (I don't want to escalate this speed war but, as Bob Orban says, "We just make the guns, we don't shoot them.")

The last element of the SpeedDemon front panel is the result of conversations with several programming types. I added a key-locked switch to limit access to the speed control buttons and prevent unauthorized observation of the display.

Straight Wire Audio took these two things to the NAB show, and the reaction was unqualified acceptance and enthusiasm. I've never seen such positive reaction to a new product. I'd like to thank everyone who took the time to stop by our booth to say "Hello."

Happy trails and stay straight!

## The Studio Timer.

The TM-1 is the versatile studio broadcast timer.

Five bright, 5/8" high LED's display time up to 9:59:59. Front panel push-buttons allow operator control of all timer functions.

Rear panel, barrier strip connectors allow complete remote control plus provide six machine reset functions.



Make any production or air studio more productive with the TM-1 studio timer from Radio Systems.

### Specifications:

**Displays:** Five, seven segment, 5/8" high LED's

**Time base:** Line

**Rate:** One second increments

**Count:** Up-time

Contact your favorite dealer or call...

**RADIO SYSTEMS INC.**

5113 W. Chester Pike, Edgmont, PA 19028 • 215/356-4700

Call 800/523-2133 (in PA call 800/423-2133)

# Buyers Guide

Antennas, Towers & Cables

## WCXR-FM Picks Alan Dick

by John Bisset, CE  
WCPT/WCXR

Washington DC . . . In the United Kingdom, the Alan Dick Company has been responsible for the vast majority of the FM and TV antennas in use. Just recently, their antenna technology was made available in the US through LeBlanc and Dick Communications of Laurel, MD.

### User Report

Before one labels Alan Dick as "just another antenna company," consider their accomplishments: In the 1930s, the BBC had a mandate to install television transmission facilities for Great Britain. Because of the unique topology of the UK, the BBC specified that the transmitted power cover specific areas. With these demands, the first directional panel antenna was born, designed and patented.

Several years later, as FM evolved, stations were required to multiplex their signals from one common antenna. This required broadband antennas, pattern-shaping and filtering. The pioneering technology was developed by EMI, which was acquired by Alan Dick and Company in 1979.

Since the 1950s, research and development has continued on the directional FM antenna. To say that the British have a good antenna is an understatement. In addition to Dick's many years of experience, their FM panel antenna achieves its directional pattern in a manner unlike most American counterparts—which brings us to why this antenna is so unique.

The tower structure is first screened; that is, the entire tower face is covered with wire mesh screens that serve as backing screens for the dipole antennas.

Even the tower corners are screened (both in width and aperture), which provides a continuous flow of current around the tower. More important, however, is the elimination of the pattern distortion caused by the tower structure or pole.

#### Additional benefits

An additional benefit is that the screens reduce the field of the antenna on the tower. Thus, it is possible to climb through the tower structure, where the bays are located, while the antenna is on the air. This greatly reduces down-time due to maintenance, especially on a tower with more than one antenna mounted on it.

Since the screening makes the tower structure negligible with respect to pat-

tern distortion, a computer accurately predicts the FM coverage pattern. One bay of the antenna is constructed (using the computer analysis), and full-scale testing begins.

#### Power splitting and phasing

Most directional patterns are achieved using reflectors or parasitic elements that intentionally distort the pattern. However, the Alan Dick Company chose to obtain directionality in much the same way AM broadcasters do—by power splitting and phasing the RF fed to each panel.

Each face of the tower is fed with the correctly phased signal to provide the desired pattern.

Power is not wasted. In the case of a Class-B FM, with directional requirements specifying 8 kW in a certain direction, for example, the power fed to the panels pointed along that bearing is reduced. This advancement over parasitic

cancelling ensures accurate coverage.

The actual dipoles are crossed. Described as a crossed dipole panel, the pair of dipoles are mounted 90° to each other. The dipole arms are then angled back toward the screening frame, resembling a spear or arrow.

A glass reinforced plastic radome protects the dipole feed points from icing. The distribution feeder system is responsible for splitting, phasing and distributing the incoming RF to each panel's crossed dipole.

#### Construction, performance

Construction of the antenna elements is impressive, ensuring first-class, rugged quality.

The antenna's performance is just as astounding. Table 1 lists the system VSWR, as measured looking into the transmitter input of a Delta 6740B Coaxial Transfer Switch coupled to a notch  
*(continued on page 32)*

## FMs Select Shively

by Mike Langer, Stn Mgr  
KHFM-FM

Albuquerque NM . . . Ten years ago, three Albuquerque NM Class-C FM stations simultaneously applied for construction permits for one 50' x 50' plot of mountaintop land atop Sandia Crest, adjacent to Albuquerque.

Since three towers and three separate antennas were out of the question, the three stations, KHFM 96.3, KRKE 94.1 and KMYR 99.5 (now KMGA) elected to use a Shively triplex-combiner and master antenna system.

### User Report

After investigating several manufacturers' equipment lines and prices, a Shively 6814-6 master antenna was chosen in conjunction with band-reject cavities for enhanced isolation. The system was installed upon delivery and has performed flawlessly ever since.

Maintenance has been limited to combiner filter cleaning, antenna tower bolt-tightening and inspection. The tower is a Pi-Rod 60' pole mounted on a 50' self-supporting tower.

Despite frequent 6" radial ice loads, the tower and antenna have suffered no damage except for one occasion when a large block of falling ice cracked one radome. The radome protected the antenna bay, which fortunately was not damaged.

The Shively triplex-combiner and common master antenna system was also chosen for electromagnetic compatibility with the many two-way radio users who suffer from intermod products that plague the site. Recent US Forest Service estimates show over 400 active radio users on over 500 licensed frequencies.

The Shively combiner, with its measured on-site 50 dB port-to-port isolation, provides negligible intermodulation among the FM transmitters. In an extensive clean-up of the site, the FCC, FAA, IRAC (Interdepartmental Radio Advisory Committee) and the Forest Service spent three days testing for and removing sources of reradiated intermod and locating transmitters in which sum-and-difference mixing was taking place.

Most of the FM stations on Sandia Crest received notices from the FCC and were forced to install cavity filters or take other interference reducing measures.

The three stations employing the Shively combiner were found not to be creating any spurious emissions.

The isolation among the three transmitters using the combiner was much greater than it would have been had the three transmitters used separate antennas.

#### SWR, SCA concerns

Since any tuned circuit added to a transmission system could have an impact on bandwidth, and could thus affect the quality of the transmitted signal,  
*(continued on page 37)*

## THE SOURCE



"maximize  
your  
system"

CTR124 \$3,465.00 mfg. list  
CTR112 \$2,060.00 mfg. list

"minimize your cost"

CTR14 \$2,350.00 mfg. list  
CTR12 \$1,325.00 mfg. list

for your special price

CALL 1-800-223-8202  
In Florida and Alaska call 305-651-5752

**ELECTREX COMPANY**  
18620 N.E. 2nd Ave., Miami, Florida 33179  
Telex: 51-4733 ELECTREX MIA

## Buyers Guide

# KQTZ Saved From Lightning

by Al Fuchs  
VP Fuchs Broadcasting Co.

Hobart OK . . . KQTZ-FM, Hobart OK, went on the air in 1979 with the help of a dissipation array system built by Lightning Eliminators and Consultants, Inc. (LEC).

The station's tower is atop King Mountain (a 1000' mountain in south-west Oklahoma), which makes it extremely vulnerable to lightning strikes. In previous years, both the Oklahoma Highway Patrol and the Western Farmers Electric Co. operated two-way radio repeaters on that same mountain, but they abandoned the use of the location because of constant lightning-induced damage to their equipment.

### User Report

Despite the problems incurred by others atop the mountain, we still used the location because of its desirable height. We decided that the lightning problem could be dealt with.

#### LEC backs system

LEC guaranteed that its antenna array would eliminate all lightning strikes, providing the unit was installed properly. The company also assumed all liability for losses resulting from poor system performance.

At the time, LEC had more than 100 systems in operation. With this in mind, and given the fact that lightning could cause damage amounting to several

thousands of dollars (not to mention the loss of air time), we chose their system.

So far, the system has proven to be a sound investment.

#### Power line problems

Besides eliminating lightning strikes to the tower, it is also important to ensure protection from lightning coming through the power lines. We felt that the competing systems on the market could not handle the destructive surges and transients unique to our situation.

In addition, we were sure the gas discharge devices could not give us the protection we wanted in our particular environment. High voltage spikes could seriously damage our transistor equipment. Therefore, we chose the LEC surge eliminator for the 120/240 3-phase power coming into our building.

The special inductive choke in this unit, together with the high energy controller and the voltage controller, has managed to keep lightning strikes on the power lines from entering our

equipment.

Our original unit offered 5,500 joules per phase maximum surge energy protection. But when lightning damaged the unit's dissipators, which also resulted in

“ “ —————  
The unit has stopped the lightning from “spooking” the computers on our automation systems.  
————— ” ”

the loss of a high voltage rectifier in our transmitter, LEC replaced, at no charge, all three dissipators with the 50,000 joules protective unit.

The surge eliminator's specifications include a response time of 5 ns or less, and it calls for internal energy dissipation of 50,000 joules per phase. The unit

is to be installed ahead of the power distribution panel.

We were so pleased with the surge eliminator that in the spring of 1984 we installed another system on our 120/208 3-phase power at our new studio.

Again, the unit has stopped the lightning from “spooking” the computers on our automation systems. Don't forget how important it is that the ground system be installed properly, because just one lightning strike can cause a great deal of costly damage.

I must admit that at first we were very skeptical that anything could prevent lightning damage. However, given LEC's research over the years, and the fact that it was their neck if the unit didn't work, we were willing to make an investment to protect our equipment.

To date, we have never had a lightning strike on our King Mountain tower. As I'm sure you know, such reliability is important when you're fighting to keep a radio station on the air during severe weather.

*Editor's note: For more information, contact Al Rich at Lightning Eliminators and Consultants: 213-946-6886.*

## Classic Rock FM Picks Alan Dick Co

(continued from page 31)

filter tuned to reject 106.7 MHz.

It should be noted that the VSWR figures were obtained without fine-tuning or use of an adjacent matching network. The antenna and power distribution network was installed, and the antenna was swept, with the results shown in Table 1.

In addition to the extensive pre-installation planning and pattern development

provided by Alan Dick and Company, service, both during and after installation, was admirable.

Two boxes of bolts for the screens were shipped, via Concorde, when it was determined that these had been omitted from the original shipment.

An in-depth engineering handbook was provided. In addition to containing all testing data and specifications, a complete set of blueprints of the antenna was

also included.

It's a broadcast engineer's dream come true! At last, a company that isn't afraid to share some of its knowledge with its customers, and back it up with documentation.

The Alan Dick Company has indeed removed some of the hocus-pocus that has veiled FM directional antennas for years, and at the same time provided a predictable antenna that works.

Speaking of the antenna's performance, it's unbelievable. The computer-predicted versus test-range-measured contours are almost identical. The market coverage is just what the GM and PD wanted, so everyone was pleased with the results.

*Editor's note: The Alan Dick Company is represented in the US by LeBlanc and Dick Communications, Laurel, MD. For more information, call Glen McDonald at 301-498-2200.*



FM Antennas  
FCC Directionals • Multistations  
Rigid Transmission Line  
Pattern Studies  
Combiners

### Shively Labs

a division of Howell Laboratories, Inc.

51 Harrison Rd  
Bridgton, ME 04009  
(207) 647-3327

TWX-710-223-8910 SHIVELY BRGT  
call or write for more information

Circle Reader Service 35 on Page 29



#### SPECIAL ENGINEERING ....

Such as helping you to conform to the new FCC/ANSI standards for non-ionizing radiation. We offer half-wave spaced FM antennas at all power levels designed to significantly and economically reduce downward radiation.

### Shively Labs

a division of Howell Laboratories, Inc.

51 Harrison Rd  
Bridgton, ME 04009  
(207) 647-3327

TWX-710-223-8910 SHIVELY BRGT  
call or write for more information

Circle Reader Service 50 on Page 29

Table 1. System VSWR

Frequency (MHz)	VSWR
105.7	1.07
105.8	1.05
105.9	1.04
106.0	1.05
106.1	1.06

\*Measurements were made using a spectrum analyzer, tracking generator and an in-line coaxial reflectometer. 105.9 is the operating frequency.

## Buyers Guide

# Rohn Outlines Tower Project

by J.M. Fleissner, Export Mgr  
Rohn Towers

Peoria, IL . . . There are those who feel a tower is not "unique" since its main purpose is just to stand there and support antennas. There are also those who feel a tower is not technical or complicated and, therefore, does not require much thought or planning except for its height and whether or not there is enough room for guy wires. WRONG.

Choosing a tower can either be a nightmare or an easy job depending on the user's planning and foresight. Choosing a tower supplier goes hand in hand with selecting the electronic equipment to be used in the system.

The user has many responsibilities to define prior to selecting the tower. And without proper homework, the tower installation phase of the project can become a difficult and sometimes expensive experience.

## Planning

For planning purposes, don't be afraid to address such things as bad soil conditions, inaccessible sites, restricted guy radius, unlevel ground, local ordinances, etc. All these factors can seriously affect the end cost of the installation and should be considered up front.

A reliable tower company can help in the preparation of a detailed specification, or you can ask your system consultant to lend a hand.

Too often final details are overlooked. In the case of FM or TV broadcasters, a change in the antenna at the last minute can mean a change in the tower configuration, thus meaning delays and added expense for re-engineering and additional material.

In the case of AM installations, directional arrays can present some pretty tricky insulation problems. Your broadcast consultant can be the best source of information if the installation is unique in any way.

When selecting the end product, be certain a reliable manufacturer is considered.

It is the job of the tower engineer to provide the structure to do your job using the information you supply. A combination of computer design, quality control, precise manufacturing techniques, and a readily available sales force is the key.

## EIA Standards

The Electronic Industries Association (EIA) is very specific about designing and supplying communication structures. EIA Standard RS-222 is used and recognized worldwide for design fabrication and installation of towers.

Reliable tower manufacturers use this standard to provide a structure specifically for your application.

A well designed tower will provide the most cost effective and structurally sound installation. Remember, to take the best advantage of this technology re-

quires the proper input from the user.

Depending on locality and personal preference, a tower can increase in price because of several factors. Such things as local building codes can increase costs in some cases as much as 50%. Hardware, such as climbing ladders, platforms, etc., although they perform a function, add

windload to the structure and thus cost.

If possible, keep the structure simple. This will not only keep the initial cost down but will decrease maintenance in the future.

The following is a very brief, but effective, specification for getting a quotation for a tower to fit your needs on an FM

application:

- Tower height—340' overall.
- Configuration—guyed; 200' guy radius.
- Windload—Zone "A" per EIA RS-222 latest revision; no ice.
- Antenna load—6-bay FM antenna  
*(continued on page 34)*



**"We're putting out 50 kw of AM Stereo and we've never sounded better."**

Morris Blum  
President and General Manager,  
WANN Radio, Annapolis, Maryland

"As anyone who's been in this business a long time knows—if you don't move ahead, you're left behind.

"We've just upgraded WANN to a 50,000 watt, four-tower directional array. We now reach a potential market of six million people.

"That—along with a new urban contemporary sound—means that WANN is moving ahead, planning for the future . . . and sounding better than ever.

## "And Of Course, We're In Stereo"

"AM Stereo is the most phenomenal sound I've heard in 40 years of owning this station.

"We sound absolutely great in stereo—a purer, cleaner high-quality signal. We even sound better in Mono.

"And you can be sure AM stereo receivers are coming. By next year, over 30% of all new cars will have AM Stereo. And we're ready to capture those listeners right now.

## "Naturally, I Chose Delta Electronics"

"When I decided to upgrade to AM Stereo, I chose Delta Electronics. Why? Because Delta's been around a long time, providing precision equipment to the broadcast industry long before they came into AM Stereo. They know my business and they know what they're doing. They installed my C-QUAM® stereo system without a hitch.

"And Delta's C-QUAM system is rugged and reliable, built to

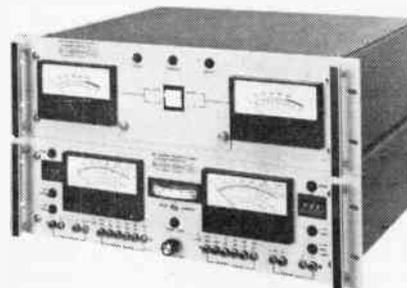
work the way it should. Literally trouble-free. Plus, it's got the numbers to back it up: over 65 systems operating in the U.S. and worldwide.

"Even better, Delta stands behind it with full technical and service support. Any problems or questions—I just pick up the phone. They're always ready to help.

## "Next Time You're In Annapolis . . ."

"Stop by and I'll personally give you the deluxe station tour.

"Better yet, turn your dial to 1190 and hear for yourself the new sound of AM Stereo—and hear where your listeners are going to be."



Delta's C-QUAM Stereo System: ASE-1 Exciter (top) and ASM-1 Modulation Monitor. FCC laboratory tested and type-accepted.

Delta Electronics, Inc.  
5730 General Washington Drive  
P.O. Box 11268  
Alexandria, Virginia 22312  
(703) 354-3350  
Telex: 90-1963

C-QUAM is a registered trademark of Motorola, Inc. Manufactured under license from Motorola, Inc.

DELTA ELECTRONICS



## Buyers Guide

# Stati-Cat Tackles Static Woes

by Pete Warren, Pres  
Warren Electronics

El Paso TX . . . Cortana Corporation's Stati-Cat dissipator appears to be the answer to lightning and static problems on antennas and towers (although I have thought of many other places one might want to eliminate lightning). After three years of experience with Stati-Cats, I am convinced they work.

### User Report

I met Ron Nott, president of Cortana Corporation, on a hotel balcony in Las Vegas at the NAB Convention. Our conversation got around to a lightning problem that was terrorizing Channel 63's transmitter site on Long Ridge near Alamogordo, NM.

He said, "I manufacture a product that I guarantee will eliminate your problem." He explained the system and how it worked.

I was familiar with a similar but more elaborate (and more expensive) system that NASA had used at a site which had hundreds of documented strikes per year for many years, and brought it to zero strikes per year (but I must say that I was a bit leery of an inexpensive, simple, small device that accomplished the same goal).

Well, I ordered three Stati-Cats (the minimum required) for the top of the Long Ridge tower. The results were fantastic!

Our performance improved from hav-

ing 10-12 microwave STL and backup, or transmitter, losses per month during the three-month stormy season, to zero losses in three years. After one season of no losses, I began recommending Stati-Cats to all my clients and specifying them on new installations, trying to keep 10 to 12 on hand at all times.

Other experiences in El Paso convince me of the Stati-Cats' worth on sites averaging one or more (usually more) strikes per storm that now have zero strikes.

One AM four-tower array that used to static-trip its transmitter three to four times per hour during a dust storm no longer does so, while the array across the street from it still does. That station's engineer has pleaded with management (and we even offered a special quantity price for the 12 Stati-Cats), but so far to no avail.

At home came the most revealing test of a Stati-Cat on my 66' amateur radio

tower. I installed only one Stati-Cat on the tower and got an idea when I saw a storm approaching.

I stuck a 0-10 ADC meter in series with

“ “  
After one season of no losses, I began recommending Stati-Cats to all my clients.  
” ”

my grounding system. During the peak of the storm, the meter indicated 2 A for over 10 minutes. The meter was surplus, but checks out with my Keithly and a Fluke.

DC resistance-to-ground from my

tower with the ground system detached, is 1,100 ohms. Two years later, I monitored my tower during what must have been the worst electrical storm in El Paso in 15-20 years (no meter this time), thankful I had a Stati-Cat on the tower when the tower lit up in a bright flash.

I ran to my ham gear (still connected) expecting the worst, only to find absolutely no damage. But I resolved to place two more Stati-Cats on my tower.

I believe in Stati-Cats and recommend and install them anywhere I can. With a retail of \$300 and discounts from us on three or more, they are a wise investment for any station.

Editor's note: For more information, contact Ron Nott at Cortana: 505-325-5336. Call the author at 915-533-2911.

## Planning For a Tower Installation

(continued from page 33)

na; assume 6 square feet projected area per bay, side mounted at top of tower.

- Transmission line — 3" heliax.
- Future loading for planning — 6 VHF/UHF antennas top 50'; 7/8" lines, 3 square feet each.

This will give you a basic tower. As long as you specify EIA RS-222, the engineering and fabrication techniques, than construction procedures are automatically taken care of—assuming the supplier can provide an EIA tower.

Obviously there are many variations

to the above 6 points, but EIA provides the basics, right down to the quality of drawings to be supplied with the finished product.

### Other considerations

Other considerations include accessories to be supplied with the tower material, including tower lights per FAA & FCC regulations (be careful, the FAA has just changed their lighting recommendations); paint, either factory applied or sufficient quantity for field application; climbing facilities such as step bolts, hor-

izontal braces, ladders, a safety climbing device and cable or rigid rail; and grounding material, both for tower base and guy anchors.

It is also advisable to briefly describe the site conditions, especially if the inquiry will include installation. You should assume the ground is level, and soil conditions should be considered normal as defined by EIA.

In addition, the site should offer easy access for men and equipment, concrete trucks, semi trailers, etc., with ample layout room and assembly area.

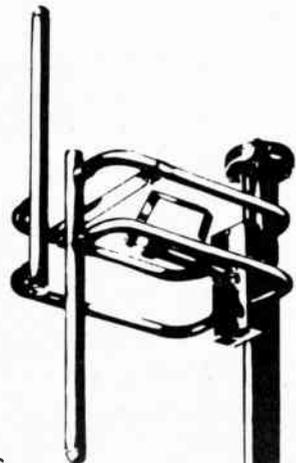
If conditions exist that can be considered normal, it will be to your advantage to define them as accurately as possible. The tower itself can remain simple in nature, but abnormal site conditions can change things drastically. Of course there will be differences depending on the tower application (whether an AM, FM, TV, or a combination). The important thing is to provide the basic parameters.

After you compare written offers from several companies, certain things will become obvious concerning the design and supply. In addition to the price, quality and assurance that you are making the right choice is important. Ask other people within your industry for recommendations.

There are those who feel a tower is the "most important" part of a communications system. Without this silent and unique structure, your system cannot operate. It's just as simple as that.

Keep your demands high; write the specs accurately and simply; make comparisons; and choose the right supplier. The job will go smoothly and the system will work properly if you do your planning and homework up front.

Editor's note: For further information on Rohn towers, contact the author at 309-697-4400.

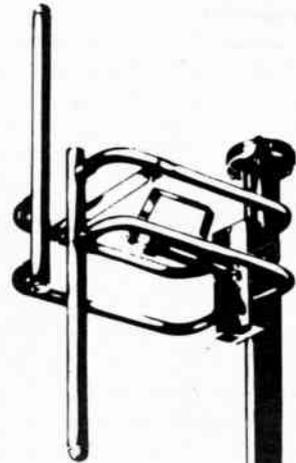


**MULTISTATIONS ....**  
From two to nine or more stations, Shively offers multistation components which have the industry's best specs. Branched or balanced combiners, side mount or panel antennas; whatever the requirements, Shively can supply.

**Shively Labs**  
a division of Howell Laboratories, Inc.

51 Harrison Rd  
Bridgton, ME 04009  
(207) 647-3327  
TWX-710-223-8910 SHIVELY BRGT  
call or write for more information

Circle Reader Service 4 on Page 29



**PATTERN WORK ....**  
In over a dozen years of providing formal directional patterns to both the FCC and DOC, Shively has never had a pattern rejected; ever. We've earned the trust of the industry in all aspects of pattern work. What are your requirements?

**Shively Labs**  
a division of Howell Laboratories, Inc.

51 Harrison Rd  
Bridgton, ME 04009  
(207) 647-3327  
TWX-710-223-8910 SHIVELY BRGT  
call or write for more information

Circle Reader Service 14 on Page 29

Buyers Guide

# WXTU Recommends Tennaplex

by Sam Garfield, Grp Dir of Engr  
Beasley Brdcast Grp and  
Don Powers, CE  
WXTU-FM

Philadelphia PA ... After two years of application processing, the FCC granted WXTU-FM, Philadelphia, a construction permit to move its transmitter facility from its far suburban site to the Philadelphia antenna farm known as Roxborough.

## User Report

Due to the shadowing geography of the Philadelphia market, the Beasley Group found it necessary to relocate the WXTU-FM transmitter into Roxborough, which is still within city limits. Using a tall tower at the site would provide line-of-sight coverage to both the city and metropolitan areas, where the existing signal suffered severe multipath and shadowing problems.

With the Commission's grant (15.5 kW at 900'), two new short spacings were created, requiring the use of a directional antenna.

### Antenna choice difficult

Selection of an antenna supplier proved difficult. During the pattern design of the WXTU antenna, each domestic manufacturer ultimately decided that the

**Tennaplex's ability to design and build an acceptable directional antenna for Philadelphia has helped create an exciting broadcaster-vendor relationship through the project.**

10' tower face of the new tower was oriented at azimuths that distracted from optimum coverage and pattern design.

Apparently, protection of two New Jersey stations would limit WXTU's signal over Philadelphia to levels far below the maximum power level allowed for a Class-B facility.

Tennaplex Systems was introduced to WXTU by engineer Jack Mullaney, PE. We've discovered that Tennaplex's ability to design and build an acceptable directional antenna for Philadelphia has helped create an exciting broadcaster-vendor relationship through the project.

The company's experience prevented the orientation of the WXTU tower

Figure 1. Horizontal View. Tennaplex FM CP Transit Antenna.

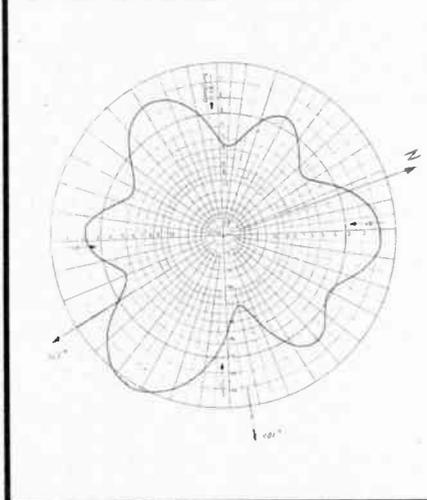
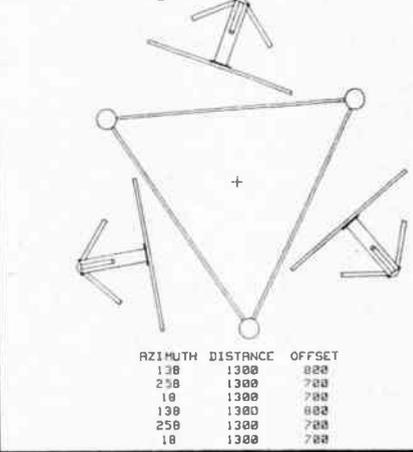


Figure 2. Top View. 2 Bays of 3 Radiators (Type 754/154). Triangular Tower; Facewidth is 3048 mm leg centers; One apex is 294 degrees.



from causing design delays or causing restricted coverage to the final design.

Tennaplex proposed a broadband panel antenna with mounting hardware that created new faces on our tower by using mounting combined with a phased panel array. This placed WXTU's full radiated power over Philadelphia while providing directional protection required by our CP (see Figures 1 and 2). Tennaplex satisfied our coverage needs.

The new antenna was delivered within eight weeks of the order date.

Modular in design, Tennaplex antennas are built from a standard off-the-shelf broadband panel (88-108 MHz) that requires no tuning.

The power dividers are also standard stock; only the phasing cables are custom designed. Cable lengths and physical panel mounting control the directional pattern shape, producing reliable results.

### Installation

During the installation, Tennaplex field engineer Ed Ritz was on hand to supervise the installation and sweep the antenna's bandwidth. The results were VSWR at WXTU frequency, and across the FM band, less than 1.05 with no field adjustments required. This directional antenna worked as well under power as it did when measured.

What sounded good even measured better. FM field intensity measurements using 30' height and standard 100' run techniques were made by Sam Garfield, group engineering director for Beasley Broadcast Group, which owns WXTU.

Measurements across six radials in New Jersey documented flawless performance of the directional antenna, placing coverage and suppression at levels expected. There were no surprises.

Further tests of the operating antenna were conducted by WXTU's first adjacent station, WOBB, Toms River, NJ. Their tests also confirmed that the Tennaplex design people had a grip on reality.

It was refreshing when WOBB, formerly an adversary to our site change project, was satisfied with WXTU's directional operation from the Philadelphia

antenna farm.

You might find interesting a rather novel approach at securing the WOBB final agreement to our CP.

On a Saturday morning, the Executive VP of Beasley, Allen Shaw, the group VP/GM of WXTU, C.J. Jones, Beasley's Garfield and I climbed into an automobile and specially equipped van and drove approximately 90 miles to Toms River for a 7 AM meeting with all of the

principals of WOBB and their engineers.

That entire day was spent driving throughout the WOBB coverage area taking field strength measurement readings. We were accompanied by a television crew which documented everything that was done, including interviewing the test participants. At the end of the day, everyone—from the president of WOBB to our own observers—was satisfied that the Katherin antenna fully met its design criteria.

After 12-plus years of problems in trying to get WOBB to agree to the transmitter site change in Philadelphia, a verbal agreement was finally reached that evening, and was formalized the following week.

To date, not a single problem has been detected with WXTU's directional Tennaplex Katherin antenna. The Beasley Group would recommend Tennaplex without reservation to any station seeking to upgrade a facility.

*Editor's note: For further information on Tennaplex antennas, contact Les Lear at 301-561-1999. Call Don Powers at 215-667-9000; or call Sam Garfield at 919-734-8000.*

## A 12 Watt Power Amp—\$6900! That's DC-X from Radio Systems.

The DC-PW has balanced inputs, an external gain control and 12 watt, 8 ohm output. Combine two in a single enclosure for stereo operation.

Like all DC-X Products, it can stand-alone with its universal enclosure and power supply (available separately) or be combined with other DC-X boards to build inexpensive studio systems.

Call today for the whole story on the DC-X network.



**RADIO SYSTEMS INC.**  
5113 W. Chester Pike • Edgemont, PA 19028 • 215/356-4700  
Call 800/523-2133 (in PA call 800/423-2133)

## Buyers Guide

# LBA Shows Off Folded Unipole

by Art Dellinger, Mgr of Tech Services and Ron Chaffee, Sales Mgr LBA Technology

Greenville NC ... Folded unipole antenna systems have recently become popular in the AM broadcast band because this approach affords the AM broadcaster significant advantages in efficiency, lightning protection and FM feedline isolation when compared to traditional "series-fed" antennas.

Because folded unipoles also offer increased bandwidth, they can contribute to successful AM stereo applications. Kits such as the LBA Technology UP-series can be readily added to existing station towers, with minimal modification needed for installation.

Folded unipole kit installations are feasible on a wide variety of guyed and self-supported towers. These systems are practical for use on both directional and nondirectional antenna systems, as well as for detuning reradiating structures in the vicinity of directional systems.

Happily, since the folded unipole antenna system shares the essential radiation characteristics of the series-fed antenna, regulatory considerations are straightforward. Prior approval from the FCC is not normally required to install a folded unipole. The FCC is ordinarily notified on Form 302 after implemen-

tation.

A typical tower equipped with a LBA UP-300 folded unipole kit is illustrated in Figure 1. By selecting the appropriate unipole configuration, excellent impedance and power handling capabilities are attained for most practical AM broadcast applications.

Custom folded unipole configurations are available for power levels of up to 100,000 W. Feedpoint resistance and reactance parameters are variable by physical adjustment of the folded unipole structure, permitting wide range impedance matching and facilitating reuse of existing antenna tuning facilities.

It is even feasible to directly attach the folded unipole feedpoint to a transmission line without an antenna tuning unit (ATU), where the tuning network harmonic reduction properties are not needed.

The desirable impedance characteristics of the LBA folded unipole came about because the feedpoint impedance of the folded unipole is determined by a transformation of the normal self-impedance of the tower on which the unipole is mounted. This transformation is highly complex and is governed by such parameters as the unipole fold wires and tower, and the number of fold wires.

As a generality, the distance from tower to fold wire determines the magni-

tude of the reactive base impedance component, while the height of the shorting ring assembly determines the resistive component.

The radiation characteristics of the folded unipole equipped tower are essentially identical to a series-fed tower of similar height. One fortunate difference is the reversal of feedpoint reactance with reference to the same tower when series-fed.

Therefore, a tower with the active folded unipole matching sections under an electrical length of  $90^\circ$  will be inductive (+j) when fed as a folded unipole even though it would otherwise be capacitive (-j) as a series-fed tower. A gain in apparent signal efficiency will often be noted, due to reduced losses and better matching.

Facilities with electrically short antennas and ground systems are particularly enhanced by the folded unipole. However, this "gain" should not affect the theoretical signal and interference contours.

Since the tower base is grounded during folded unipole installation, the LBA folded unipole avoids many of the notorious lightning problems associated with series-fed towers.

Furthermore, with a grounded tower, any number of FM, two-way, TV transmission lines, deicing or lightning conduits may also be secured on the tower without insulators.

The installation of a folded unipole should be carried out only by a competent structural contractor. Any question as to adequacy of the existing tower should be resolved with its manufacturer before mounting the unipole kit.

To comply with FCC RF radiation rules, the station should arrange to suspend transmission during the installation.

In most instances, installation of the LBA UP-series of folded unipole kits by

a single tower rigger and an assistant is straightforward, and typically takes less than half a day to accomplish.

In fact, a wrench, a screwdriver and a handline for lifting are normally the only tools required to install the unipole.

If you are adding the unipole to an existing tower, it is probably now equipped with a base insulator. This should be left in place, and at least two 4" copper straps should be brazed from the bottom of the tower structure to the ground system, thus "shorting out" the base insulator.

A similar bonding scheme should be used even if the tower has no base insulator, since excellent tower attachment to the ground system is a must.

All conduits and coaxial lines coming off the tower must be well-bonded at frequent intervals to the tower along their vertical runs. The importance of good bonding practices in any antenna installation cannot be overemphasized!

For stability, all wiring on the tower should be installed in conduits, particularly in directional systems. Proper grounding of tower lighting circuits is frequently overlooked. These should have the neutral bonded to the antenna ground system at the tower, and bypass capacitors should be attached from each hot side of the tower lighting system to neutral.

This procedure will eliminate possible impedance variations with flasher operation.

In some installations, it may be advantageous to mount ATU directly to the tower. This is possible since the tower is at ground potential. Such an arrangement eliminates the need to provide a support structure for the tuning unit, saves space and eliminates the ATU ground system copper strap.

Be sure that the tower-to-ATU electrical contact is excellent and permanent.

It is very important that the cabinet mounting provides adequate personnel clearances from the high voltage parts of

(continued on page 39)

## TRANSMISSION LINES

Planning a New System or Having Problems With Your Old One?



Only One Number to Call  
603-529-2500

- Free Consultation
- Better solutions at no extra cost

Systems with Reliability  
P. O. BOX 215  
GOFFSTOWN, N. H. 03045  
603-529-2500

# SWR<sup>®</sup> INC

Circle Reader Service 47 on Page 29

## RF Coaxial Load Resistors

5 KW to 200 KW

NEW!

... Model 5780 B  
80-Kilowatts Single Resistor



(CALL TOLL FREE)  
1-800-482-LOAD



P.O. Box 249, Yellville, AR 72687 (501)449-4093

## ALTRONIC RESEARCH INC.

For (OMEGALINE) RF Coaxial Load Resistors

Circle Reader Service 6 on Page 29

## Buyers Guide

# Mountaintop FMs Pick Shively

(continued from page 31)

several concerns were expressed to Shively when the system was being first considered. Among those concerns were SWR and SCA/stereo pilot interaction (whistles and birdies).

Shively assured the three stations that these concerns would not be a problem. Shively was right.

SWR is actually lower on the transmitter side(s) of the combiner than it is on the antenna side. Worst-case SWR has never exceeded 1:35 to 1, even with nearly a foot of radial ice on the tower and antenna randomes.

The three stations all employ 67 kHz subcarrier metering, and one carries Muzak. No problems with SCA/stereo pilot interaction ascribable to antenna or combiner have occurred.

While 92 kHz SCA operation has not, at this writing, been attempted by any of the three stations, Bob Surette of Shively Labs, assured us that the system should pass the 92 kHz information without difficulty.

The combiner system is forced-air cooled. Eager to commence operation when Program Test Authorization (PTA) was first granted, one FM station manager drove up Sandia Crest late in the evening, without his engineer, and began operating before the fan interlock was connected, and without turning the combiner blower on. The combiner sustained no damage—even after 18 hours of operation with no cooling.

## Diplexer-combiner installed

In December 1982, Albuquerque non-commercial stations KANW (89.1) and KUNM (90.1) commenced operation with a Shively 6810-6 master antenna and diplexer-combiner. When PTA was granted, the FAA installation located 200' away experienced intermittent interference from a weak intermod product on 269.3 MHz, an apparent mix of two times 90.1 + 89.1.

Measurement of the intermod product with a Tektronix 7L12 spectrum analyzer, using fundamental notches for 89.1 and 90.1, showed the product to already be 106 dB below both FM carriers.

A trap was immediately ordered from Shively which reduced the product to 113 dB below either carrier. Needless to say, measurement of signal levels this far down is difficult, and was done very carefully with the active participation of the FCC, which recorded the results of the adjustments.

Interference to the FAA's receiver did not change, however. Several days later, the interference was cured by banging on a tower about a hundred feet from the FAA site.

Sometimes a good pine 2 x 4 cures what high-tech cannot! Apparently the problem was caused by mixing from rectification in a bad tower or guy wire joint all along!

The Shively combiners atop Sandia Crest have required no servicing except for filter cleaning and blower motor lub-

rication. The antennas have received annual bolt-tightening and have performed flawlessly through radial ice up to a foot or more thick in an environment that typically sees one or two towers or antennas fail each winter.

The Shively master antenna systems have proven themselves, both mechanic-

ally and electrically, sound on a mountaintop that has been compared with Mount Washington for its severe weather and Mount Wilson for its electromagnetic congestion, requiring freedom from spurious emissions.

Sandia Crest, NM, the difficult site that it is, continues to be home for two

Shively systems that provide excellent performance for five FM stations enjoying combiner-master antenna systems and their attendant advantages.

Editor's note: For further information, contact Charles Peabody at Shively: 207-647-3327.

## OFFSAT<sup>®</sup> transportable

The Go Anywhere  
Mobile Uplink  
With a Record of Success.

The ultimate test of a mobile satellite antenna lies in its day to day use under all types of weather and uplink situations. Comtech's OFFSAT<sup>®</sup> has not only passed the tests but is rapidly becoming one of the most sought after mobile uplink systems in the nation.

Compatibility with FCC 2° spacing, compactness, quick setup, ruggedness, and dependability make Comtech's new OFFSAT<sup>®</sup> one of the best transportable uplink antenna systems available today.

Proof of Offsat's success in tackling and solving difficult uplink events is best described by some of its users:

"The Comtech Offsat Antenna was instrumental for the success of our four C Band transportable uplink trucks that broadcast the Live Aid Concert to over 1.5 billion people. The Offsat Antenna proved to our major clients that it was indeed 2° certified in performance tests we performed on their behalf."

Chris Morris  
Assistant Chief Engineer  
STARS  
Houston, TX

"Our Comtech Offsat Transportable survived the full force of Hurricane Gloria with NO loss of signal while providing uplink service for A.B.C. News."

William F. LaShell, V.P.  
CRESCOMM Transmission  
Services, Inc.  
Fairfield, NJ

"The 2° compliant Offsat Antenna from Comtech is an excellent small aperture performer. It's one of the best performing small uplink antennas available for transportable and temporary operations at remote sites."

Michael L. LoCollo  
V.P. Engineering  
Wold Communications, Inc.  
Los Angeles, CA

For mobile video, SCPC or data uplink, Comtech's 5.5 x 2.4 meter OFFSAT<sup>®</sup> is truly the professional's choice. For more information call or write Comtech Antenna, 3100 Communications Road, St. Cloud, Florida 32769. Telephone (305) 892-6111, TWX: 810-870-0220

TAKING THE LEAD IN SATELLITE ANTENNA SYSTEMS  
**COMTECH ANTENNA** A Division of  
Comtech Systems, Inc.

## Buyers Guide

# Market Calls for OMEGALINE

by Tim Roper, Marketing  
Altronic Research, Inc.

Yellville AR ... Transmitters, microwave components and power tubes require ideal dummy load conditions during designing, testing, adjusting and aligning.

The OMEGALINE RF series of coaxial load resistors (dummy loads), manufactured by Altronic Research, fills this requirement.

OMEGALINE load resistors are economical, lightweight, portable, non-reactive, direct, water-cooled dummy loads for terminating coaxial transmission lines.

All of the ceramic resistors in the loads are supplied through a sister company, Power Film Systems Inc., leaving Altronic in an advantage position for responding to customer needs.

### 80 kW load

When the market called for an 80 kW load with a lower pressure drop, higher energy dissipation, high frequency characteristics, superior UHF qualities and easier field maintenance, Altronic, in conjunction with Power Film Systems, developed the OMEGALINE model

5780B, a single resistor dummy load.

By eliminating one resistor and the mid-section assembly, potential problems were reduced. A single resistor dummy load also makes repairs much easier than the more common two-resistor 80 kW loads.

The OMEGALINE dummy load is a termination-type unit with characteristic impedance at the RF input and tapered to zero impedance (short circuit) at the opposite end.

### The center conductor

The center conductor is a tubular ceramic resistor with DC resistance equal to the characteristic impedance of the line.

The outer conductor of the coaxial line is a symmetrical, horn-shaped enclosure, contoured semi-logarithmically along its length to obtain an essentially reflection-free termination.

The RF dielectric medium consists of three distinct materials: the liquid coolant (in most cases ordinary tap water), a Teflon water jacket and the air space.

Coolant enters the load at the electrically shorted end, flows axially down the center of the resistor tube, mushrooms over into the annular channel under the water jacket, and makes a second pass

over the resistor in direct physical contact with both the inside and outside cylindrical surfaces of the resistor, providing optimum heat transfer with minimal coolant flow rate.

### Power, frequency options

All models of the OMEGALINE series of coaxial loads are rated for continuous duty and may be operated in any position at any power level within their rating, and with the proper water flow rate. OMEGALINE loads are available in models with power ratings from 5 kW to 200 kW.

The OMEGALINE terminations are designed to match the most common

high frequency transmission media—50 and 75 ohm coaxial lines.

The units are universal and operate over an extremely wide frequency range from power line frequencies to beyond the UHF band.

The impedance of the loads, in the language of VSWR (voltage standing wave ratio), is independent of frequency, water flow rate, and water temperature, and is almost purely resistive.

For all models, the VSWR is maintained below 1.1 to 800 MHz.

Below 100 MHz the input impedance can be regarded as purely resistive and equal to the DC resistance of the load.

*Editor's note: For more information, contact the author at Altronic: 501-449-4093.*

## New 1 1/4" Cable Ideal

by William Meola, Natl Sales Mgr  
Cablewave Systems

North Haven CT ... Cablewave Systems' new FLC114-50J, a 1 1/4" OD, low-loss foam dielectric transmission line offers another option to the broadcaster. Where 7/8" is questionable and 1 5/8" is "overkill," the 1 1/4" could be the ideal choice.

Manufactured to the design criteria of MIL-C-28830, the FLC114-50J is a closed-cell, low-density foam dielectric cable which exhibits loss characteristics significantly lower than medium- to high-density dielectric. Its outer conductor is annularly corrugated for flexibility and ease of bending, and serves as a high crush-strength factor and positive preventer of moisture migration.

The center conductor is a copper corrugated tube for additional ease of bending. By virtue of the cable design, the corrugated outer and inner conductor are totally captivated.

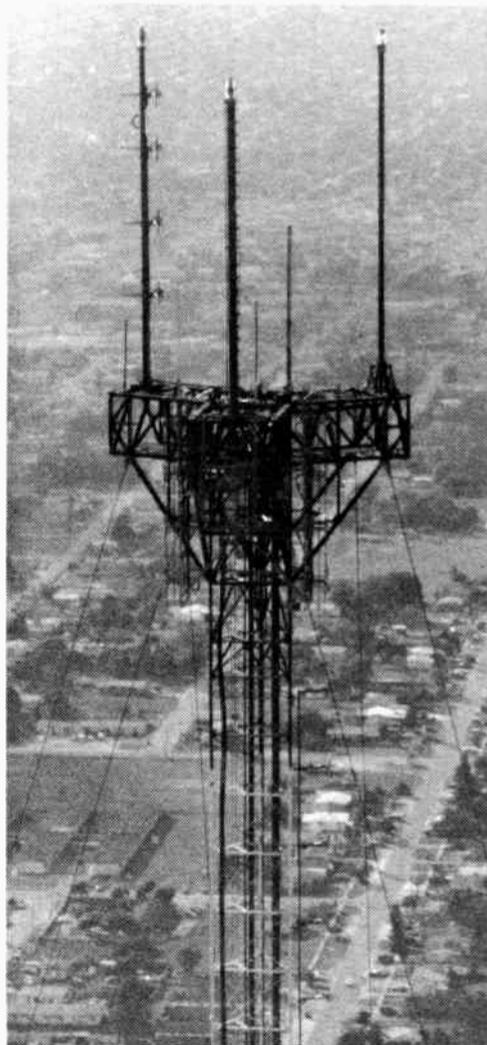
Thermal expansion, due to severe environmental change, is no problem with corrugated inner and outer conductors. Any expansion is absorbed in an "accordion" effect when both end connectors are fixed.

The parameters of the Cablewave Cellflex, type FLC114-50J, are indeed impressive. RF loss at 100 MHz is measured at .275 dB/100'. A typical 500' run has an efficiency of 73% and only 27% heat loss for FM application. A peak power of 188 kW makes this cable ideal for most low- and medium-power AM stations.

The cable's design is state of the art, with guaranteed quality construction and superior performance.

*Editor's note: For more information, contact your Cablewave Systems representative for Technical Bulletin No. 121 or contact Cablewave Systems: 60 Dodge Ave. North Haven CT 06473; or call Bill Meola at 203-239-3311.*

## We love a good challenge



### Challenge:

Design a panel antenna to protect a Class "C" License, with the center of radiation at 300 meters (1000 feet) on an existing tower, without interfering with a full array of other antennas already installed at that level.

### Solution:

First we prepared our optimum computer design, then we constructed a working scale model to run tests and, having satisfied ourselves that all specifications were being met or exceeded, we built the full size antenna. We mounted the panels, at the 300 meters center of radiation, on the arms of the candelabra at the top of the tower in bracing areas not normally designated for antenna positioning, having previously re-guyed and strengthened the tower to take the additional load.

### Description:

This seemingly impossible challenge was fairly typical of many we receive from broadcasters all over North America. It came from Mr. Joe Amatore, President of the Amatore Group. The two channel system is now meeting all expectations in Hollywood, Florida, serving the Miami/Fort Lauderdale markets.

Although we thrive on challenges, custom engineering is not our only business...we can do the simple jobs too!



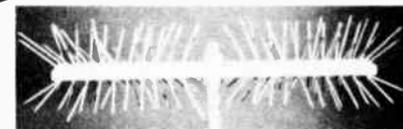
LeBlanc & Dick  
Communications Inc.

14440 Cherry Lane Court, Suite 201,  
Laurel, MD, 20707. Tel: (301) 498-2200.  
FAX: 301 4987952

STATI-  
CAT

Before the lightning season strikes,  
protect your valuable equipment  
with a Stati-Cat discharger  
for as little as  
\$300!

Eliminate Costly  
Lightning Damage!



Each Stati-Cat has 120 sharp, stainless steel points to provide a continuous low-resistance discharge path for the static electric charge found on all tall structures. Stati-Cat prevents the high voltage gradient between cloud and earth that eventually leads to the sudden, massive discharge known as lightning.

Write for a free brochure.

Also available from Cortana:  
Folded Unipole Antenna Kits  
Ground Radial Wire Detectors

Cortana  
Corporation

4001 LaPlata Highway  
Farmington, NM 87401  
(505) 325-5336

Mastercard/Visa

Buyers Guide

# Folded Unipoles Satisfy AMs

(continued from page 36)

the folded unipole. These same considerations apply to any other tower-mounted equipment, such as two-way radio cabinets.

Adjustment of the typical LBA folded unipole system is straightforward and requires only a radio frequency bridge, a signal generator, a communications receiver or null detector, and a frequency counter. However, experience with the proper setup, use and interpretation of impedance measuring equipment is critical to success.

In fact, it is strongly recommended that the station's consulting engineer be engaged for any antenna adjustment. The services of a tower rigger will also be needed for the adjustment to properly locate the folded unipole shorting ring. Time and money can usually be saved by adjusting the system when installed.

With the folded unipole installed and initially adjusted as recommended in the instruction manual, a series of measurements should be taken every 10 kHz in a band  $\pm 100$  kHz of the station frequency. Luckily, this initial setup often results in a feed-point impedance that is perfectly usable with "on-the-spot" modifications to the antenna matching unit at hand.

Care should be taken that resistance is not too low and/or reactance too high, which would result in losses or bandwidth problems.

Contrary to popular belief, there is nothing magic to a 50 ohm feed point as an adjustment target. If best bandwidth occurs at 150 ohms, for example, then that should be used. Bandwidth can be determined from these measurements and can be monitored if further adjustments are made.

If the initial impedance measurement is unacceptable, or you wish to further

explore matching options, then the fold-wire-to-tower shorting ring should be repositioned to yield a change of parameters in the direction desired. The position of the fold wires relative to the tower may also be varied to further facilitate reaching the desired parameters.

However, most users find maximum fold wire spacing best for stability and bandwidth. When the final feedpoint impedance settings have been achieved, measurements should be recorded for use with FCC Form 302 and for future maintenance.

We have found that very little maintenance has been required in LBA folded unipole kits.

Impedance measurements should be checked annually against the initial adjustment records to determine any system change or deterioration.

The tower and all tower-mounted components should be examined annually for damage and security, especially following any severe weather.

The associated ground system should also be checked for any deterioration, remembering that both the tower and ground system are extremely important to proper station performance.

Periodic checks for arcing and insulator cleanliness are also important when excessive salt spray is encountered (especially in high power applications).

In LBA Technology kits, the fold wire tension is calibrated and should be visually checked quarterly. In no event should the foldwires show slack.

After tower painting, check to be sure that paint has not been allowed to build up on insulators to the detriment of power handling capacity.

Finally, the base of the tower should always be kept clear of weeds and brush that can contact the radiating system and cause signal loss and instability.

A folded unipole can provide many benefits to AM stations. Greater apparent efficiency, superior lightning protection, simple installation of other antennas, and greater bandwidth for both AM mono and stereo performance are key benefits.

Installation requires a minimum of time and labor. The installation process itself also provides a wonderful opportunity to "tweak-up" other aspects of the station!

Once the installation is accomplished, only minor, routine maintenance is required to ensure many years of service from a folded unipole antenna system.

*Editor's note: For further information on LBA folded unipole kits, contact the authors at 919-758-4509.*

## Buyers Briefs

### Dielectric Communications

Dielectric's DCR-M series FM antenna is used primarily for broadband applications. It was designed for cases where a broadcaster needs to diplex two or more stations separated by less than 5 MHz into a single broadband antenna, or for cases where restricted aperture requires higher bay power densities.

With an input power capacity of 18 kW per bay, the DCR-M series has a peak power of 30 kW that can be applied to each bay while still providing a 30 to 1 safety margin to external voltage breakdown.

Dielectric's DCR-C and G series FM antennas with 1/2 wavelength spacing are extensively used for high power omnidirectional applications. Designed for reducing emission levels near a tower's base, both are available in a tapped feed configuration on 3 1/8" ELA transmission line, and can handle up to 40 kW.

For more information, contact Rick Broadhead at Dielectric: 207-655-4555.

### SWR Inc.

SWR's Clarion Waveguide UHF transmitting antenna, designed both for high power and medium power transmitters, can be tailored to specific coverage requirements. In terms of design, the Clarion is a slot cut into the wall of a waveguide support structure. Elevation and azimuth patterns are controlled by adjusting the phase and amplitude of the signal radiated by each slot.

Offering either coaxial transmission line or waveguide, the Clarion is a galvanized steel waveguide enclosed in a pressurized fiberglass radome. Input power capability is 240 kW for the omnidirectional design and 120 kW for cardioid designs. Upon request, SWR can provide elevation and azimuth patterns tailored to a coverage area. The standard model, designed for mounting on top of the tower, is horizontally polarized, but custom circular or elliptical polarization designs can be provided.

For more information, contact Jack Kruger at SWR: 603-529-2500.

Subscription/Reader Service Forms																																																																																																					
<p><b>Radio World</b> May 15, 1986 Issue Use until August 15, 1986 <b>FREE Subscription/Renewal Form</b></p> <p>I would like to receive or continue receiving <b>Radio World</b> FREE each month. YES NO</p> <p>Signature _____ Date _____</p> <p>Please print and include all information</p> <p>Name _____ Title _____</p> <p>Company/Station _____</p> <p>Address _____</p> <p>City _____ State _____ ZIP _____</p> <p>Business Telephone ( ) _____</p> <p>Please circle only one entry for each category</p> <p><b>I. Type of Firm</b></p> <table border="0"> <tr> <td>1. Commercial AM station</td> <td>6. Recording studio</td> </tr> <tr> <td>2. Commercial FM station</td> <td>7. TV station or teleprod facility</td> </tr> <tr> <td>3. Educational FM station</td> <td>8. Consultant/ind engineer</td> </tr> <tr> <td>4. Combination AM/FM station</td> <td>9. Mfg. distributor or dealer</td> </tr> <tr> <td>5. Network/group owner</td> <td>10. Other</td> </tr> </table> <p><b>II. Job Function</b></p> <table border="0"> <tr> <td>A. Ownership</td> <td>D. Programming/production</td> </tr> <tr> <td>B. General management</td> <td>E. News operations</td> </tr> <tr> <td>C. Engineering</td> <td>F. Other (specify)</td> </tr> </table> <p><b>III. Purchasing Authority</b></p> <p>1. Recommend 2. Specify 3. Approve</p>		1. Commercial AM station	6. Recording studio	2. Commercial FM station	7. TV station or teleprod facility	3. Educational FM station	8. Consultant/ind engineer	4. Combination AM/FM station	9. Mfg. distributor or dealer	5. Network/group owner	10. Other	A. Ownership	D. Programming/production	B. General management	E. News operations	C. Engineering	F. Other (specify)																																																																																				
1. Commercial AM station	6. Recording studio																																																																																																				
2. Commercial FM station	7. TV station or teleprod facility																																																																																																				
3. Educational FM station	8. Consultant/ind engineer																																																																																																				
4. Combination AM/FM station	9. Mfg. distributor or dealer																																																																																																				
5. Network/group owner	10. Other																																																																																																				
A. Ownership	D. Programming/production																																																																																																				
B. General management	E. News operations																																																																																																				
C. Engineering	F. Other (specify)																																																																																																				
<p><b>Reader Service</b></p> <p>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.</p> <table border="0"> <tr><td>001</td><td>021</td><td>041</td><td>061</td><td>081</td></tr> <tr><td>002</td><td>022</td><td>042</td><td>062</td><td>082</td></tr> <tr><td>003</td><td>023</td><td>043</td><td>063</td><td>083</td></tr> <tr><td>004</td><td>024</td><td>044</td><td>064</td><td>084</td></tr> <tr><td>005</td><td>025</td><td>045</td><td>065</td><td>085</td></tr> <tr><td>006</td><td>026</td><td>046</td><td>066</td><td>086</td></tr> <tr><td>007</td><td>027</td><td>047</td><td>067</td><td>087</td></tr> <tr><td>008</td><td>028</td><td>048</td><td>068</td><td>088</td></tr> <tr><td>009</td><td>029</td><td>049</td><td>069</td><td>089</td></tr> <tr><td>010</td><td>030</td><td>050</td><td>070</td><td>090</td></tr> <tr><td>011</td><td>031</td><td>051</td><td>071</td><td>091</td></tr> <tr><td>012</td><td>032</td><td>052</td><td>072</td><td>092</td></tr> <tr><td>013</td><td>033</td><td>053</td><td>073</td><td>093</td></tr> <tr><td>014</td><td>034</td><td>054</td><td>074</td><td>094</td></tr> <tr><td>015</td><td>035</td><td>055</td><td>075</td><td>095</td></tr> <tr><td>016</td><td>036</td><td>056</td><td>076</td><td>096</td></tr> <tr><td>017</td><td>037</td><td>057</td><td>077</td><td>097</td></tr> <tr><td>018</td><td>038</td><td>058</td><td>078</td><td>098</td></tr> <tr><td>019</td><td>039</td><td>059</td><td>079</td><td>099</td></tr> <tr><td>020</td><td>040</td><td>060</td><td>080</td><td>100</td></tr> </table>		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
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																																																																																																	
<p><b>Sales Call Service</b></p> <p>Please have a salesperson contact me about these items (list numbers):</p>																																																																																																					

## For RF-Related Products and Accessories

**CALL THE SPECIALISTS:**

- A. RF Specialties of Washington, Inc.**  
11721 15th Avenue NE  
Seattle, WA 98125  
(206) 363-7730  
John Schneider/  
Bob Arnold
- B. RF Specialties of Washington, Inc.**  
1810 Cliff Drive, Suite 163  
Santa Barbara, CA 93109  
(805) 682-9429  
Sam Lane
- C. RF Specialties of Nebraska**  
2003 Brewster Road  
Bellevue, NE 68005  
(402) 734-5521  
Don Denver
- D. RF Specialties of Texas**  
P.O. Box 8316  
Amarillo, TX 79114  
(806) 372-4518  
Don Jones
- E. RF Specialties of Florida**  
P.O. Box 397  
Niceville, FL 32578  
(904) 678-8943  
Bill Turney

Featuring Nautel and Broadcast Electronics Transmitters.

**RF Specialties Group**

# The inside story on *Flexwell* is performance

Flexwell Transmission lines offer low RF loss, smooth impedance coefficient, and conservatively rated power handling capability.

Flexwell utilizes a copper corrugated outer conductor, solid or corrugated inner conductor (depending on size), and a tough, durable, corrosion resistant polyethylene jacket suitable for burial and prolonged life. A low loss foam version called Cellflex is also available in 1/2", 7/8", 1 1/4" and 1 5/8" sizes.

In Canada: LeBlanc & Royle Telcom, Inc.

514 Chartwell Road  
Oakville, Ontario L6J 5C5  
Tel: 416-844-1242



Member of the Radio Frequency Systems Group

Air dielectric Flexwell in smaller diameters (1/2" and 7/8") offer a field proven, fixed helix design called Spirafil II, a single, continuous extrusion which locks the center conductor coaxially within the outer conductor, resulting in a linear impedance coefficient throughout the entire length of line.

Larger diameter air dielectric Flexwell Cables, (1 5/8", 3", 3 1/2" and 4 1/2") feature a unique vertebra helix design to achieve optimum crush and tensile strength. Its "pillar

effect", using less volume of dielectric, provides lower loss and higher average power handling capability due to the more rapid dissipation of heat from the center conductor.

Flexwell has it all: low loss, low VSWR, high power handling, smooth impedance coefficient, and rugged, long dependable life. Cablewave System's Flexwell is type accepted for sampling systems in accordance with FCC Part 73.68.

For complete details contact Cablewave Systems.

## **Cablewave Systems**

DIVISION OF CELWAVE SYSTEMS, INC.

60 Dodge Ave., North Haven, CT 06473

Tel: 203-239-3311

TWX: 710-465-0244

# CELWAVE