Published Twice A Month

Radio World®

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Vol. 12, No. 10 | May 15, 1988 | $2.00 Per Copy

NAB '88 Drew Record Crowd

by Alan Carter

Las Vegas NV ... If "largest evers" make for a success, then the 66th annual National Association of Broadcasters Convention and International Exhibition, held here 8 April to 12 April, can be so designated.

The NAB reported attendance at 46,871, up from 40,388 for the 1987 Dallas convention. Exhibitors totalled 723, compared to 696 a year earlier. Exhibit space was 383,400 square feet, compared to 313,000 square feet in 1987.

While the spotlight may have shone more on television—specifically surrounding advanced and high definition television—radio broadcasters found plenty to feast their eyes upon in the Radio & Audio exhibit hall in the Las Vegas Convention Center, specifically in digital developments. Exhibits also were at the Las Vegas Hilton and in an outdoor display area.

Many of the more than 120 engineering and management sessions also focused on radio issues.

A difference in this year's exhibit was the separation of radio and audio exhibits from the television displays. The exhibits were clearly divided, making it easier to focus on specific areas of interest.

Highlights of the show included a speech by President Reagan to approximately 4,000 at the Hilton Pavilion. The speech was transmitted by fiber optics to an advanced television theater and presented on high definition television.

This was the first appearance by a US president on high definition, 65 years to the day after President Warren Harding became the first president to make an address broadcast on radio.

The NAB presented Reagan with the "The Ronald Reagan Broadcasting Award" for "a lifetime of achievement and leadership through the effective use of the broadcast media."

Las Vegas desert and skyline casinos were the backdrop for NAB '88. Complete coverage begins on page 7.

Other highlights of the convention were the presentation of the Engineering Achievement Award to Jules Cohen of Washington DC and the Distinguished Service Award to former FCC Chairman Mark Fowler.

The 1989 convention is slated 29 April-May 2 in Las Vegas. The event travels to Atlanta in 1990 and returns to Las Vegas in 1991.

For more information on the convention, contact NAB's public affairs and communications department at 202-429-5350.

FCC To Include Mask

Washington DC ... A confrontation may be on the horizon between the FCC and the NAB over a notice of proposed rule making expected on an NRSC audio and RF mask standard.

Mass Media Bureau Chief Alex Felker said he instructed his staff to prepare a proposed rule making addressing both the NRSC audio and RF mask standard.

But neither the NAB nor the National Radio Systems Committee want the RF mask included in the rule making.

"The mask is still tentative. There was no sentiment at all (from the NRSC) for the RF mask to be discussed by the FCC," said Science and Technology VP Michael Rau.

The NAB last November asked the FCC to adopt the voluntary NRSC audio standard. It calls for 75μ sec preemphasis and a 10 kHz stopband.

Support was strong for the audio standard in comments filed as part of the AM technical review, with more than 700 stations having voluntarily converted.

The committee approved the transmission complement to the audio standard, the RF mask dubbed NRSC-2, in April at a meeting prior to the NAB convention. NRSC-2 addresses the signal from the transmitter out.

Agreeing with Felker's position during the meeting, Wilson LaFollette of the Mass Media Bureau said some are asking why the FCC should wait on the RF mask issue.

LaFollette said the two standards are related , but a proposal on a mask from the FCC may not be as stringent as what the NRSC wants.

Asked why the FCC would include the RF mask portion in the rule making when such a move is opposed by the group that helped develop the standard, Felker said the Commission wanted to address interference concerns.

"One of our important jobs is controlling interference, and to the extent that the RF mask goes in that direction, I think it is something that we definitely want to consider," Felker explained, add-

(continued on page 3)

Kudos To NAB For Exhibits

Washington DC ... Accolades are pouring in to the NAB about the exhibition at the 1988 annual convention, according to Exhibits Director Rick Dobson, although he acknowledged there were some problems.

"This was without question the most successful NAB in history," he said. "Every exhibitor I talked to reported record sales off the show."

Dobson said a radio equipment manufacturer, whom Dobson declined to name, reported selling eight transmitters at the show, having never before made a sale on the floor, only on follow up. "That gives a real good idea of how it went," Dobson added.

With the record size of the exhibit—732 exhibitors in 383,400 square feet—the NAB show now ranks among the top 20 in the US, according to Dobson.

This was Dobson's first year at the helm of the exhibit, a show that introduced some changes in procedures.

Dobson noted that concerns about use of the Hilton Center raised in 1985, the last time the convention was in Las Vegas, were not a problem this year. The Hilton was used as overflow in 1985 and floor traffic was slow.

For '88, Dobson said the Hilton was "part of the plan" from the beginning. Exhibit guest registration was moved there, and that section and outdoor exhibits opened a half hour before the main show in the Las Vegas Convention Center.

Dobson rated the changes directed at the Hilton a success based on requests from exhibitors who "insisted on being

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REGULATORY NEWS

Class A's Ask For FCC Action

by Alan Carter

Washington DC ... New Jersey Class A FM broadcasters seeking an across-the-board power hike claimed opponents raised unrealistic scenarios and challenged proposed remedies but not the basic premise of their proposed rule making.

The New Jersey Class A Broadcasters Association concluded, therefore, that the FCC should begin a rule making on their power hike request.

The group's reply comments to Docket RM-6237 noted that comments opposing the power hike "criticized the method chosen to provide relief" rather than the group's theory that the power limit for Class A broadcasters increasingly prevents them from effectively serving the communities and produces other "deleterious" effects within their current primary service contours.

"The benefits to be gained from the power increase outweigh any conceivable detriments," the Class A broadcasters argued. "Accordingly, the proposal is ripe for initiation of the requested rule making."

Several broadcast group owners who opposed the rule making in initial comments continued to note their opposition in the reply comment period.

The New Jersey group filed a petition for rule making last September that the Federal Communications Commission raise the current 3 kW Class A power limit to 6 kW.

In the reply comments, the New Jersey broadcasters focused on Class B concerns about the 54 dBu protection contour, noting that many stations are not receiving that much protection even now.

"With respect to Class Bs, the opposition's premise is that this class is entitled to protection to the 54 dBu contour," the New Jersey group wrote.

"Significantly, however, not a single one of the New Jersey's opponents has disputed the fact that, under existing separations, Class B and B1 stations have as often as not received significantly less protection to 54 dBu—widespread assumptions to the contrary notwithstanding."

New Jersey broadcasters maintained that the only thing consistent about Class B protection is a lack of consistency.

The group concluded that Class B interest will oppose "any meaningful relief" for Class As that affects "their assumed, but largely fictitious, 54 dBu protection—despite the fact that such operators would continue to dwarf Class As even under New Jersey's proposal."

The benefits to be gained from the power increase outweigh any conceivable detriments.

New Jersey Class As suggested the Commission may want to re-evalute the 54 dBu protection issue and conform Class B protection levels to that of Class As and Cs.

In the initial filing, some commenters, including the NAB, said they would accept power hikes on an individual basis.

New Jersey broadcasters disagreed with that proposal.

"It would guarantee that any relief for Class As would proceed at a glacial pace with manifold opportunities for opponents to use the regulatory process for the purpose of delay," the group stated.

"Given the limited financial resources of the average Class A broadcaster, it is likely that many Class As would be unable to afford the legal and engineering counsel necessary for the protracted litigation which could be required to secure grant of their applications."

Many broadcasters who expressed previous opposition to the Class A power hike stood steadfast in reply comments.

Tribune Broadcasting stated the move would undermine the Commission's FM mileage separation standards.

The result, the group owner added, would be significant deterioration of the coverage of Class B, B1, C, C1 and C2 stations through co-channel and adjacent channel interference from Class A stations.

Tribune also replied that proponents do not offer "specific evidence" to show that Class As are no longer able to render the local service to the communities of license that they were licensed to provide.

Greater Media, another group owner opposing the power hike, said the proposal "would provide at best limited benefits to Class A stations while causing runious interference to all other classes of stations."

Greater Media also argued that stations, including Class As, would suffer approximately a 2 dB increase in co-channel interference.

Greater Media also said all class first-adjacent stations would receive approximately 1.7 dB in additional interference, and second- and third-adjacent channel facilities would likewise experience increased interference.

"Such gains in no way justify the fundamental degradation of service to all other classes of stations which would result from adoption of the Association's proposal," Greater Media stated.

The docket number at the FCC is RM-6237. For information from New Jersey broadcasters, contact Robert McAllan at 201-774-7700.

FCC Clips

McNally appointed acting chief

The FCC appointed James McNally Jr. acting chief of the Mass Media Bureau's Engineering Policy Branch, in the Commission's Policy and Rules Division.

Starting his career with the FCC in 1969 as an engineer in the Field Operations Bureau, McNally worked from 1980 to 1984 in what is now the Mass Media Bureau's Engineering Policy Branch. In 1984, McNally joined the FCC's Office of Plans and Policy, although he returned to the Engineering Policy Branch in 1987.

McNally holds a General Radiotelephone Operator license and an amateur radio call sign, and has been active in the General Mobile Radio Service.

For more facts, contact the news media information office at 202-643-5050.

Tampa office moves

The address for the FCC Tampa office has changed, effective 18 April, to the Airport Executive Center, 22203 North Lois Avenue Room 1215, Tampa, FL 33607.

Public inquiries on telecommunications matters, complaints of electronic interference and schedules of radio operator examinations should be directed to the above address, according to the FCC. Operating hours for the new office are 8:00 AM to 4:30 PM.

For more information, contact the Tampa office at 813-228-2872.

Broadcast station totals

A total of 10,294 licensed radio broadcast stations were reported by the FCC as of 31 March. Of this total, 4,912 were AM broadcasters and 4,058 were FM facilities. The remaining 1,324, according to the FCC, were comprised of FM educational broadcast stations.

For more information, contact the FCC news media information office at 202-632-5050.

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Super Radio Design Completed

by Alan Carter

Washington DC ... "Super radio" designer Richard Sequerra has submitted the first-stage design of a new and improved AM-FM receiver to the NAB.

The NAB signed a $25,000 research and development contract with Sequerra, a Long Island NY-based consulting engineer known for his receiver designs, to come up with a "high quality" tabletop, multi-function AM-FM radio.

The executive committee also in April designated another $25,000 for building of prototypes.

In the end, Sequerra will design three prototype receivers with the only difference being the AM stereo decoder in each. One will be C-QUAM, the second will decode the Kahn ISB system and the third will be multisystem, decoding C-QUAM, Kahn and Magnavox, according to Sequerra's plans.

The design features include a "super little loudspeaker," Sequerra explained in an interview.

"The size of the box determines how many low frequencies you can produce, or how low in frequency you can reproduce," he said.

He has "optimized" the design for "performance out of that little box that will probably beat many of the hi-fi sets that you know of, in terms of its resolution and clarity," Sequerra explained.

The FM receiver is designed on the basis of Sequerra's large high quality $10,000 FM receivers.

"We used the same basic technology that I use in the biggest ones, with the most elaborate IF filters or selective circuits that have ever been used in the small radio," Sequerra said.

"These are computer derived filters. They are not just the plain little chips that you buy from Japan. These are very, very elaborate filters designed to give you the maximum separation with the minimum distortion."

The FM section also has no AGC, he noted. "There is no gain until you hit the limiter section, and all the gain is in the limiters."

The design includes selective circuits and amplifying circuits that are effective for signals that are "very, very large—the kinds of things you encounter in urban centers."

The radio will also contain an FMX decoder.

The super radio design has a builtin rotatable antenna.

The design contains an impulse noise blanker, a device Sequerra said senses possible AM interference noise.

"It detects this noise as being separate from the wanted signal," he explained, "and develops a control signal which blanks the performance of the radio for a very tiny piece of time—like one or two microseconds. It actually prevents these noise pulses from hitting the tuned or selected circuits."

He continued, "When a noise pulse hits a selective circuit, it gets stretched out in time so that the noise pulse that might be so short you could never hear it, once it is stretched through the selective circuits, becomes audible. This is a way to reduce the noise problem in AM."

And like the FM receiver, the front end of the AM section can handle a very large signal—in the area of a half volt, Sequerra said. "This is far greater than in any set on the market."

The AM receiver has two IFs in cascade or series. The first is a wide design of 10 kHz for AM stereo. The second is a narrow 5 kHz.

Among the elements Sequerra listed as available for use in the receivers are the Sanyo LA1910 multisystem AM stereo decoder and the Motorola MC13022 C-QUAM AM stereo decoder.

It will also tentatively have a Sanyo LA3440 FMX decoder; Sanyo LA3450 stereo multiplex decoder; Korin lowpass filter; NEC PD1703C-014 PLL/controller for AM-FM tuners; Sanyo LC-7030 PLL synthesizer for AM-FM tuners, and 10 kHz notch filter.

Among the "unresolved questions" in the design that Sequerra noted are the resolution of the tentative FMX and the Sanyo LA1910 multisystem AM stereo decoder, which he maintained "will work equally well for both C-QUAM and Kahn stereo."

Neither the design nor the panel layout have been finalized. The second stage of the project, according to Sequerra, is the design of the engineering breadboard prototype.

The design is "exactly what we were expecting," said NAB Science and Technology VP Michael Rau. "We look forward to the next step."

For more information on the "super radio," contact the NAB Science and Technology Department at 202-429-5346.

RF Mask Part Of Plans

(continued from page 1)

ing, "I think we are going to want to look at both."

Felker invited skeptics to provide details on why they believe it is too early to mandate an RF mask in comments.

He added, however, "it doesn't mean we can't start talking about it in some formal way."

A recommendation for Commission action could be forthcoming this summer, Felker said.

During the subgroup meeting, Ken Brown, manager of allocations and licensing for Capital Cities/ABC and an NRSC member, noted the committee's opposition to combining the audio and RF mask standard in a single rule making.

"It (the RF mask) is simply not ready for consideration by the FCC," Brown said. "It's just a first step. It's something from which people can work."

Brown later referred to comments filed with the NRSC that noted hesitation on adopting the voluntary standard.

Some concerns focus on use of a spectrum analyzer to measure the RF mask and another measuring instrument, the splatter monitor, which is still being developed. The splatter monitor is considered more economical for broadcasters to use, but the RF mask approved in April is based on use of a spectrum analyzer.

Questioned after the meeting about the FCC position, the NAB's Rau said he did not immediately know what position the association would take on a rule making addressing both standards. He noted the NRSC's opposition to making the RF mask mandatory but emphasized NAB's strong support for a rule making on the audio portion of the standard.

The contact for the NRSC is Stan Salek at the NAB, 202-429-5350. For information on the FCC's rule making procedure, contact the public affairs office at 202-632-5050.

Now That The Party's Over . . .

by Judith Gross

Falls Church VA . . . Like I said, nobody can digest the entire **NAB convention** in a single sitting, so now that it's over and there's been time to reflect away from the dazzle of crazy old Vegas . . .

The interesting thing about **DAT** is that while some stations see it as the latest gimmick in the **march toward digital**, some enigneers are holding back, waiting for the technology to prove itself.

One snag is the fact that any way you slice it **it's still tape**, with tape transport and all the tape-based little problems radio has been eager to move away from.

One thing it will be interesting to keep an eye on is **time code**.

Some of DAT's proponents are ready to begin incorporating time code into recorders and playbacks, all in the hope of giving DAT **electronic editing capability** for the future. Shouldn't be too hard to accomplish, since it's all very similar to videotape technology and editing.

Shouldn't be too expensive, either, because it's been around for some time. Then you can expect to see DAT replace reel-to-reels. But as **cart machine replacements**? Well, we'll see . . .

Speaking of DAT, **BSW** gave away a **Sony Pro model**, and the winner was **Todd Noordyk of WSHN** radio. Thousands entered, and BSW president Bernice McCullough pulled Todd's name out of the box on the last day of the show. Now don't say you didn't **get lucky in Las Vegas**, Todd.

And the winner is . . . BSW gave away a Sony DAT machine in the closing hours of the show.

☆☆☆

Took the **FMX road test**, (not to be confused with that *other* road test at the show). **Broadcast Technology Partners**, the FMX people had their own van with an FMX generator. (I like the nifty new FMX logo, guys.) You could drive around

Vegas and hear FMX switched into and out of the local stations.

What I heard was **no increase of multipath** effects, and actually in some cases the **multipath was lessened** when FMX was switched in. And there was a noticeable improvement in the nulls.

Plus as we drove further out into the coverage area of a station, you could hear FMX help the noise level and thus improve the stereo reception. So I give the BTP people good marks on promoting a **much improved product**.

But stations are still going to have to assess FMX for themselves, because in some cases the improvement was quite subtle and **benefits will vary** depending on the type of music a station plays and the way it processes the audio.

So the answer to the question, "**will it help?**" has to be answered individually. The CBS stations think it will. But at least we know **it couldn't hurt** . . .

☆☆☆

Musical jobs? What's always fun about visiting the NAB show is seeing the **same faces at different booths**, or in the case of broadcasters, same faces, different call letters.

Some of these we've told you about, but there was **Tom Ransom**, who you used to find at the **IGM** booth, busily attending visitors at his former haunt, the **Harris** booth . . . **Nick Solberg** and **Duke McLane**, formerly of **Concept Productions** and **Ward Beck** respectively, handing out **Media Touch** cards with their names on them . . .

Anders Madsen, who used to be with **Tascam** can now be found at **Pacific Recorders & Engineering**, meanwhile **John Kenyon** who was with PR&E was explaining all about mics at **Sennheiser's** booth . . . **Ron Schiller**, who had his own consultancy is now with a firm called **Tele-Measurements** . . . and **Mike Sirkis**, who did some design work for **Fidelipac** awhile back surfaced at the **Radio Systems** booth . . .

John Bisset, who was CE of **WCPT/WCXR** was back with his old pals at **Delta Electronics**, and although **Straight Wire Audio** didn't have a booth, **Bill Sacks** was spotted roaming about the convention floor in ham gear . . .

On the station side of things, **Margaret Bryant**, who **RW** readers may recall as the "broad" in broadcast engineer, has left sunny San Antone to brave the midwestern chill of Chicago. She's now working for **Group W's WMAQ**, the station it bought from NBC. It's a long way from Binghamton, huh Margaret?

☆☆☆

Okay, now that the great big party in Las Vegas is over, the question is, **could it go any longer**? Attendees and exhibitors are happily pointing out that the last day, when the exhibits went until 4 PM, was **not a throw-away-day**. So could there possibly be rumblings to the effect of making the show **another half day longer**? Watch and see . . .

There may soon be a new GM for **Harris Broadcast**. All we know is they're looking at someone with experience . . .

It's over 'til next year . . . all but the clean-up.

Had to buy the May issue of *Playgirl* (which I never do) all in the interest of the job. They had 14 winners of the **Sexiest DJ contest**, photos (and I mean photos!) and all.

So I had to wonder, how 'bout the engineers? *Playgirl* says it proved DJs can look as good as they sound, but they don't sound like much without the engineer keeping that sound together.

So how about a **sexiest radio engineer** contest? Any candidates?

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

OPINION

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 or MCI Mailbox #302-7776).

Antenna article misleading

Dear RW:

In Mr. Alexander's article, "Source Induced FM Multipath," which appeared in the 1 February issue of **Radio World**, I found several statements which were incorrect and misleading.

Let me start with the title itself. The multipath phenomenon is path related and independent of the internal operation of the source antenna; i.e. as long as the radiation characteristics and the location of the antenna (or the source) is unchanged, the multipath phenomena remains solely terrain and path dependent.

Therefore, the notion of "Source Induced Multipath" does not make any physical sense and it is an inaccurate use of these terms.

I also found his reasoning in arriving at certain conclusions totally inaccurate and misleading.

For example in relation with the input impedance of an antenna, he stated that "Some type of antenna matching schemes seem to be more susceptible to this phenomena."

He also asserts that "Antennas that use matching transformers and 50 ohm bays seem to have more trouble than the matched feed point type of antenna."

I don't think anyone who understands antennas would attach any credibility to these assertions. To begin with, he does not present any evidence to support his statement, in any part of the article.

I will assure you that even if he has any supporting evidence, the problem is not the matched elements, or matching transformers. His reasoning is not unlike a person who sees a blue color Ford and concludes that all blue cars are Fords. To clarify the matter, let us digress a little.

A matched element, on a matched line, would only result in a nominally matched system. To remove the line and junction mismatches, one still has to match the line at the input, otherwise the antenna system performs less than optimally.

This deterioration of performance is not because the elements are tuned, it is because the overall system is not tuned. In fact, a system with carefully tuned elements, if carefully tuned at the point of input, is far superior to an antenna system that has untuned elements, but is tuned at the input by known techniques.

Indeed, in such systems there is a substantial standing wave which deteriorates the antenna performance. In cases where there is a null fill or beam tilt designed in the antenna, any mismatch at the element locations result in non-uniform illumination and reduction in antenna gain.

That is why in such systems it is essential to use transformers at each bay, to ensure uniform illumination and maximum gain.

A matched element optimizes the power transfer and a matched feed system eliminates excessive standing wave and multiple reflections and transmissions. It is also a well known fact that a thoroughly matched system has optimum bandwidth.

All that is being said is that it is certainly possible that mismatches at the input point, whatever the reason may be, can have adverse effects on the signal. However, it is absurd to link such adverse effects to well matched elements, or well matched feed systems.

Dr. Ali Mahnad, PhD E.E.
Director of Engineering
Jampro Antennas
Sacramento CA

One Step Forward

The FCC's desire to begin a rulemaking to make both the NRSC audio standard and the RF mask mandatory is a positive step.

But now that receiver manufacturers and broadcasters have finally agreed on a way to help AM, some of the NRSC's original proponents seem reluctant to give the proposed rulemaking their full support.

The stumbling point is the RF mask, which would impose more stringent transmission standards than the FCC currently requires.

While some stations will undoubtedly balk at the more stringent transmission standard, the NRSC audio standard alone cannot insure relief from the second adjacency and overmodulation problems which plague AM.

Older transmitters especially need to be monitored for emissions which exceed the NRSC envelope. The benefits promised by the NRSC standard will not be entirely realized if transmitters can't conform to the more demanding specs.

In fact, adopting both portions of the standard will force stations to clean up their signals and upgrade the overall quality of their technical plants.

Receiver manufacturers also need to be reassured that the standard is truly effective before they will fully commit to the marketing of new receivers.

While the NAB and some NRSC members rightly point out the difficulties in measuring compliance with the RF mask, the strides made in developing a splatter monitor should help allay those fears.

The FCC has always concerned itself largely with transmission, not audio standards. In this era of deregulation, it may be easier to get a mandatory NRSC standard adopted if the transmission standard is also included.

A mandatory audio and transmission standard will go a long way toward cleaning up the AM band and bringing new radios to market. This is no time for its proponents to jeopardize its potential by not giving it their full support.

—RW

Radio World

Vol 12, No 10 May 15, 1988

Publisher: Stevan B. Dana
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Circulation Mgr.: Marion Alsup
Advertising Coord.: Simone Leeser
Production Dept: Jean Barnes, Mgr. Gina R. Rosario, Jeanne Pearson

Radio World (ISSN: 0274-8541) is published twice a month by Industrial Marketing Advisory Services, Inc., 5827 Columbia Pike, Suite 310, Falls Church, VA 22041. Phone: 703-998-7600. Application to mail at second-class postage rates is pending at Falls Church VA 22041 and additional mailing offices. POSTMASTER: Send 3579 forms and address changes to Radio World P.O. Box 1214, Falls Church VA 22041.

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The Needs Of The Many in AM

by Jeff Loughridge

Guest Editorial

Mechanicsville VA ... I read with great interest the Guest Editorial by Leonard Kahn (15 March **RW**). Frankly, I am embarassed for him.

It reminded me of the approach used by children to get even with their adversaries: having exhausted all of their limited resources, they resort to name-calling.

Mr. Kahn couldn't get beyond the first sentence without launching a "devastating" attack by claiming "some equate **RW** with Really Warped."

He also seems to rely on nuances and technicalities to discredit sources, as in the Patent Office Examiner prohibited by law to comment.

Well, in journalism that is called a "leak" and many leaks are more reliable than normal channels. Besides, how many who read this can say they have *never* spoken out of turn on an issue?

Mr. Kahn does, however, have a point as far as questioning a person's qualifications, bias and integrity before giving credence to that person's comments.

In pursuit of this ideal, I would like to see a list of the "some" Mr. Kahn referred to who equate **RW** with Really Warped. Is this an opinion, or have they actually played **RW** on their turntable?

It is only fair that I evaluate these people as well and determine what makes their appraisal of **RW** something I should consider. In fact, all **RW** readers should have the opportunity to evaluate those people's qualifications.

No, I'm not serious.

The point of this is to show how immature this latest approach can be and how it can go on and on forever with each step down the ladder, ultimately solving nothing, only wasting the time and compromising the integrity of those involved.

The fact of the matter is AM stereo can be a blessing to AM broadcasters everywhere, but only if the politics can be set aside and if the industry can pull itself out of the ditch it has driven into.

Unfortunately, someone is going to have to lose here. Of the original contenders, only Motorola and Kahn/Hazeltine remain.

The other developers took their knocks, but bowed out for the benefit of the industry. They could all still be in the ring, filing, counter-filing and litigating until AM stereo is dead.

Fortunately, those who have left the AM stereo competition saw it for what it was supposed to be: a business venture with a considerable risk (their system may not make it!) whose prime motive was to help the AM broadcaster.

Mr. Kahn seems to have forgotten about that risk, and can't seem to take no for an answer.

Nobody wants to lose money, and I'm sure a considerable amount has been invested in the Kahn/Hazeltine system (I wonder, though, what the ratio between R&D and litigation is).

But this has to end soon or Mr. Kahn may be regarded historically as the person who propelled AM to what could be its ultimate destiny: turning on hot water heaters.

Then stereo could be used to turn off air conditioners with one channel and hot water heaters with the other. At least my water heater wouldn't care about platform motion!

There is an interesting quote from the movie *Star Trek II: The Wrath of Kahn* that is particularly well suited for this situation.

Mr. Spock, having forfeited his life so that others may survive says, "The needs of the many outweigh the needs of the few."

There is enough irony in the film's title; I would like Leonard Kahn to think about the meaning of Spock's words.

Jeff Loughridge is a contract engineer and CE of five AM stations and four FMs. He can be reached at 804-730-1291.

ALLIED

The *FULL SERVICE* Broadcast People

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A *NEW* PRODUCT
Especially for our industry

ACM-1
AMPLITUDE COMPONENT MONITOR

The Instrument No FM or TV Station can Afford to be Without!

What is an AMPLITUDE COMPONENT MONITOR? The ACM-1 is a precise AM noise meter which connects to the RF sample on an FM transmitter or television aural carrier. A digital string display with 20dB of range exhibits AM noise for precise transmitter tuning. It interfaces with any remote control to sample and then read back a stable indication of AM noise. An adjustable alarm threshold can signal the station operator when AM noise has increased beyond a level you determine will cause reception problems. The nature of AM noise measured can be examined by the engineer with the oscilloscope output. Audio and data outputs are provided.

Why is it said of the ACM-1 that this is the first product no FM station can afford to be without since the advent of audio processing? For many years, FM broadcasters have turned to audio processing for better signals...a tailored sound for programmers... improved signal to noise ratio for engineers. In short, a good foundation for bigger audiences and more sales. Your signal path, however, does not end at the output terminals of your processing system! The STL, transmitter, transmission line, antenna, various impedance matches, atmospherics and terrain all play a part in the *consistency* of your FM signal. Now television operators, with the marketing requirements for stereo and improved audio quality, are discovering the same important reasons to provide the finest audio and separation possible.

The ACM-1 is designed to be a constant watchdog of the integrity of your potential RF signal. Natural shifts in transmitter tuning, tube aging, interstage coupling mismatches and antenna problems will all increase the AM noise in your FM transmitter. And it often goes undetected. (Except, perhaps, by station salespeople or management who notice variations in the signal, but are told the station is putting out "full power".) In fact, proper ongoing detection of AM noise is a BIG problem. Most stations' modulation monitors are at the studios where AM noise *cannot* be read! Even current modulation monitors which are located at the transmitter site may not give an accurate indication of precise AM noise null, since the detectors used are located at the end of a coaxial cable rather than at the transmitter output. And, until now, product technology has not offered a way to read the AM noise at the studio, or to alert the engineer that the AM noise is reaching a level which will audibly affect the station signal. The AMC-1 does all this and more...

It provides:

- — a precision tuning instrument for the engineer.
- — assurance of transmitted signal integrity for management and sales.
- — a constant readout for the programming staff that their "sound" remains consistent through the antenna.

Engineering consultants in the field have long proclaimed the need to maintain consistent minimum AM noise. And we are now hearing a lot more talk among station engineers about controlling AM noise. After several years of planning and research, this is indeed music to our ears.

Keep the Sound Consistent...with ACM-1!

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Radio World

NAB 1988 Convention & Engineering Conference REPORT

Las Vegas, NV 8-12 April

Technology A Key Motivator

by Alan Carter

Las Vegas NV ... Technology will be one of the "lightning bolts" affecting the broadcast industry during the next decade, according to NAB President and CEO Eddie Fritts.

In a state of the industry address opening the 66th annual convention, Fritts ranked technological advances, legislative and regulatory issues, and taxation and advertising restrictions as broadcasters' concerns in the coming years.

Also addressing the opening session were NAB Joint Board Chairman Wallace Jorgenson, president, Jefferson Pilot Communications, Charlotte, NC, and former FCC Chairman Mark Fowler, who was presented with the 1988 Distinguished Service Award, the industry's highest honor.

Although Fritts directed most of his comments on technology toward advanced television development, he recognized advancements in radio during the past decade including stereo FM, the introduction of stereo AM and new standards for AM transmission and reception.

"As we view the inevitable march of technology, we recognize it is not a new subject for our industry," Fritts said, "for, in fact, it has been largely built on technological advances. Broadcasters established and maintained the definition of the phrase 'broadcast quality' as standing for state of the art, the highest technical standards."

Directly concerning radio, Fritts said the association is exploring the feasibility of radio-only license renewal reform.

The Radio Futures Committee of the NAB and the RAB also is preparing a national media campaign to highlight radio's "pervasive role in the daily lives of all Americans." The campaign is designed to promote radio's "many contributions to our economy and our society," Fritts said.

In his closing, Fritts called the broadcasting industry's technical and policy challenges "more complex than ever before."

Jorgenson stressed the importance of NAB lobbying efforts on Capitol Hill and at the FCC, claiming the association had some "very big victories" in the 99th Congress.

"At the outset," Jorgenson said, "let me tell you that the NAB is in excellent shape."

He also noted that the board "confirmed" that NAB's primary mission is representing the broadcasting industry with Congress and the FCC. He called on broadcasters to support the government relations efforts by contacting Congressmen personally.

For the first time, the Radio & Audio Exhibits were in a separate exhibit area.

Photo by Jim Somich

Exhibit Showcase A Smashing Success

(continued from page 1)

in the Hilton again."

Difficulties that Dobson confirmed included a "very, very small percentage" of people who had rooming problems due to hotels overbooking.

"In my opinion, a couple of hotels really did not appreciate the no-show factor," Dobson said. "I believe a couple of hotels projected no-shows in double digits." NAB's rate, however, is only in single digits, he explained.

The Las Vegas hotels' experience with convention no-show rates apparently do not correlate with NAB's history, Dobson said. "We have some work to do with the Las Vegas hotels.

Another difficulty surrounded courier deliveries. Recipients complained of delays, which Dobson said occurred when convention hall teamsters distributed packages after delivery by couriers.

Couriers cannot make deliveries inside the hall, only to it. Under a union contract, teamsters then make deliveries inside the hall.

Dobson said he believed the delay occurred when the teamsters had to inventory deliveries.

To solve the delay, NAB will invite the couriers to set up pickup points outside the hall where recipients can get their packages personally.

Union squabble

A final ongoing situation, Dobson explained, is a disagreement between the IBEW and IATSE unions over set-up of stages and stage lighting.

IBEW claims the right to all electrical set ups, except where used in stages, work that goes to the IATSE. The disagreement is over displays in the exhibits that use models, lighting and equipment to simulate a stage, Dobson said. Both unions claim rights to the work.

Based on an 11-year-old precedent, Dobson said, NAB recognizes the "exhibit stages" as the right of IATSE.

"It is something that the two unions have not settled," he continued. "It's a very emotional situation because we are talking about dollars."

The Exhibitors Advisory Committee was scheduled to meet 20 April in Washington to address these issues, Dobson said. The meeting will also focus on the 1990 show at the Georgia World Congress Center in Atlanta. The 1989 convention and exhibition is 29 April-2 May in Las Vegas.

Rick Dobson can be reached at NAB in Washington, 202-429-5335.

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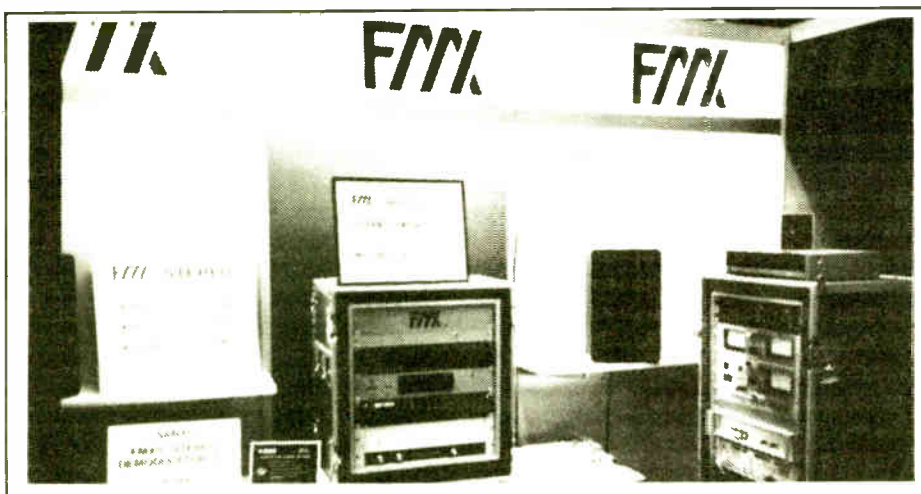
NAB REPORT



Prototypes of FMX receivers were demonstrated by the NAB.

Convention Sparks First Sales For FMX

by Alan Carter

Santa Cruz CA ... Inovonics made its first sales of FMX stereo generators at the 1988 NAB convention, a step President Jim Wood attributed to recent good publicity surrounding the noise reduction technology.

The manufacturer sold between 15 or 16 generators, either at the show or within several days, Wood said. Between 15 to 20 other broadcasters have indicated they are interested in buying "as soon as they can," he added.

Other generator manufacturers involved in FMX development said they received added interest from broadcasters during the convention, but still do not have a product on the market.

CRL, however, said it could have a compander card for its SG800A FMX-adaptable generator within 30 days after the first request comes in, said Sales Manager Bob Richards.

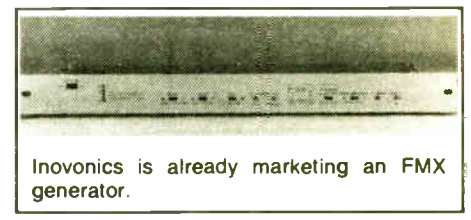
Sales begin

Inovonics sold 11 FMX generators to CBS Radio, which announced in April the network would convert its 11-owned FM stations to FMX transmission. Wood said the company sold 11 generators to one buyer, but declined to reveal the identity. CBS previously told **RW** it would buy Inovonics product.

"What can I say; the numbers are the same," Wood commented.

Inovonics sold four or five generators in separate sales, but Wood again declined to name the buyers.

He said he did not know if the broadcasters wanted to announce their purchases until the generators were operating and tested. When listeners know there has been a change in transmission, they sometimes imagine problems, Wood explained. Compliments or complaints made during anonymous testing


Inovonics is already marketing an FMX generator.

are more valid, he said.

Interest in FMX took a notable upswing during the NAB convention, according to Wood and other manufacturers.

"It's as if there were a rekindling of interest," Wood said.

"We are in a position to deliver and we are in the process of filling these orders."

Inovonics, at the present, has three units designated for stations to use in testing, Wood said.

Other manufacturers

CRL's Richards said his generator includes 80% of the FMX technology, with only a compander card left to manufacture.

"We have built that internally, and it does work," Richards said. "We haven't had any demand for it. If somebody wants it, call us and we will have it in 30 days."

At Orban, inquiries have increased "somewhat," according to Sales Manager Howard Mullinack. The company does not have a product on the market.

"We're still looking into the system itself," Mullinack said. "We haven't made any decisions on what to do. We hope to make a decision within a month or so."

Orban plans more on-air tests as the

(continued on page 16)

NAB REPORT

Digital Growth Slow But Steady

by Rob Meuser

Las Vegas NV ... The trend towards more digital and automatic broadcasting seems to be following the pattern of most earlier technological change: slowly and steadily.

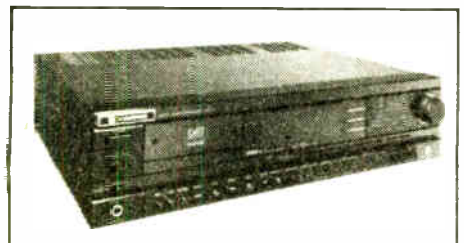
The cautious but steady approach seems apparent with today's digital equipment, all except CD players, which are virtually standard equipment for many stations.

The biggest surprises came in the latest technology to hit the broadcast arena: R-DAT, which is now simply reduced to the term "DAT."

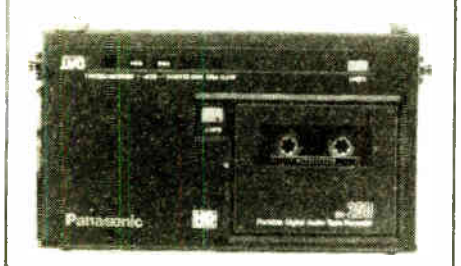
Panasonic introduced two pro machines, the SV-250 portable and the SV-3500 rack-mountable model. Both feature balanced inputs and the portable model weighs less than 3.2 pounds including battery pack.

Sharp unveiled its pro studio model, the SX-D100. Like many of the machines being marketed to the professional side of the industry, it seems to have a lot in common with consumer models, which have yet to reach this country in mass quantities.

Some of the pro vs. consumer debate has been heard before in the use of CD players. There are questions about such items as balanced or unbalanced inputs and infrared vs. hard-wired remote.



Harris introduced a DAT machine.



Panasonic's SV-250 portable DAT.

Harris has solved at least one of those problems with its DAT unit, the XD 001UH, developed under a joint arrangement with Aiwa. Harris has added a very attractive remote control and remote console control to the unit.

Over at the Radio Systems booth, a controller for the Sony pro model R-DAT unit was on display. Developed by Peak Audio, it allows for auto cueing, balanced ins and outs and complete remote interface.

Tascam also revealed its new R-DAT machine. This unit is more pro oriented than some, with a very heavy duty and well designed loading system.

Systemation demonstrated the new Marantz R-DAT player, a basically consumer oriented machine with good features and front panel presentation.

Then there is the Sony family of R-DAT Sony is the original machine introduced in North America.

The hottest CD entrants this year include the new Studer—Phillips A730 player. Not only does the A730 have the obvious balanced outputs for Pro audio, the unit goes much further.

Its CD recognition recognizes 100 different CDs and has up to three preset cue points for each one in memory.

The other level of pro CD players include the special types for DJ use or for automation.

The Denon CD cart is by now well known. And the duel seems to be on between the Sony CD jukebox mechanism and the 100 disc Audiometrics CD Jukebox.

Studer's new A730 CD player.

Now IGM is offering a multi-disc player as well. The CD-240 is so named because it can accomodate 240 CDs, more than the 100 disc capacity of the other multi-disc players.

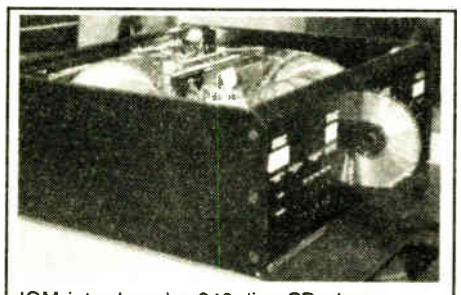
R-DAT and CD are not the only form of digital record and playback. Hard disk recording systems were in abundance this year.

Tascam also unveiled DAT gear.

CompuSonics demonstrated PC interfaces to its equipment.

The biggest and most elaborate of the playback systems was shown by Southern Broadcasting of Australia.

The system, called DAMS provides 500 minutes of hard disk storage, with back up. It can simultaneously feed two stations and record, either by remote control panel or computer interface.



IGM introduced a 240-disc CD player.

Digisound, distributed by Gentner now that Gentner took over Microprobe Electronics, offers a stand alone unit with either 80 minutes of mono or 40 minutes of stereo, stored on a 380 Mb drive.

CompuSonics demonstrated a wide range of hard and removable disk storage and playback units. There was new software this year, including MacSonics, which allows interface to Apple Macintosh PCs.

Another player in the digital audio arena was IMS with Dyaxis. The Dyaxis system is a very high quality (48 kilohertz sampling) digital audio system.

Media Touch takes Touchstone on the road.

Waveframe had probably the most advanced digital audio system shown. If you buy enough of its modules, almost anything can be done digitally and in real time.

DAR was again featuring its Soundstation II, a digital audio workstation. At current price ranges, however, these workstations are still more likely to find homes in audio production houses before they are considered practical by radio stations.

New England Digital is another company looking at the radio market for possible applications of its Synclavier. The company announced a remarketing agreement with Columbine, a station business computer company.

New England Digital also announced installations of systems at Gannett stations KIIS-FM in Los Angeles and WGCI-AM/FM in Chicago. The stations have been experimenting with the Synclavier for production uses, and there is the possiblity that group owned stations such as these two could "network" the equipment in the future.

Only one area of digital technology has been left for further development: RAM storage. To date, other than the incidental use of RAM storage by disk-based systems, only Broadcast Electronics has made a modest entry intro this field. The product is the DV-2.

It stores six minutes of 6.5 kilohertz mono audio, totally in RAM. The unit sounds quite good considering the ba-

(continued on page 18)

NAB REPORT

From Exhibit Aisles Show Reaction Varies

Radio World's roving reporters took to the aisles of the Las Vegas Convention Center to see what products in the radio exhibits were the attention grabbers. People were asked, "What do you consider to be this year's 'hot' product?" Here's what they said.

"I happen to be here to try to get equipment together to put a new FM station on. My knowledge of the engineering areas are limited and I did write down the names of certain companies that I was given by the consulting engineer. We are looking at some used equipment where it would make some sense and getting a lot of ideas."

Bill Gittler, President & GM
KRKC-AM/FM King City, CA

"To be honest, not a lot has changed since last year. Some of the newer innovations in FM radio (are interesting.) We came to look at the new FMX system; some of the other smaller pieces of equipment. We're fixing to build a new FM station, and we're out here shopping."

Marty Rowland, GM
WAYX/WBGA Waycross, GA

"The new DAT equipment is interesting technology because that is something everybody in radio is looking at right now."

Dan McAllister, GM
CKKQ-FM Victoria, British Columbia, Canada

"A lot has caught my eye. Some of the computer equipment is quite interesting. That seems to be what radio stations are getting into, to become more efficient."

Barbara Morgan, President
Morgan Capital Corp. Austin, TX

"I haven't seen a whole lot of new technology. Of course the television section is fascinating. That's where all the new toys are. As far as radio, the big thing is digital electronics, like digital audio, digital cart machines and R-DATs. That's what I'm looking into."

David Petrik, Technical Director
KACE-FM Los Angeles, CA

"We came with a list of equipment that we needed to buy, and that's what we've been primarily looking at. For an automation system, we picked the Di-trol. It's the new kid on the block, but it has a good reputation. Then we came for a console; we haven't bought yet, but we're almost certain to buy the Arrakis 5000.

Ray Dammon, CE
KWIL-AM/KHPE-FM Albany, OR

NAB REPORT

First Digital Processor Debuts

by Jim Somich

Las Vegas NV ... Valley International of Nashville introduced its new Digital Dynamics Processor at NAB '88 to an enthusiastic reception.

The DDP is a multi-band *true digital* (not digitally-controlled analog) audio signal processor operating on a 16-bit linear PCM format and designed for on-air applications.

It may be configured as a 3-, 5- or 8-band processor. Each of the unit's cards is a stereo pair consisting of a digital filter and digital dynamics processor.

The filters are phase coherent FIR type digitals. The DDP is powered by the AT&T DSP chip. Valley has scooped the industry with the first genuine totally digital processor.

There is little doubt that this will inspire other players to enter the "total digital" market.

More surprises

Circuit Research Labs surprised visitors to its booth with the world's first stereo generator with a digital 15 kHz low pass filter.

Although only in prototype form, the filters were fully operational and exhibited substantial performance improvements over analog units.

Valley International's digital processor.

Photo by Jim Somich

The digital LPF is an excellent example of how digital processing technology can solve problems that are difficult to manage in the analog domain.

An interview with Ron Jones of CRL confirmed the company's commitment to digital technology as the next major force in audio processing.

In digital control in the analog domain, Glen Clark of Texar featured the company's Audio Prisms.

The very popular Prisms have a well-deserved reputation for aggressive processing without many of the artifacts associated with less sophisticated systems.

New for '88 is the Texar Lazer, a 3-band peak limiter/stereo generator combination, obviously designed to replace the Optimod 8100 that is now used in most Prism installations.

Unfortunately, the prototype was not ready in time for the show and only the limiter section, in rough form, was demonstrated.

Texar maintains that it will be ready to ship in the third quarter, however, and this will be a combination well worth testing on your station.

Armadilloes and audiophiles

Armadillo Audio, a new company out of Richardson, Texas introduced the Eliminator Stereo Audio Signal Processor which can be combined with its Z4 multi-band digital (controlled) audio processor.

Delta, meanwhile showed a preliminary model AMP-1 tri-band audio processor for AM stereo. It features digital control, tri-band processing in the matrix mode and is designed to complement the company's AM stereo exciter.

Delta unveiled the AMP-1 Matrix Stereo Mic Processor.

Photo by Jim Somich

Aphex Systems is taking a refreshingly different marketing approach to the audio processing wars with its "audiophile" processing chain.

Rather than push absolute maximum loudness at all cost, the chain will give you the cleanest and most transparent sound on the air if you are willing to trade 1-2 dB of maximum loudness.

The audiophile chain consists of the Compeller, Aphex II Aural Exciter, and Aphex Studio Dominator. I really hope this approach starts a trend!

New from Aphex this year is the model 612 expander/gate/ducker, a high quality approach to cleaning up "dirty" audio, and the 10-4 audio level interface, the audiophile approach to matching IHF ins and outs to pro gear.

The best of the rest

Mike Dorrough, the father of multi-band audio processing, offered the most convincing demonstration of the attributes of his much underrated model 610 digitally-controlled tri-band audio processor.

At the JBL/UREI booth, we were treated to UREI's new model 7110 limiter/compressor. This VCA-based device utilizes what JBL calls smart-sloper compression characteristics and peak or average gain reduction.

The 7110 is a simple unit to set up and use and is sure to find a place right alongside the legendary LA-4's and 1176's from UREI.

The gain control action can be continuously varied between either peak or average detectors.

Simple setup is accomplished with a single automatic preset pushbutton that engages a program-dependent variable attack and release circuit and fixes compression and peak/average blend controls to standard settings.

This is a single-band unit and will find greatest use in mic processing chains or on individual tracks in production.

The Tri-Maze is a new universal processor from Hnat-Hindes. It is designed to feed the stereo generator directly with no intervening processor.

Eventide introduced the Ultra-Harmonizer for broadcast.

Featuring NSRC compatibility at low cost as well as zero-hysteresis post-filter clipping for FM applications, the Tri-Maze promises up to 2 dB of increased loudness without composite clipping.

This unit might be a sleeper and I plan to test it in the near future.

Effects and reverb

Eventide demonstrated the new model H3000B Broadcast Ultra-Harmonizer.

Texar's Hilton Center booth resembled a giant "Prism."

This broadcast version of the H3000 incorporates special software written especially for broadcast applications.

A wide variety of character voices, special presence and vocal treatments, weather and sound effects are available as preset programs.

The Ultra-Harmonizer also incorporates Automatic Stereo Timesqueezer which is built-in automatic stereo audio time compression and expansion.

The broadcast Ultra-Harmonizer is scheduled to be available in June and will be well worth waiting for. It also sports a new low price.

Yamaha, always a leader in digital technology, offered the DEQ-7 Digital Equalizer. It has the power of 30 equalizer configurations including graphic, 4-band parametric, tone-control, band-pass and band-reject.

In addition to the 30 preprogrammed configurations, you can store 60 of your own EQ programs in the RAM memory locations. The DEQ-7 is analog in and out.

For the real "tech-ies," AKG created quite a stir with its new ADR-68K Digital Reverb and Effects Processor.

Configured as a "blank slate," the 68K is fully integrated with its software. A large display with "soft" labelled switches and slide controls can be reconfigured at the software level to provide virtually unlimited expansion capabilities.

The powerful 68000 microprocessor engine provides more processing power than had been heretofore available in

(continued on page 18)

Hot! from CRL

Digital Friendly Sound

FOR PROGRAMMERS:

Pictured above is the new FM processor from CRL, the SMP-850. It offers you a clean, open and transparent sound that will make you the winner on the FM dial. Here's why. Most audio processors get muddy sounding if you turn them up to get loud. Because of this fact, all kinds of add-on boxes are being used to "brighten" the sound. CRL has solved the problem by developing the variable transfer function pre-emphasis limiter, which will give you a LOUD clean signal that STAYS bright and open. That's why we call it "Digital Friendly".

But that's not all. We have "built in" a circuit that widens your stereo image. Sound Field Enhancement increases the separation between the left and right channels, but only on those recordings that need it. This means that YOUR stereo image is going to be more dramatic than your competition.

Also in the SMP-850 there is new input compressor that keeps the highs and lows in balance and gives you clean consistent bass that has punch and impact. All this for an affordable $1950.

Yes, we know it sounds too good to be true. That's why we offer free auditions. Hearing is believing. Call CRL now, BEFORE your next ratings period starts.

Call 800-535-7648

FOR ENGINEERS:

INPUT (Ref. 0 dBm = 0.775 VRMS)
- TYPE: Active balanced (differential)
- IMPEDENCE: < 10 K ohms balanced bridging
- TERMINATION: 600 ohms (selectable)
- LEVEL: (adjustable): - 10 TO +20 dBm

OUTPUT
- TYPE: Active balanced (differential)
- IMPEDENCE: 100 ohms (designed to drive 600 ohm load)
- LEVEL: (adjustable): < - 20 TO + 20 dBm

FREQUENCY RESPONSE: 50 HZ TO 15 kHz: +/- 1 db

HARMONIC DISTORTION
- OPERATE MODE: < 0.15%. 50 Hz - 15 kHz typical

S + N/N: > 80 dB in operate mode, deemphasized

STEREO SEPARATION (minimum)
- OPERATE MODE: > 60 dB. 50 Hz - 1 kHz 50 dB, 1 kHz - 10 kHz

INPUT COMPRESSION:
Input leveling G/R; selectable in 3 dB increments to 15 dB, 25 dB overall range

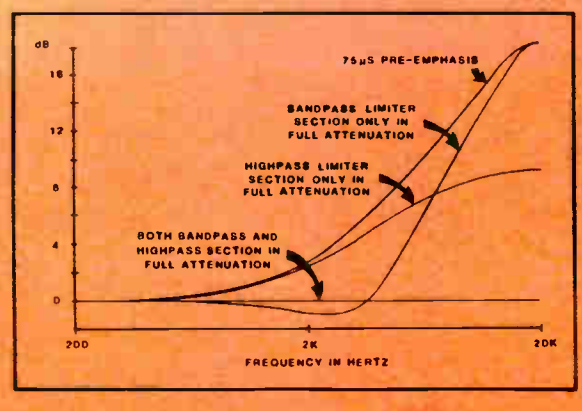
LIMITING: Selectable in 1 dB increments from 0 to + 5 dB

TIME CONSTANTS: Program dependent

STEREO ENHANCE:
- Threshold: Adjustable from 3 dB of program separation to infinity (off)
- Enhance: Adjustable for 6 to 26 dB of enhancement (program controlled)

FRONT PANEL INDICATORS
Dual 10 - Segment LED type input level meters with 22 dB (28 dB with OVLD) dynamic range

TRANSFER FUNCTION LIMITER



THE HOT ONES

CRL SYSTEMS

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OPERATIONAL FEATURES

- Three output busses
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- Remote channel on/off control
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- Turntable synchronizer interface *
- Adjustable peak LED indicators
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- Talkback circuitry internal
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* *Available Option*

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MODELS & PRICING

RS-6	6 Channel	$3995.	complete
RS-12	12 Channel	5995.	complete
RS-18	18 Channel	7995.	complete

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NAB REPORT

NAB VP Reflects on Convention

In the closing hours of the convention, RW News Manager Alan Carter met with NAB Operations Executive VP John Abel to get his comments on the show.

RW: *What about the show caught your eye?*
Abel: First is how much the convention has grown. It has grown sizably since last year and from 1985, the last time we were in Las Vegas.

RW: *Do you foresee the convention growing?*
Abel: I would have said '85 was a peak. There's not much room in terms of exhibit space, but there's probably going to be more growth in terms of people. Who can venture to say what the limit is?

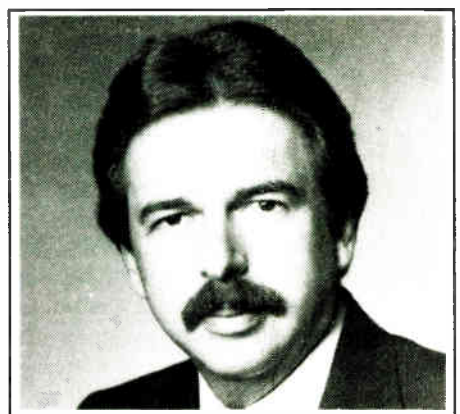
RW: *Do you think the show could be split between radio and TV?*
Abel: I really don't. It's hard to say there is specific radio equipment or specific TV equipment. (Some exhibitors) are in both the radio and TV business, and they want to be at this show.

I think you're going to see both shows (the convention and international exhibit and the 'Radio Show') grow. The Radio Show has a lot of opportunity for growth. You probably are going to get a lot more exhibitors there, and we intend to build that show as much as we can to be a show for radio broadcasting.

But I don't think we're going to abandon radio broadcasting at this show.

RW: *Will a stronger emphasis on technical issues continue at the convention?*
Abel: This convention has always been much more a technology convention. But in preregistration, every category—radio managers, television managers and engineers—was up. Still, engineers did increase the most, I believe.

The other thing about engineering I've noticed is we had more interest expressed by other related industry—not just teleproduction types, but cable and satellite.


NAB Operations Executive VP John Abel.

They're coming here to see the technology and, I presume, even attend a couple of the sessions to see what broadcasting is up to.

RW: *Will we see a continued growth in NAB's Science and Technology department?*
Abel: The area will definitely grow; there's just no question. (President) Eddie (Fritts) has commented in speeches that the executive committee and board has said how important the technical areas are.

The department is probably understaffed today. I'm almost certain that more people will be hired in time.

RW: *What is the most crucial concern, in your opinion, for NAB's radio members?*
Abel: On the AM side, generally, AM improvement, AM enhancement, elimination of man-made interference—probably AM antennas.

In FM, probably a couple of technologies—one, FM translators. We're not very happy about the fact that the FCC has not been more concerned about dealing with translator abuse, and the potential threat of low-power FM stations, which we think would be a disaster for FM radio.

(A second issue is) possibly FMX. I think we are probably more than a year away from when FMX is going to be viable in the market.

NAB REPORT

Transmitters Abound

by Tom Osenkowsky

Las Vegas NV ... Roaming about the NAB exhibit floor, it wasn't hard to find myself almost continuously within reach of a new transmitting product.

Digital modulation took a quantum leap forward at Harris with the introduction of the DX-25, a 25 kW digitally modulated AM transmitter modelled after the very successful DX-10. Harris soon hopes to expand the DX series into the 50 and 100 kw power ranges.

The advantages of digital modulation are extremely high overall efficiency, resulting in substantial power savings, exceptional audio specifications and modular construction for ease of maintenance.

On the FM side, a new Harris 55 W exciter, THE-1 made its debut. THE-1 can function as an exciter for any FM transmitter or as a standalone transmitter.

With two power ranges: 3-15 W or 3-55 W, THE-1 is currently found in the new Harris HT-lOFM 10 kW transmitter.

Using technology developed in the popular FM 3.5K, Harris also introduced the FM30K, FM20K2, and HT10FM (30 kW, 20 kW and 10 kW, respectively) FM transmitters.

Each features a quarter-wave cavity, single tube design and solid state IPAs which can be patched directly to the antenna in the event of a PA failure.

Automatic power control, VSWR foldback, and high efficiency are additional standard features. The FM20K2 and FM25K2 have another feature—a low noise cooling system. Typically −14 dB down from conventional blowers, you can even converse on the telephone right in the transmitter room!

Continental introduced the XL-301 1 kW solid state AM transmitter. The XL-301 differs from some designs in that no filtering system is required since the carrier is modulated on frequency. The XL-301 may operate from 10 through 1,100 W and features front panel tuning and loading controls.

Another solid state introduction by Continental is the 814C, a 3.8 kW FM transmitter requiring a single phase supply. The 814C uses a splitter/combiner technique with 700 W PA modules.

Continental also displayed the 816R series which feature solid state driver sections. Speaking of solid state drivers, the new 317C-3 50 kW AM transmitter uses modules which directly retrofit the familiar 4-400C tube socket ... neat, huh?

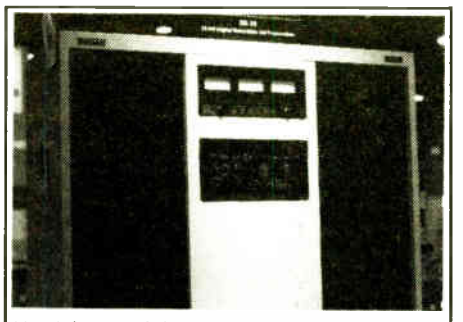
CCA Electronics displayed its line of AM, FM and medium wave transmitters. The AM10000D is a conventional high level modulated 10 kW broadcast transmitter. The AM10000D has conservatively rated RF drivers and modulator sections.

On the FM side, CCA has four models to choose from with TPO ratings ranging from 500 through 5500 W. These transmitters utilize the CAA FM20G direct FM exciter.

Also available from CCA is the FMIOOG, a 100 W exciter/transmitter. CCA also manufactures a 15 and 25 kW medium-wave transmitter for frequency synthesized international service.

Nautel introduced the AMPFET ND-10, an upgraded 10 kW solid state AM transmitter. The ND-10, modeled after the AMPFET 50 kW, has 1.4 kW PA modules which may be removed on-air for easy servicing.

Designed with AM stereo in mind, careful attention has been paid to low



Harris' new digital transmitter, DX-25.

and high frequency phase shift (tilt and overshoot), as well as an impressive IQM figure of −40 dB at any frequency up to 10 kHz. Low IMD and THD figures will impress even the most critical engineer.

Broadcast Electronics unveiled two new additions to its FM transmitter product line. Rounding out the series is the FM-l 1 kW and FM-20 20 kW.

The power range of BE's line now ranges from 100 W through 70 kW combined. This range allows an economic choice for any class of FM broadcaster. The BE line features half-wave cavity final coupling, automatic power control and an optional Microprocessor Video Diagnostic System.

The MVDS allows computerized monitoring and troubleshooting on a continous basis. The IPA sections are modular in design and broadband. All BE FM transmitters use the field-proven FX-30 exciter. The FX-30 may be configured in a master-slave booster operation for filling in holes in the primary service area.

AEG, formerly Telefunken, displayed an impressive array of solid state FM transmitters. Rugged in construction and modular in configuration the AEG solid state line has operating powers from 100 W through 1.5 kW.

All solid state transmitters through 1.5 kW are convection cooled and wideband throughout. AEG manufactures a 10 kW S3217 single-tube FM transmitter with on-board filament voltage regulation and can be switched down to 3 or 5 kW.

QEI introduced its FMQ series transmitters. These feature grounded-grid design and are available in 3.5, 5, 10, 20 and 30 kw single tube models. All of these transmitters have "Automod," a built-in modulation controller.

Also standard is a remote control—that's right, you get the studio unit too! The 3.5, 5 and 10 kW models are single phase powered. The ARC-27 automatic remote control is very impressive with plain English readouts and multiple alarms.

QEI also manufactures a complete line of FM transmitters and two FM exciters. The 695 exciter is capable of 20 W output, is fully metered and has a synthesized PLL circuit. The 675 exciter is housed in a 3½ inch rack space, has a front panel multimeter and adjustable 20 W output.

QEI's solid state 1 kW FM, the 695T1, has extensive microprocessor-based diagnostics, full front panel metering and quick start-up time. The low-pass filter is internal.

Vector Technology Inc. is well known for its production of AM phasors, ATU's and coupling equipment. Vector now also manufactures an economical line of FM transmitters ranging from 3 to 25 kW.

With solid state IPA's, stable grounded-grid PA, 12 phase secondary supply and full VSWR foldback protection, the Vector FMT line specs certainly draw the attention of FM broadcasters. All of Vector's FMT transmitters can be special ordered for single phase.

LPB Inc., well known for its application of low power AM transmitters in carrier-current and Traveler's Information Service, have a variety of low power, solid state transmitters perfectly suited for PSA/PSSA applications.

Of special interest is the 30 and 60 W models. For PSA/PSSA applications, power savings alone would be an incentive over bulky, low efficiency power dissipators.

McMartin Industries displayed models of its AM and FM transmitter line. Currently at new headquarters in Iowa, McMartin produces AM transmitters ranging from 1 to 50 kW and FM transmitters with TPO ranges from 400 W through 30 kW.

New FCC rules since last fall allow the use of synchronous repeaters for FM stations troubled by terrain shielding and multipath problems.

Comad Communications introduced the Synch/FM system of synchronized broadcasting for FM booster operation on the same frequency. Developed by TEM, an Italian company, the system allows FMers to "drop in" low power boosters to improve their signal reception and coverage area.

It was the first such system demonstrated in North America and could clear up FM channels by eliminating the need for repeater frequencies.

Omega also introduced a synchronous repeater. It uses digital techniques to lock the main transmitter and the repeater transmitter frequencies together. Omega says its system has been designed to be compatible with transmitters and exciters in use today.

And along with traditional multipath problems, another multipath-type of effect which is getting attention these days is the presence of AM noise in FM transmitters.

Radio Design Labs introduced the ACM-1, the Amplitude Component Monitor designed to detect AM noise, deliver AM noise readings via transmit-

(continued on page 17)

NAB REPORT

Test Products To Fit Every Need

by Tom Jones

Las Vegas NV ... Those attending this year's NAB convention had their appetites whetted and test equipment needs met by a plethora of interesting devices.

Manufacturers seemed intent on broadening their customer bases with pricing within range of more station budgets. There was a good range of RF test items for both AM and FM and an ever-expanding collection of audio test gear.

Many well-recognized test equipment items, introduced in previous years, were on display again this year—some with added new features and enhancements. Also, an increasing number of manufacturers are incorporating RS-232 and GPIB computer interface connectors

Radio Design Labs ACM-1 detects AM noise for FM stations.

into their equipment.

AM broadcasters bringing their stations into compliance with NRSC recommendations will find the Delta Electronics SM-1 AM Splatter Monitor a useful device.

It measures the level of splatter which falls between 11 kHz and 100 kHz away from both sides of the carrier. Either in-phase or quadrature modulation components can be measured to determine the origin of the splatter.

Varied applications

FMers looking for a stereo monitor at a reasonable price will be attracted to TFT's new model 884. The new monitor is a simplified version of the TFT model 844 with a few less bells and whistles and price tag $1,200 lower than the 844.

Many engineers yearn for a spectrum analyzer but know there is no way to justify the expense. Avcom may have the answer with the PSA-35 portable spectrum analyzer priced at less than $2,000.

The unit's frequency coverage is such that in addition to transmitter monitoring, it could be used for STL and satellite dish alignment.

Audio test gear showed the most activity at this year's show. Sescom displayed its audio test set which is actually four test devices in one—a low distortion oscillator, a digital multimeter, a distortion analyzer and an oscilloscope.

The old adage "to measure is to know" should make you a real believer in the new R-DAT digital audio cassettes. Audio Precision demonstrated new R-DAT and CD software for its System One audio test system which connects to your PC. The model SWR-122 12 by 2 balanced switcher was also in action, making multi-track tape recorder alignment a snap.

Likewise, Sound Technology was exhibiting its model 2000A PC-based audio test system which is menu driven with both RS232 and GPIB interfaces.

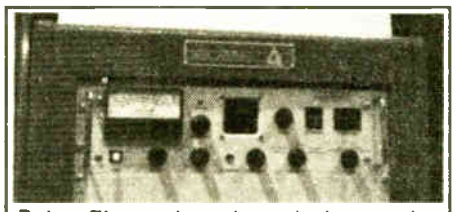
Leader introduced its new model 3216 AM/FM stereo-synthsized RF signal generator. The unit can store and recall 100 different test conditions and features programmability and edit functions to speed testing.

Leader also introduced several new oscilloscopes and a companion thermal printer for hard copy printouts of stored scope data.

Meters and testers

Meanwhile, Potomac Instruments displayed a prototype of a digital meter retrofit for its popular FIM series of field strength meters.

Both frequency and field strength can


Delta Electronics showed the much-publicized Splatter Monitor.

be read on the LCD display avoiding misreadings of a conventional analog meter. The retrofit mounts directly over the opening where the present analog meter is mounted.

Wireworks displayed its TE-3 "intelligent" microphone cable tester selling for less than $100.

Not far away in the Holaday Industries booth, a new hand-held VDT radiation survey meter was of interest to convention attendees. The model HI-3600 was specifically designed for measuring the electromagnetic field emissions from computers and video display terminals.

Holaday also displayed its HI-5000-SX RF Exposure Measurement System. This system has generated much interest of late with broadcasters' concern for complying with the ANSI RF exposure standard.

B&B Systems was urging AM and FM stations to take the guesswork out of stereo broadcasting by using its audio phase monitors. Several versions of the basic phase monitoring X/Y display are offered--some with companion VU meters and peak overload LED indicators.

The units were surprisingly cost effective for the amount of real-time audio monitoring offered. Any one of the several units offered would be especially valuable in a production control room where chances of phase reversal are more possible.

The engineers from Kintek also demonstrated two phase related audio monitors. The KT-960 Monogard continuously monitors both stereo channels for out-of-phase conditions for both speech and music then, intelligently, corrects the phase relationship of the channels.

The Kintek KT-932 phase meter was also displayed with an easy-to-read LED 30-step bar graph to continuously display left and right phase relationships.

Other new features

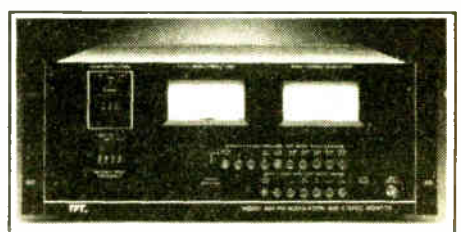
Boonton Electronics had two new products on display at its booth. They were the model 1130 distortion analyzer and the model 8200 modulation analyzer with GPIB interface for completely automatic operation.

Belar demonstrated its popular line of AM/FM/TV monitors. New this year was the FMM-4 FM digital frequency monitor and the SCM-2 SCA modulation monitor.

My eye was caught by a prototype of a new Belar FM RF amplifier which had impressive specifications and should improve the accuracy of studio modulation monitoring when the transmitter site is remote from the studio.

Amber Electro Design presented another impressive display of the power of automated audio measurement using a personal computer.

Amber's Audiocheck MS-DOS software package completely controls the Amber 5500 audio measurement system. New this year was a split version of the 5500 system and new capabilities for the Audiocheck software package.


TFT showed the model 884 FM modulation and stereo monitor.

Gorman-Redlich displayed its familiar line of digital monitors for AM directional antennas including the model CMR which is remote controllable.

This year's exhibits were easy to find and conveniently located. Anyone wanting to upgrade or add to test and measuring equipment inventory would have had no problem spending the entire four days at those booths alone!

Tom Jones is GM of KNXR in Rochester MN and an occasional contributor to **RW***'s Buyers Guide. He can be reached at 507-288-7700.*

FMX Sales

(continued from page 8)

company fine tunes the product. Mullinack declined to reveal results from previous testing.

Jon Sanserino, product manager at Aphex Systems, said a generator with FMX capability is his company's "next big project."

"I would like to have it out by the fall," he said. "People are interested, and I know broadcasters are following (this development). I still think it will be market by market."

Jim Wood can be contacted at 408-458-0552, Howard Mullinack at 415-957-1067, Jon Sanserino at 818-765-2212 and Bob Richards at 602-438-0888.

NAB REPORT

Cohen Gets Engineering Award

Las Vegas NV ... Jules Cohen, called by many an "engineer's engineer," received the NAB Engineering Achievement Award during the convention's engineering luncheon.

Cohen, president of Jules Cohen & Associates, Washington DC, was chosen for "his many outstanding broadcasting achievements over a 40-year career," according to the NAB.

In thanking the association for the honor, Cohen noted changes that have occurred in the industry over the span of his career.

"At the end of World War II, AM broadcasting, with fewer than 950 stations, was not only the dominant broadcast medium, it was virtually the only medium," he said.

"Today, television with its more than 1,300 stations clearly dominates, with the approximately 5,000 AM stations struggling for their lives," he continued.

Looking toward the future, Cohen praised the work of broadcasters in convincing the FCC that "a threat" to local broadcasting exists.

"Some terrestrial broadcasters may have come only recently to the realization of the threat from other media, but some voices have been crying in the wilderness for a decade or more."

He called for action "if the structure is not to be weakened seriously."

Cohen spoke based on his experience as either a sole principle, partner or officer in a consulting engineering firm for almost 40 years.

He was involved in satellite earth station studies, interference design and adjustment, propagation studies, and radio and TV studio and transmitter layouts.

He also conducted extensive work involving the engineering aspects of several FCC rules.

Cohen authored Appendix C of the Cable Television Advisory Committee Panel II Report to the FCC that involved the problems of echoes in TV systems.

He also played a major role in the development of FCC rules governing the assignment of FM stations in the frequency band from 88.1 MHz to 91.9 MHz.

NAB S&T VP Michael Rau with Engineering Achievement Award winner Jules Cohen.

Transmitters

(continued from page 15)

ter remote control or program alarm circuitry to alert the operator or on-air person when AM noise reaches the threshhold where it degrades the signal.

In AM stereo the going may be a bit slow, but the technology moves forward. Motorola Inc. introduced its second generation model 1410 C-QUAM modulation monitor and model 1400 C-QUAM exciter.

The 1400 exciter features improved internal construction, front load circuit boards and front/top adjustable controls. The 1410 monitor serves as a test instrument and monitor in one package.

Both front panel meters are autoranging for separation and noise measurements, an RF AGC permits variation of RF signal level and front panel test and headphone jacks allow for quick monitoring of all parameters.

Delta Electronics demonstrated its exciter/monitor combination with a variety of receivers and its new Splatter Monitor in operation. Delta's equipment is very well constructed and easily adjustable in the field.

Broadcast Electronics displayed its AS-10/AX-10 C-QUAM package. A second generation exciter and monitor combo, BE demonstrated its commitment to AM stereo by the introduction of these two products in 1987.

Kahn Communications was exhibiting the company's AM stereo and related equipment at the show as well, including the PowerSide.

And a final interesting development in AM stereo may help put more radios into listener's hands. Target Tuning featured the company's single frequency walkman-type radios.

Designed as promotional items for stations to purchase in cooperation with advertisers, Target Tuners have been well-received in the FM community.

Now the company intends to market them for AM stereo, and showed samples of both C-QUAM and Kahn ISB receivers at the convention.

Tom Osenkowsky is a radio engineering consultant and a regular **RW** *columnist. He can be reached at 203-775-3060.*

NAB REPORT

Processing Products

(continued from page 11)

similar units. Data input is through a small "data cartridge."

Eric Small and his company, Modulation Sciences, continue on the forefront of audio and RF wizardry with the new StereoMaxx stereo enhancer and FM ModMinder. Stereomaxx can make your station sound bigger, not just louder.

It enhances and enlarges the stereo image, making it wider and deeper. The effect is audible on all sizes of radios. The Modulation Sciences FM ModMinder is similar to the "back end" of a modulation monitor.

Feed it composite baseband from any high quality source, such as a tuner, and it displays total mod percentage, overmod peaks and the status of all subcarriers.

This product is destined to find itself on many PD's desks to keep track of the competition easily, accurately and inexpensively.

Bob Orban impressed the crowds with his new 787A programmable mic processor box. The 787A stores up to 32 different control settings in memory for instant recall. It accepts line level input or mic level with the optional mic preamp.

The box consists of a 3-band parametric equalizer with variable frequency, bandwidth and boost/cut married to a smooth compressor, full-function deesser and noise gate which attenuates noise by up to 25 dB.

Also new from Orban is the 222A Stereo Spatial Image Enhancer. Operating on program transients, the 222A produces a subtle but noticeable improvement in stereo soundstaging without creating multipath effects and while maintaining full mono compatibility.

The 929 module shown by dbx contains two channels of single-ended one-step noise reduction for sources that have a continuous unchanging hiss floor beneath desired signal. Without such program material, this very fast sliding filter design is remarkably effective and unobtrusive.

Properly set, the 929 reduces or eliminates the hiss with little or no sacrifice of musical high frequencies or treble overtones.

Inovonics is gearing up for FMX with the model 705, a full-featured FM stereo generator with digitally-generated stereo subcarrier and pilot signals. FMX is a plug-in option and can be installed in a matter of minutes.

1988 is undoubtedly a turning-point year for audio processing. Total digital is coming on fast and those manufacturers who are not thinking in digital terms will be left in the dust in the years to come.

Jim Somich is CE at New York's Z-100 (WHTZ-FM) and president of Major Market Engineering. He can be reached at 201-867-5000.

Digital Growing Slowly

(continued from page 9)

sic specs.

Automation in today's radio environment represents the transition of the art.

Computers are nothing new to automation, and along with Broadcast Automation with its non-computerized controller, Innovative Automation showed the Di-Trol complete automation driven by an Apple Computer. Sentry Systems with a PC controlled switcher and controller and several others have improved the art.

New automation systems that throw out the concept of carts and reel-to-reel tapes are increasing in number.

Paul Schafer's company, Schafer Digital showed its digital system comprised of Beta VCR units and a Dyaxis Hard disk playback for commercials. The hard disk draws upon a library of spots on a Beta tape.

The system software runs on an AT compatible and Schafer uses timecode to keep track of cut locations.

Systemation uses both analog cassette decks and 8mm VCRs, coupled to their own multi microprocessor controller. The package can range from operator to satellite assist to a full blown system.

With Systemation, an ASCII burst is recorded on the audio tracks to provide positive cut location. New this year was its introduction of R-DAT as well as a touchscreen option for its controller.

Concept Productions showed a complete R-DAT automation system. This system uses a PC based controller that directly commands its bank of Sony R-DAT units.

Concept is also forced, for the moment to use ASCII bursts on the audio track for positive identification of cuts, as R-DAT does not yet supply its potential wealth of stored data to the outside world .

The Concept system was originally designed to support only its program services. This year's display revealed that this equipment is now available for stand alone use for full automation, operator or satellite assist.

Futuristic automation systems were also more plentiful than ever before.

Touchscreens were to be found in many places. Of course the term "touchscreen" normally makes most people think of Media Touch, which had the show well covered.

Not only did the company have the inside booth, but also an outdoor exhibit of its "road show"—a complete mobile unit fitted with its system.

Media Touch was also found in the Baysis booth. Not so much a system as a control concept, Media Touch has numerous interfaces to various broadcast equipment, including carts and reel-to-reel.

Media Touch was not alone this year either with the touchscreen or the control concept.

DMS, Digital Management Systems demonstrated its DMS-100 Compact Disc Jockey.

The CDJ is a touch screen—RS 232 interface system that provides RS 232 interface and playlist control for automated music playback as well as operator assist.

The DMS unit was shown at the Allied booth driving two Audiometrics CD jukeboxes.

Rob Meuser runs International Broadcast Services. He can be reached at 416-692-3330.

NAB REPORT

Analog Products Not Forgotten

by Michael Starling

Las Vegas NV ... While the future of broadcasting may lie with digital technology, most manufacturers at the NAB show believe it's safely beyond the near-term radio horizon.

This year vendors spent significant sums introducing a host of incremental improvements and intermediate product lines in confidence that analog recorders will remain the dominant mode of audio storage and manipulation for the foreseeable future.

Since residual noise is the principal qualitative difference between analog-based and digital audio technology, Pacific Recorders & Engineering introduced its Dolby SR card-cage so broadcasters could reap the benefits of this new signal processing.

The company demonstrated the superb results SR encoded/decoded material delivers on its line of Tomcat and Micromax cart machines.

KPBS-FM recently pitted a Dolby SR recording against an R-DAT recording of the same folk music performance. The A/B comparison revealed both recordings to be absolutely devoid of extraneous noise.

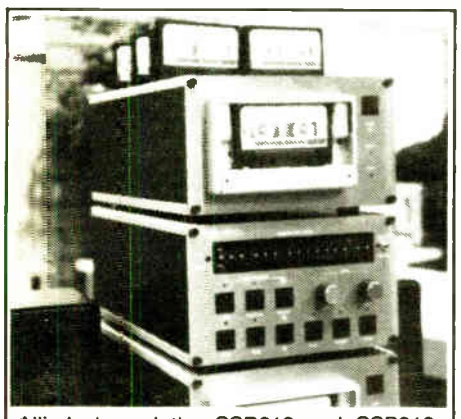
The only discernible artifacts with either process was an apparent "downshift" in high frequency material on the DAT playback (using a Sony 1000ES) and a slight low-frequency bump, characteristic of the Otari 5050B (at 7.5 ips), detectable in the SR-encoded material.

Reportedly, up to four generations of SR-encoding are possible before the audio suffers any discernible impairments.

ITC had its prototype digital cart machine, introduced last year, again on display, but according to the company's Bill Parfitt, there are no current plans to go ahead with production.

With an introductory price-tag on the player estimated to be well above $8,000 there would be some significant risks in marketing this product, even with the financial clout of 3M behind the effort.

The continued success of the ITC series 99s and Delta cart machines, which

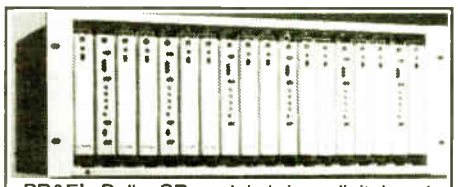


Allied showed the CSR212 and CSP212 professional cassette system.

were also on display, is much more certain.

It also featured its audio switcher which was introduced at last year's NAB and has generated a lot of positive interest.

Elsewhere in the cart market Broadcast Electronics introduced the feature-packed Phase Trak 90 recorder to complement its Phase Trak 90 reproducers. Engineers frustrated over cartridge-



PR&E's Dolby SR module brings digital quality to cart machines.

based phase instabilities will rejoice at the PT 90's non-encoding phase correction system.

Fidelipac displayed its CTR100 series cart recorders with its well-received cart-scan, varispeed, and block-out status functions.

For anyone desiring improved cart performance but not in a position to purchase new equipment or external noise reduction, Fidelipac's Dynamax Cobalt carts are a must for evaluation. The excellent high frequency response, superb phase stability and longer-life shell and tape design are a welcome improvement.

Audiopak, the new name of the cart and tape manufacturing business which used to belong to Capitol Industries, made its first NAB appearance in a booth which had been reserved for Capitol Magnetics.

The new company's officers, including president Nick Krassowski were on hand and swamped with visitors in the wake of the deal which saved the popular cartridge line.

The latest word on the widely used Audiopak AA-4 cartridges is that "shell" production should resume by the time of this issue. There were no plans to change tape formulation and substantial quantities of tape were reported on hand at the company's Winchester VA plant.

Capitol Magnetics' original plans to introduce a new cartridge at the spring show were, of course, put on hold while the company was reorganized. Krassowski said that he expected to have samples ready by the SBE convention in September.

Audi-Cord displayed its new "DL" series of playback, record-playback, and a unique dual transport record-playback machines. All versions are rack-mountable, and stations where two recordings (for both the FM and AM) of a particular spot will appreciate the dual transport deck.

For any broadcaster working within a tight budget (and who among us isn't?) Audi-Cord's most expensive stereo record-play deck selling for only $1,469 including digital timer is impressive competition to the more expensive offerings.

Otari, which also featured its cart machine at the show, had some other introductions to offer.

Otari's new MX-55 reel-to-reel.

The company is betting its new MX-55 will carve out an intermediate market for reel-to-reel recorders. Bolstered by the success of it MX-5050B sales and the wide acceptance of the MTR-10, the MX-55 is a promising choice for those who want all of the features of the $7,000 models and then some.

For example, several features not available on the MX-5050B do come with the MX-55. These include compensation for non-matching take-up and supply reel sizes; a three point memory and repeat function on the real-time counter and a built-in cue speaker.

Also new are fixed recording level selection; 100 Hz in addition to the 1 kHz and 10 kHz on the built-in oscillator; a front-panel microphone input which can feed both channels; and a ±20% varispeed.

There is also an optional Voice Editing Mode (VEM) for $250 which your news/public affairs producers will love. The VEM circuit cuts the pitch in half while playing back at double speed, thus greatly assisting intelligibility during review.

A scaled-down version of the MX-55, called the MX-50, was also on display. The retail price tag is just under $4,000 for the stand-alone, two-track MX-55.

For those who prefer European styling, Studer Revox has also spotted the vacuum in this intermediate price market and introduced its new C270 as a full-featured machine starting at about $4,000 for the 2-track deck.

It's also available in 4- or 8-track configurations, utilizes constant tape tension on both supply and take-up motors, and has the increasingly popular Dolby HX Pro built-in.

The VU meters have +6, +9, and +12 peak reading LEDs, a built-in cue speaker, and the front meter/control panel hinges outward for quick record and reproduce setup. The 270 series incorporates plug-in electronics, offers a programmable "library wind," adjustable demute audio output time up to 990ms, and fader start circuitry standard.

Studer's model A807 is a full featured high-end reel-to-reel, with shuttle and electronic front-panel setup of audio amplifiers (via programming, the D/A converters from the timer keypad or via serial interface).

The ability to do an equalization or bias setting from the front panel, without the long-term imperfections of

(continued on page 20)

NAB REPORT

Consoles Compete For Market

by Barry Mishkind

Las Vegas NV ... Of all the items that must be put in a control room, the console is the focal point. It takes the most space and is most intensively used by station personnel.

But the eight- or ten-pot board that once ran a pair of turntables, three cart decks, a microphone and a remote input for news, telephone, EBS and RPU, now has to handle cart decks, CD players, microphones and have dedicated pots for some items that used to be on the remote selector.

At the same time, there are many different philosophies of console construction.

Being able to view and compare a variety of consoles really helps identify the different features and the "feel" of each unit.

Radio Systems new RS-10 console.

One of the really nice things about going to the NAB show is that opportunity to personally check out any equipment that you are considering for purchase.

Nowhere else can you compare as large a variety of consoles as at the convention. And this year's representation was no exception.

There were introductions from several maufacturers, as well as a good number of well established models on the floor.

Over the past few years, the console manufacturing industry has worked hard to produce units with exceptional response and virtually immeasureable noise and distortion. With few exceptions, the basic electronic specifications of any console shown far exceed broadcast requirements.

Among Wheatstone's products was the new A-20 console.

Since the station budget is often the overriding consideration in smaller markets, one of the stars of the show had to be the new Radio Systems RS-10. At around $5,000 it is a complete unit, including remote control and logic.

By moving away from smaller modules and using a motherboard construction, Radio Systems has produced a cost effective console that will soon be appearing in many stations.

Or, maybe your budget is just on the fringe of the high end. Wheatstone introduced the A-20 to appeal to a wider range of stations than before. Under $10,000, it too is a full-featured unit.

Autogram's new RTV-12 is a logical addition to its well respected line of solidly performing consoles. In a nice move, Autogram has also given new life to many of its IC series of consoles with redesigned modules.

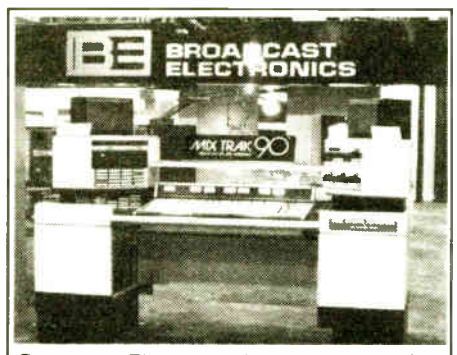
Interestingly, several manufacturers have decided to reach up into the high end market for the first time. Although facing an admittedly limited market, both Broadcast Electronics and Arrakis claim to have identified features not always addressed by existing consoles.

BE's MixTrak 90, for instance, features wider pots, attempting to give a less cluttered feel to the console. Incorporated in this $15-21,000 unit are three mix-minus busses, separate music and speech busses, and a built-in sequencer.

Arrakis' new series 10,000 console is designed to permit inclusion of as many as 50 (yes, fifty!) different kinds of modules to customize the unit for anything from air work to production. Athough it can get rather pricey as modules are added, it is unlikely that the console mainframe would ever need replacing simply because of changes in station operation.

Another very interesting console was shown by Harrison Systems. Designed to be the ultimate "air console," the thought put into the "Air 790" is obvious. This unit not only does what the DJ needs, it doesn't get in his way. It tries to prevent errors by a very straightforward layout.

Although not all of them showed new models, many other manufacturers were represented from the low end to the high end.



Broadcast Electronics introduced the Mix Trak 90.

Stations looking for a linear fader console could find them at ATI, Broadcast Audio, Howe, UREI, Logitek, and others. Those favoring rotary pots could check out LPB, Tapecaster, Dorrough and others. Some companies offer models that can be supplied either way.

If your taste runs to recording style boards, either for cost factors or for features, the Studer 970, Amek BC II, Yamaha, Ramsa, and Tascam consoles will be high on your list.

For those looking for a long term high end investment, ADM Auditronics, McCurdy, and Pacific Recorders & Engineering all continue to provide well built, versatile, field-proven consoles.

In addition to a console for just about every need, there were some related products and news emerging from the convention floor.

Some interesting news just prior to the show was that Harman International, the parent company of JBL Professional signed an agreement to acquire Soundcraft Electronics.

Soundcraft introduced its SCA200 Broadcast console at the convention, aiming at the radio production market.

ATI had a few new products at its booth. In addition to its line of consoles, new this year were a line of Micro-Meters which monitor up to four stereo signal pairs (eight channels).

ATI also introduced Micro-Matchers: tiny, connector mounted amplifiers to retrofit and upgrade existing equipment.

There was new studio gear unveiled on the exhibit floor as well. ElectroVoice wa featuring its RE45N/D hand-held shotgun mic.

Beyer also had several production introductions, including its MCE 86 Short Shotgun.

And Stanton featured its line of professional headphones for broadcast and production.

Barry Mishkind is a consultant and contract engineer, and has been the cornerstone of **RW***'s NAB coverage from the beginning. He can be reached at 602-296-3797.*

Analog Gear

(continued from page 19)

mechanical pots, will be welcome news to most any engineer. Starting price on the 2-track A807 is just over $6,000.

Tascam's new line of 122MKII and 112 series cassette decks was on display and offers several improvements over the popular 122Bs. The 112 series operates at −10 dBV, while the 122MKII employs +4 dBm balanced XLR input/outputs.

Tascam has dispensed with the mechanical tape counters and included a digital counter.

Thanks to front access to head azimuth and level/EQ controls, setups can now be performed while the machine is in the rack. All of the tape bias and Dolby settings are now selected with push-button switches and Dolby HX Pro is included on the 122MKII and model 112.

One other interesting new cassette product was demonstrated in Allied's booth.

A professional broadcast cassette system developed in Brazil and carrying the Audiometrics name featured rugged construction, set length cassettes, 3¾ ips speed and easy front loading with instantaneous rewind.

Mike Starling is CE of KPBS in San Diego and a frequent contributor to **RW***. He can be reached at 619-265-5025.*

NAB REPORT

Antennas Specialize

by George Riggins

Las Vegas NV ... Tower manufacturers and erectors go for market niches rather than trying to do all things under all conditions. One tower company is erecting all-welded towers of up to 180'. At the other extreme, structures of up to 2000' are being erected.

Kline Towers and Kline Iron and Steel Company specialize in heavy, large and complicated structures (towers). The tallest structure Kline has erected is at Fargo ND, 2063' tall. They have erected 21 towers that are 2000' tall.

Dr. Ali Mahnad of Jampro Antennas, Sacramento CA, has developed a new broadband FM antenna, model JBBP. The antenna features a new patented feed design to reduce or eliminate radiation from the antenna feed and antenna boom.

This elimination of radiation from the feed and boom produces an omnidirectional CP FM Antenna. Dr. Mahnad explained that the new feed design gives the antenna better frequency stability, lower VSWR, superior axial ratio and provides flexibility for high power capabilities and enhances multistation use.

Ron Nott, K5YNR, President of Cortana Corp. of Farmington NM has blended the Valmont unguided light pole into a Folded Unipole Antenna for the AM Broadcaster.

The Unipole Antenna, built around the Valmont Pole, has a relatively small "footprint" (42") and no guy wires. From the aesthetic side, most of our population is accustomed to seeing light poles in almost all neighborhoods, so there seem to be fewer objections to this type of pole staying when houses start surrounding the rural transmitter location.

The Folded Unipole Antenna can be used for simple directional arrays as evidenced by a recent two-tower installation by Cortana at KPRZ in San Marcos CA.

Ron mentioned other advantages of the Folded Unipole, such as no RF in the transmitter shack, no detuning during weather changes, and a broader bandwidth. The broader bandwidth should be a real plus for stations transmitting in AM stereo.

According to Ron, changing from a normal series feed tower to a Folded Unipole Antenna is considered a minor change in the eyes of the FCC and requires only a form 302 with the new impedance measurement after installation. Cortana has an installation kit available that can usually be installed by two men in one day.

All towers and antennas need obstruction lights and/or painting. We also realize that birds like high places for a perch, and what happens when a bird or birds stay in one place for more than a few minutes.

Flash Technology made its Electro Flash Beacon, model FTB 139 with a long spike on the top of a smooth rounded housing so birds have no way of staying.

The FTB 139 is lightweight, easy to install and requires only 130 W of power. This is a medium intensity omni-directional white light that can be used for levels lower than the top where one beacon can be seen in all directions.

One interesting note is the FAA tower painting requirement change for towers of 500' or less. As an alternative to painting, a 24-hour strobe can be substituted on many structures. For further information, contact the FAA or Flash Technology.

Central Tower Inc. specializes in towers, guyed and self-supporting, up to 1200'. According to Terrence Becht, project coordinator, Central Tower is able to install self-supporting all-welded towers up to 180' high.

The all-welded tower can be installed quickly using a mobile crane and features a small footprint. This type of tower is applicable for STL, short AM antennas, mountaintops and other limited area sites.

William Meola of Cablewave Systems did not give me his amateur radio call sign, but I am still going to call him Bill because as far as I know that is his handle.

The major point Bill was trying to make at the NAB convention was the *new* complete line of antennas, feed lines, low-pass filters, directional couplers, power dividers and field services for the broadcaster.

This broadening of the Cablewave product line is the result of the company having acquired product lines from Phelps Dodge.

Among the new items Bill wanted to discuss were redesigned optimized FM antennas for educational broadcasters, de-icers, mil-spec C 28830 cable and new connectors for mil-spec 28830 cable.

Tennaflex Systems Ltd. specializes in large TV and FM antennas. The installations are made using the Kathrein antenna and feature the ability to handle heavy ice and wind loads. Another plus of using the Kathrein is expected low maintenance.

One of the larger installations Tennaplex has done is on Mount Royal in Montreal, Canada. This installation is a

(continued on page 35)

High Power FM Power

Before you purchase a high power FM transmitter, ASK:

Q. ***Which manufacturer has offered leadership in high power FM since 1961?***

A. ONLY HARRIS. Since we introduced our first high power FM transmitter in 1961, we've been the *only* constant force in the business. Some companies have come. Others have changed hands. And a few have gone completely.

As the high power FM industry's most solid player, Harris will give you the industry's strongest safety net. You can count on us for top confidence that service and parts will be available *tomorrow* for the product you invest in *today*.

Q. ***Which manufacturer combines a continuing record for innovation in FM with a broad range of high power FM transmitters?***

A. ONLY HARRIS. From the first solid-state FM exciter to our revolutionary IPA, functional innovation is more than a Harris tradition. It's a principle we've applied to an extensive range of compact high power FM transmitters. We have *new* 20, 25, 30 and 35 kilowatt models. And they're available in dual configurations for FM super powers!

At *every* power level you'll get a competitively-priced transmitter engineered for years of top performance, low-cost ownership, and easy operation and maintenance.

Q. ***Which manufacturer has provided 24-hour technical service since 1975?***

A. ONLY HARRIS. Because we were the first company to understand your need for service on *more* than a 9 to 5, Monday through Friday basis.

Total approaches to RF system problems are always available from our specially-trained RF systems service engineers — even if your system went on the air before they were born! Your engineers can get answers to over 90 percent of their technical questions by phone. And the service is free to our customers!

You can also phone us 24-hours-a-day for parts — even for products we no longer manufacture!

If you use our toll free parts priority hotline — 1-800-422-2218 — we'll even pay for the call!

We take our service commitment seriously. Because we know that if you're off the air, everything stops. Except the expenses.

Q. ***Which manufacturer offers formal technical training?***

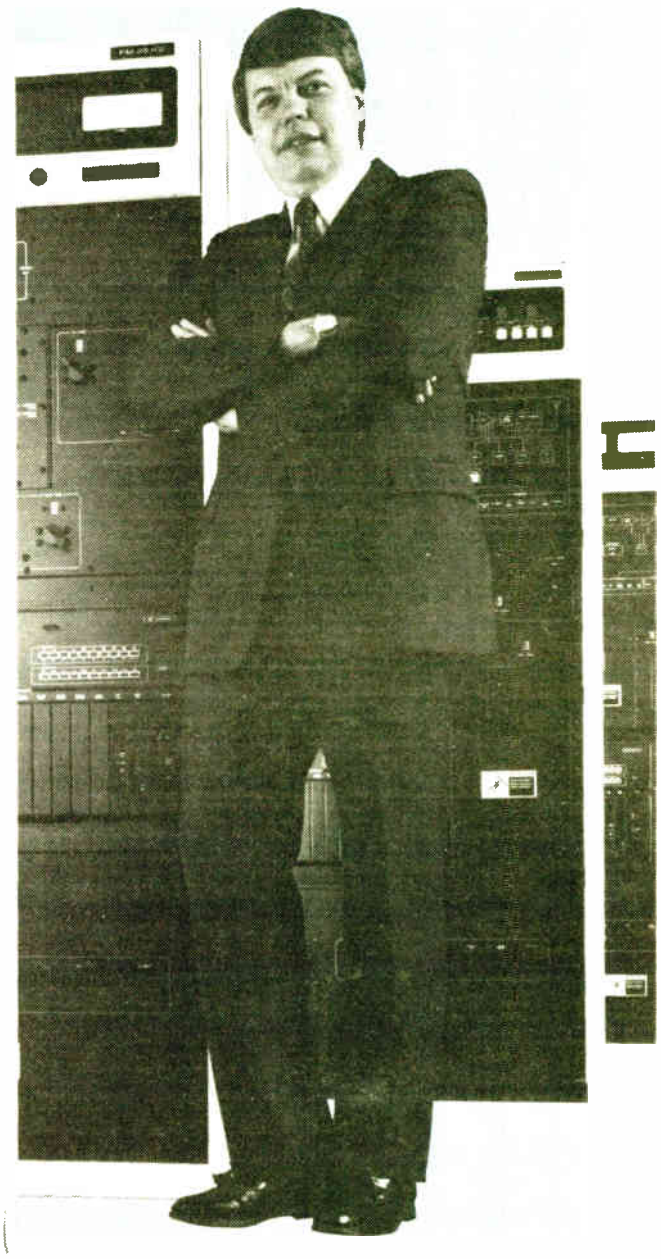
A. ONLY HARRIS. We know station engineers retire . . . that new engineers come on board . . . that engineers move from studio to RF systems maintenance. And we know that those who keep your equipment on the air need to be in the know.

That's why we offer more than 50 regularly-scheduled technical training programs every year at the industry's *only* Broadcast Technology Training Center. While some of our courses focus on major Harris products, we also offer comprehensive, general courses on complex RF systems for *all* broadcasters.

Q. ***Which manufacturer has more high power FM transmitters on the air nationwide than both the second and third-rated manufacturers combined?***

A. ONLY HARRIS.

For complete information about our high power transmitters or to arrange a visit from one of our radio district sales managers, write to me at Harris Broadcast Division, P.O. Box 4290, Quincy, IL 62305-4290, or phone Harris TOLL FREE: 1-800-4-HARRIS, Extension 3012.



Ronald C. Frillman
Manager — Domestic Radio Sales
Harris Corporation, Broadcast Division

HARRIS

NAB REPORT

Hot Hybrids and Phone Gear

by Geary Morrill

Las Vegas NV ... There's plenty new in phone gear as evidenced on the floor of the 1988 NAB Convention.

Telos systems pushed the state-of-the-art in telephone interfaces to new heights with the introduction of the Telos 100, featuring trans-hybrid loss at a whopping 40-45 dB with a full −9 dB send level to the caller.

The unit is designed to stand alone, or work with a new key system interface, available in June.

The basic Telos 100 hybrid is currently available from stock at Bradley Broadcast Sales and Broadcaster's General Store.

Gentner Electronics and Symetrix also had digital hybrids on display at their respective booths. Gentner's Digital Hybrid™, introduced last year, is also in stock for immediate delivery.

The Symetrix Model 111 adaptive hybrid, features continuous adjustment of the null with no tone or "noise burst" and will be available this summer.

There's plenty of activity in the remote control area, with the unveiling of Advanced Micro Dynamics new ARC-16, which combines full-time studio remote control with the convenience of telephone access with voice synthesis.

Telos Systems' Telos 100 digital hybrid.

Gentner Electronics has added enhancements to its VRC 1000 to better suit it to a wider variety of applications.

A DC amplifier, antenna monitor interface and temperature sensor have been added to the line, as well as software to allow fast setup of the VAC 1000 with any IBM-compatible PC and radio version firmware.

Potomac Instruments had its new 1500 series modular transmitter control on display. This unit provides automatic transmitter control of up to 16 modes of operation, and is user programmable in the field.

The modular aspect allows enhancement of the system or repair without removing the entire system from service.

Moseley Associates has added enhancements to its MRC 1600 system allowing access through dial-up lines and addition of voice synthesis modules and interface for PC interrogation of the system.

Similar enhancements are also provided for the MRC 2 system.

Hallikainen and Friends were showing prototypes of the new DRC200 system, that provides up to 96 analog, status and control channels at an inexpensive price by utilizing a simple CRT terminal and modem at the studio end.

Gentner is also one of the major players in the dial-up line frequency extender game, with introduction of its EFT-3000 Digital Frequency Extender, which allows full 7.5 kHz bandwidth transmission on three dial-up lines and one person setup.

The EFT-3000 joins the EFT-100, 900 and 1000 to provide a full family of extenders to meet various levels of desired performance. Moseley also showed its CL-100 system for TSL applications, and its new RPL 4000 RPU combination.

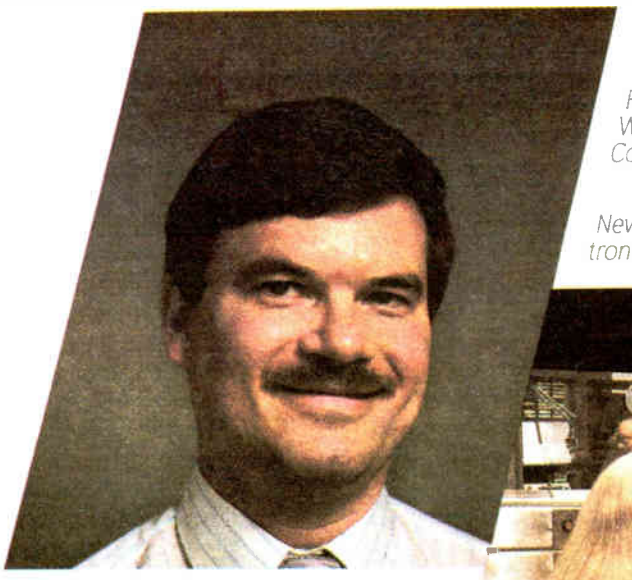
Comrex Corp. introduced its new generation of multi-line frequency extenders. The dual line system has been reconfigured to one-half its former size for greater portability.

Another interesting device was a frequency extender introduced by Comrex that was designed to operate specifically in conjunction with a mobile cellular telephone.

Speaking of congested spectrum,

(continued on page 31)

Gentner introduced 23 new products, many for telephone use.



Ron Gaier. Chief Engineer. WHIO-AM-FM-Dayton, Ohio. Cox Broadcasting.

Newscaster Dawn Matthews on the Auditronics 212 in WHIO-AM news studio.

"Reliability makes Auditronics boards winners with us",

Jim Jones on the Auditronics 224 in WHIO production.

says WHIO AM-FM chief engineer Ron Gaier. "Our job in engineering is to keep the station on the air, so our three Auditronics consoles' record of zero failures makes me very happy."

"When we renovated three years ago, I insisted on enough input capacity so every signal source could have its own channel with no switching or patching. So we bought the 224 for production and on-air, and the 212 for news. This also gives us the flexibility to easily reconfigure the boards as our needs change."

"We got everything we wanted from Auditronics through our dealer Allied, including timely delivery which was critical to us then."

"Based on our trouble-free experience with the Auditronics 200 series thus far, I'd buy them again tomorrow."

If you'd like to know more about why Ron Gaier specifies Auditronics consoles, call toll-free 800-638-0977 or circle reader service number.

auditronics, inc.
3750 Old Getwell Road, Memphis, TN 38118
901-362-1350

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NAB REPORT

STLs and RPUs Aim To Please

by Gary Diamond

Las Vegas NV ... My feet have had it.

No matter how many times I go to the NAB show, and wherever the show is, I forget to bring comfortable shoes.

Nevertheless, I had some time—and strength—to visit some old friends and see what new trinkets are being offered in STL and microwave gear.

Moseley Associates introduced the PCL-6000 series of studio-transmitter links this year as a mid-priced (around $6000) companion to its PCL-606 line of STLs.

The PCL-6010 transmitter and the PCL-6020 and 6030 receivers have synthesized reference oscillators to do away with fixed frequency crystals, making frequency changes an easy task.

The system can be preset to enable wideband composite stereo or 15 kHz mono audio by moving internal jumpers. The receiver bandwidth can also be field set for channel spacings of 100 to 500 kHz.

TFT has been busily at work designing its new 8700-series TSL system for use in the 450 MHz group "P" frequencies. Because of the very limited number of frequencies which can be used for telemetry return links, TFT has come up with a unique system to allow up to four users to share a single TSL system.

This data multiplexing system uses DTMF codes to open the squelch of the proper receiver in the network at the proper time. A data stream is then sent at a rate of up to 1200 baud from the shared central transmitter to one of the receivers.

The basic price for this system is $2,750, with the special DTMF option costing an additional $920 for the transmitter, and $420 for the receiver.

Would it really be NAB if you couldn't stop to see George Marti and the nice people from Cleburne?

This year the folks from Marti were showing off the 23 GHz digital STL system. This system claims full digital audio resolution and noise specifications, 80 dB stereo separation and more. The transmitter has an output power of only 65 mW.

Emissions in that frequency range are attenuated by atmospheric absorption and rainfall, so the use of the system is limited to relatively short-haul paths.

The people at Marti will help you by supplying data for use in the calculations involved in 23 GHz links in your area.

Eric Small of Modulation Sciences has printed a little booklet called "Making SCA Work in the Real World." Copies were available at his booth, and it should be studied by anyone who anticipates using an FM SCA.

Modulation Sciences carries the "Sidekick" SCA generator line, which contains an integrated audio processor and a built-in modulation monitor with peak-reading capability.

It also contains a transmitter tuning aid so crosstalk can be minimized by optimizing transmitter tuning controls.

Jack Bergman of Emergency Alert Receiver has designed a receiver which detects the two tone alert of the Emergency Broadcast System. These "EAR" receivers can be placed in schools and offices as warning devices.

Moseley introduced the PCL series STL transmitter and receiver.

The systems are equipped with Ni-Cad batteries so the receiver will continue to work up to six hours without commercial AC power. Stations may purchase these receivers for less than $100 each in groups of over 10 for resale to others.

The Peter Dahl Co. impressed passers-by with the size of a power transformer in its booth. That thing was rated at well over 100 kW, and had to require quite an effort to move it through the convention center!

The company has a full line of power transformers, filter chokes and power line transient suppressors. It has also introduced a rectifier stack retrofit for RCA "F" line users at a reasonable cost.

Coaxial Dynamics has introduced a new RF wattmeter series for use in 4- and 6-inch rigid transmission lines, at power levels of up to 50 kW. Dual-sockets may be ordered so that both forward and reflected powers may be read easily.

And so the spring NAB show has come and gone for 1988. I've been told that the pain in my legs will go away in a day or two, but I think that my feet may be permanently deformed. It was worth it, though, to see friends and have an opportunity to take a long look at all the new toys.

Gary Diamond is CE of KKOB AM/FM, Albuquerque NM. He can be reached at 505-243-4411.

Circle Reader Service 41 on Page 38

Fine Tune Processing for CDs

by Stephen Waldee

Part II of II

San Jose CA ... In the first part of this article, I demonstrated with chart recordings that two classic recordings of both Beatles and Beethoven had been subjected to peak limiting on LP record issue, as compared to compact discs.

The dynamic range constriction in both cases was more than 6 dB in soft passages, or 50% power decrease in the CD issues in these passages.

The result as processed over the air is to present a much higher average level on the LP issue than on the CD version, changing the perceptible "loudness" characteristic for a given amount of audio processing.

Many CDs are recorded with greater high frequency content than LPs, since the power bandwidth of CDs is flat over the audio spectrum.

LPs, however, are restricted by the RIAA curve, which reduces headroom over 17 dB at 15 kHz, necessitating the use of high-frequency limiters in disc cutting.

Furthermore, LP frequency response deteriorates in the inner grooves, as shown in John Eargle's fine article in November 1987's *Audio* magazine. He documented the rolloffs found on typical analog discs, preferred by some listeners for their absence of "CD harshness."

Processing not enough

As a techical consultant for both an oldies AM station (KOFY) and a classical FM stereo broadcaster (KBOQ), I wish to avoid the inconsistency in loudness and brightness that may result when 45s, LPs, and CDs are segued in a stop-set.

In pop music broadcasting, the multiband processor can smooth out level and spectral differences over a fairly wide range.

But it can't reduce tracing distortion, correct improper mike balances and flawed mixes, or prevent the loudness buildup of squashing an already heavily compressed LP such as the *Sergeant Pepper* disc used in my previous test report.

This artifact of compression build-up causes the infamous loudness factor of commercials. When a compressed, shrill spot follows a local dry announcer's voice or soft record or movie dialogue soundtrack the listener may literally wince with discomfort.

The engineer accustomed to using only a VU meter will be surprised to realize the true dynamic range of contemporary recordings.

Beyond the VU

I checked the two albums employed in Part 1 of my report on the expanded-scale fluoroscan peak meters in my Sony EVS-700U digital recorder. Levels from −40 to +5 are shown on this meter, a far greater power range than the G−−20 to +3 on a standard VU scale.

The *Sgt. Pepper* CD, when peaked at +5, seldom read lower than −30 except in cuts where a solo instrument was heard only on one track.

The George Szell/Cleveland Orchestra CD version of the *Beethoven Fifth Symphony* demonstrated a dynamic range of about 35 dB between the oboe solo at measure 268 and the outburst from bars 390 to 395.

The Szell recording was mastered on analog tape in 1963, but in the all-digital version by Herbert Kegel, recorded on Capriccio CD 10 003 in 1982, the same passages registered a dynamic range of over 40 dB.

Beethoven employs dynamic markings from "piano" to "fortissimo" in the Fifth Symphony, and the contrasts are not extreme.

But in the CD of the *Mahler Second Symphony* on CBS (M2K 38667) the softest passages fail to illuminate the −40 LED, with the loudest exceeding +5.

My guess is that the true dynamic range of this recording may be from 60 to 70 dB, while an LP pressing of the Bernstein performance on Columbia (M2S-695) seldom displayed a 40 dB difference between loudest and softest parts.

Thus, even with a healthy 10 dB of limiting a classical FM stereo station playing the CDs of a Mahler symphony will find the soft passages only slightly above the noise level of telephone lines or composite microwave STL.

Old recording, new processing

I tried playing a Mahler CD on an old and venerable audio compressor found at most stations in the 60s and 70s. The "gated gain stabilizer" circuit continuously returned the AGC to the unity-gain point throughout the recording.

This was because the dynamic range was so wide that the detector circuit was assuming that the soft parts were programming pauses. Each time this happened the over-

(continued on page 35)

Delay With A Competitive Edge

by Ty Ford

Baltimore MD ... "I want a box that will give me the edge against the competition."

If I had a nickel for every time I've heard that line within the last year, I'd have a hernia from trying to carry around the money.

If your production people have been telling you that reverb and EQ just doesn't cut it anymore, listen to them. To sound "major," you must use "major" toys.

One of the best of these toys is the TC 2290 dynamic digital delay + effects control processor, from t.c. electronic (yes, lower case) of Denmark.

With a frequency response of 20-20K ±.5 dB, a dynamic range of 100 dB, distortion at .05% 1 kHz and a 1 MHz sample rate, the TC 2290 is the quietest, most invisible studio toy I've ever used.

For the price, no unit I've seen to date matches the quality and performance of the TC 2290. Its ability to combine delay, panning, extensive dynamic control and 1 MHz sampling make it a device to be reckoned with. After an hour in the studio, stereo enhancement boxes will be history.

So powerful is this software-programmed box that I will not be able to completely cover its abilities in this article. That's the bad news.

The good news is that because it can do so many things so well, and because it has been engineered for expansion, it will likely become your "production weapon of choice," especially if you have one or more MIDI-based synthesizers.

The fact that there are 45 buttons, five separate numeric displays, and enough blinking lights to mesmerize a room full of the most pompous production rats is offset by the fact that the TC 2290 comes with a 71-page manual, a demo/instruction video tape and a handy short-form setting card.

To reduce start-up frustration, there are about 20 presets and a setting card which offers quick tips. Because almost every value is variable you can start with factory presets, then learn as you go.

Producer's File

Getting lost along the way is expected. At one point I produced settings by accident that made sound seem to come out of a place on my studio wall where there were no speakers. Unfortunately, I didn't save the settings and I still haven't been able to reproduce the phenomenon.

While the unit is ideally suited for musical instruments, it also does great things for the human voice. My suggestion would be to limit its use to station promos. The effects are too good to waste on everyday production.

Downstream, should you start feeling guilty that you're ignoring your other processing gear, you'll be happy to know that the TC 2290 has jacks on the back for interfacing four mono effects and one mono in/stereo out.

The jacks are ¼" TS with Z-out of 100 Ω and Z-in of 220K Ω. I found that interfacing my Rev 7 with the mono/stereo port provided some great multiple effects.

Note that the TC 2290 does not have a reverb program. They figure that by now most people have at least one reverb.

If you're further along than most radio production rats and have been dabbling with synths and MIDI, you'll be happy to know that the TC 2290 can act as a master controller in a MIDI set-up. It has the standard in, out and thru on the back.

Also on the back is a remote control section consisting of three ¼" jacks. The control voltage in jack is there because the company has some future plans for it.

The link jack is used to connect the optional serial remote controller, which allows control of the presets and assign keys on the front panel.

The Assign Switch input parallels the Learn key on the front panel which, among other things, let's you "tap" in the delay time with your foot or trigger a sampled sound.

Inputs (all mono) are either ¼" High Z(1 MΩ), or XLR Low Z(20 KΩ). Outputs (left mono or stereo) are High Z 750 Ω +16 dBm max, or Low Z 100 Ω +26 dBm.

Both High Z and Low Z sections have direct outs which vary with the output of the unit. A High Z "buffered" copy of the input signal is available at the #1 Send jack.

Because the TC 2290 allows you to separately control the direct and delay output levels, it can be used as an aux effect on a mixing board with sends and returns. However, some of the effects like tremolo and auto-panning require both direct and delay paths.

The front panel of the TC 2290 is intimidating at first glance. There are separate displays and controls for input, feedback, output, modulation, pan, dynamics, delay, presets, assign keys, MIDI, external effects and other "special" functions. Getting the hang of pressing the right buttons takes a little time, but you get used to it.

Per the manual, the modulation effects possible include delay time modulations with automatic depth correction by sine, random for chorus, flanger, ADT, delay, chorus effects or input level envelope triggered for periodically constant pitch-shift and level gated chorus/flanger sweeps.

There are also dynamic modulations of direct, delay and feedback levels in various combinations by sine or random for tremolo effects or input level dependent for compress, expand, duck and gating effects, and panning modulations of direct, delay or both by sine, random, envelope triggers sideshift or level gated panning.

If your eyes haven't glazed over after reading the preceding three paragraphs,

(continued on page 37)

Amplipath: Beyond Multipath

by Joel Bump

Part I of III

Canyon Lake CA ... FM broadcasting has come a long way in its brief history.

We have produced cleaner audio sources, louder audio processing, superior exciters and many other gadgets to make us think we are more competitive.

Yet we continue to try to spray our signal out through a spigot that isn't any wider than it was before all these fancies were thought of.

Realistically, most of the technical areas of FM quality transmission have been addressed over the past ten years except for the bandwidth of the system which is responsible for amplifying the whole signal.

This one final area needs to be addressed, seriously, by the FM broadcast engineering community. And indeed, the talk has begun. This discussion centers on AM noise, specifically, synchronous AM noise.

For the purposes of this series I have coined the term "amplipath." Synchronous AM noise has been a particular interest of mine over many years, and I have been observing its causes and effects.

Joel Bump is a radio engineering consultant in southern California and is responsible for the design of Radio Design Labs' ACM-1 Noise Monitor. He can be reached at 714-244-3440.

Everyone affected

While spending time in many different stations, I have also observed its effects on the opinions of station staff about their signals.

Each person has an individual response to varying signal quality. Management gets complaints from sales. Salespeople hear it from clients (and usually in their car radios).

Programmers may hear it for themselves and tolerate a certain amount of it. But in the end the engineers take the heat. And more often than not the blame gets shifted to "atmospherics," "propagation anomalies" or some other esoteric explanation.

In reality there are outside factors affecting FM signals which the station engineer cannot control.

Beyond multipath

We all know about multipath, and so does the majority of the station management and staff. Unfortunately, however, the noise which is commonly called "multipath" is not necessarily multipath!

It may indeed be amplipath. Since first using the term at a presentation before the Los Angeles SBE chapter, I have received positive feedback on its acceptance.

Multipath can be defined as FM baseband distortion in receivers resulting from changes in received RF amplitude which result from phase cancellations of the transmitted RF spectrum as signals reach the receiving antenna from different directions at the same time.

Amplipath, however, can be defined as FM baseband IMD in receivers resulting from dissimilar amplitude and phase relationships between transmitted sidebands.

Multipath and amplipath both produce essentially the same effect in the receiver. But the cause is different. And that is why it is imperative that each condition be defined and understood separately.

Short of changing transmitter sites or antennas, multipath cannot be controlled. Amplipath, however, is controllable by maintaining consistently low synchronous AM noise.

A number of engineers are aware of the effects of AM noise, and many others are well on their way along the learning curve. Unfortunately, the methodology most often used to measure it doesn't work. And it often tends to drift "out of parameter" sooner than the engineer's next transmitter visit.

A little knowledge

The most important starting point to conquering a new frontier is knowledge.

Programmers must be aware that AM noise exists and has a considerable effect on the reception of their product, and that it significantly degrades audio quality thus derailing their best efforts at audio processing.

Management and sales need to know that the "multipath" they hear isn't necessarily multipath at all, but may indeed be controllable amplipath.

Educating programmers, salespeople and management in these areas, however, will only serve to increase the frustration of the engineer unless he or she understands AM noise and has a solution for it.

In this series I'll address AM noise and its causes, effects and solutions. We will also be looking at the requirements for making AM noise control a very practical part of ongoing maintenance.

But first we'll have to agree on a few definitions of terms I'll be using.

Noise and more noise

AM noise refers to any variation in amplitude of an RF carrier intended to be only frequency modulated.

Asynchronous AM noise refers to amplitude variations of an RF carrier intended to be only frequency modulated, which do not result from frequency modulation of the carrier. These variations result from fluctuating power supply voltage and from vibrations.

Synchronous AM noise (also called Incidental AM) is amplitude variation of an RF carrier intended to be only frequency modulated, which results from frequency modulation of the carrier. These amplitude variations are produced by bandwidth restrictions of the frequency modulated carrier.

It is synchronous AM noise which produces amplipath.

Controlling synchronous AM can result in improved audio clarity, better stereo separation, significantly lower cross-

(continued on page 34)

Improving Audio From "Ground" Up

by Tom Vernon

Harrisburg PA ... Technology is sometimes a mixed blessing. Advances in one area reveal deficiencies in other areas. Such is the case with broadcast audio. Noise sources that were below equipment noise levels 10 or 15 years ago now stand naked to the world.

One such newfound source of noise is the AC power line and its associated ground. Noise from electric motors, SCR dimmers, air conditioners, UPS's as well as RF, are all waiting to come into your studio through this path.

This threat makes the planning and installation of AC and ground systems an important component of studio design.

Domestic AC service comes in four basic flavors: 120 V single phase, 240 V single phase with center tap ground, and 3-phase. These are illustrated in Figure 1.

In all cases, the first line of defense should be an isolation transformer. For this transformer to be effective, it should include a Faraday shield, tied to ground, and very low capacitive coupling.

Single phase 240 V service must be run through a 240/120 V step down transformer.

If you have serious voltage fluctuation problems you can kill two birds with one stone by installing constant voltage transformers. These will smooth out line variations, and are very effective in blocking out high frequency noise sources.

The above measures should isolate the studio AC from the outside world. Next, protection from inside AC and ground noise must be considered.

The most important point is to use the studio AC line for audio equipment and nothing else. Run studio lighting and personal computers off another branch.

For 240 V 2-phase run all studio equipment on one phase, and balance the load by running lighting and other equipment on the other half.

Station Sketches

Trouble lies ahead for the engineer who uses both phases of the AC for audio equipment in the same studio. Figure 2 illustrates why this is so.

Conventional wisdom about shielding AC wiring in the studio still prevails. Run all AC in steel conduit. Run all audio in separate troughs or conduit. If audio and AC must cross paths, do so at right angles. Keep audio and AC conduits as far apart as possible.

Some precautions must be followed when installing steel conduit. Make sure that the conduit for studio power doesn't contact other conduits, water pipes, etc.

The only point where this conduit should be grounded is at the service entry point. Don't use the conduit as a ground point. This may be acceptable according to local electrical codes, but doesn't make for a low noise ground.

Purchase isolated ground outlets, and run a separate, insulated #14 or #16 ground wire from each outlet back to the service entrance ground.

There is one problem to be aware of with steel conduit. Over the years junctions between sections can corrode and create rectification points for RF. Some engineers prefer to use PVC conduit, especially in high RF environments.

When the equipment layout is being planned, it is important to designate a central ground reference for everything in the studio. Typically this is the main ground bus or lug on the console.

It is important to have this reference as close to the point of amplification as possible to insure superior noise performance. A #14 (or larger) insulated wire should run from each piece of equipment to this ground reference.

This type of grounding is known as a star system, and is illustrated in Figure 3. This is opposed to a series ground system, where one piece of equipment is grounded to another, which is grounded to a third, etc.

When the star system is used it is necessary to connect 3 > 2 ground adapters to all of the 3-wire AC plugs. If you don't, you'll create ground loops, with equipment grounded both through the station ground and electrical ground.

An alternative system is to use the ground wire in the power cord by connecting all the isolated ground wires from the AC outlets to a ground plane with a heavy wire from this point running to the service entrance ground.

Whichever system is used, be consistent! Either use all the power line ground connections, or isolate them with an adapter and use none.

With only AC and central ground connected to the console, power up and check for noise. If you haven't done

(continued on page 37)

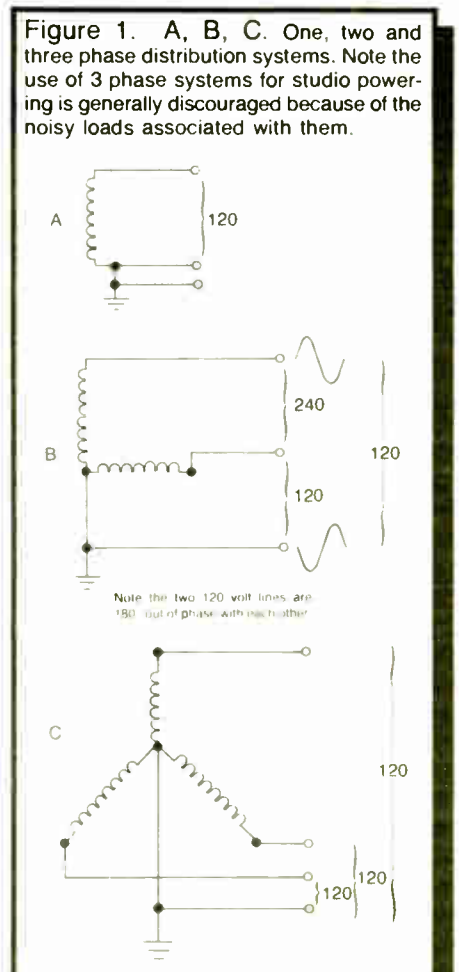


Figure 1. A, B, C. One, two and three phase distribution systems. Note the use of 3 phase systems for studio powering is generally discouraged because of the noisy loads associated with them.

Figure 2. Capacitive coupling between power transformer and ground can cause leakage currents to flow in a system with audio equipment powered from out of phase AC lines.

Back To Basics With Line Tester

by Bill Higgs

Louisville KY ... If I may continue for a moment on last month's theme, I am fascinated by test equipment available today.

Several devices currently on the market will sweep your audio, test for both harmonic and IM distortion and provide you with a computer printout of the results.

Presumably, this high-tech help will someday tell you when your turntable is off pitch, your tweeter is off resonance, or the DJ is out-of-sorts.

Forgive my skepticism. But no stack of silicon, regardless how sophisticated, can tell you what your audio *sounds* like.

It may come as a surprise to some manufacturers, but we broadcasters do not sell square waves, 1 kilocycle (I refuse to call it a Hertz!) tones or white/pink noise.

What we sell is program audio, and the only valid judge of this commodity is the human ear.

Simpler times

In the days of antiquity it was simple. Audio lines ran at 600 Ω at 0 dBm, and the engineer merely clipped a pair of headphones across the line.

Early headphones consisted of a thin metal disk attracted to a fixed electromagnet, much like the receiver in a standard telephone set.

These cans had all the fidelity of a car horn. They did, however, allow you to monitor an audio line and get some idea of what was going on.

Alas, times have changed. Standard impedances have become something of a myth, and headphones these days have impedances of under 300 ohms.

BottomLine—Broadcaster—

A pair of modern phones across a medium-impedance line appears as a dead short. The need to monitor a line still exists, however, and the following describes a nifty little gadget to overcome these limitations.

The box in question consists basically of a bridging amplifier and a small low-impedance headphone amplifier. Construction is not critical; perfboard or protoboard is fine. The setup is shown in Figure 1.

A fair amount of gain is available, so good practice should be followed in separating output circuits from input circuits. I used clip leads for the inputs, but if you use patch bays extensively you may wish to attach a suitable plug.

A plastic box is fine if it will not be used near RF fields. I have not used the unit near transmitters, but a metal minibox or the like would probably be necessary due to the high impedance input.

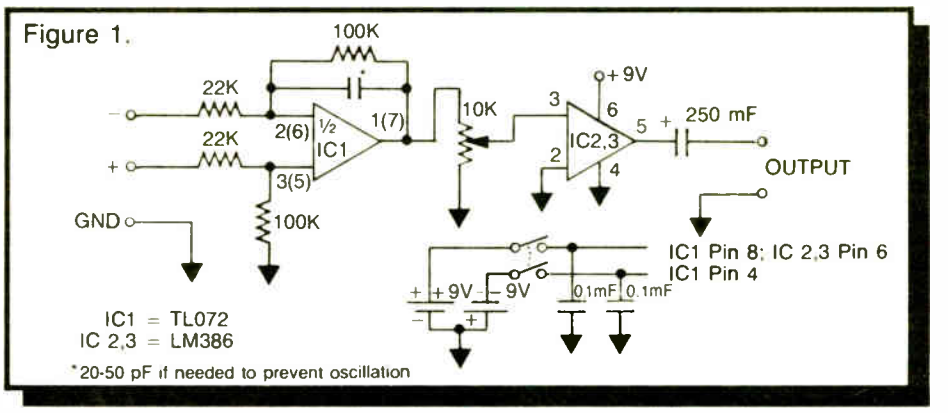
Those of you wishing to economize may wish to build a mono version. If so, you can replace the TL072 with a TL071. Note that the pinouts are different.

The volume control can be eliminated, but beware: The LM386 can put out 1 W into an 8 Ω load. Regardless of what the jock will tell you. that's a *lot* of audio!

Turn a pocket transistor radio wide open and hold it to your ear and you'll see what I mean. The power switch *must* be a double-pole type; otherwise you can get latchup on the TL072.

Splurge a bit and use alkaline batteries; the 25-cent variety simply will not hold up to high output. Swap the batteries frequently for increased life.

Figure 1.



Hands-free operation

A belt clip is a handy accessory, as it will allow you both hands free. Any number of tricks can be tried here. Also, use a ¼" headphone jack for the output.

It is then possible to use the station's headphones without having to carry around a dedicated pair. By the way, the LM386 will drive anything from 8 Ω on up. If you build a mono version, add a 3.9 Ω resistor (1 W) in series with the output of the chip to prevent damage.

The unit was designed, as much as possible, with DC coupling. The only capacitor in the circuit is in the output stage. The value shown is optimized for 8 Ω phones.

If you choose to use higher-impedance phones, a somewhat smaller value can be used. If DC blocking is required for testing purposes, NP electrolytics of approximately 2 mfd work well in series with the inputs.

Use of the unit is almost self-explanatory. The inputs are actively balanced differential inputs with an impedance of approximately 45 K, so the device can be bridged across almost any low impedance circuit.

Some consumer equipment outputs will object to even this impedance, so 47k resistors can be added in series with each input with a slight loss in gain. For bridging unbalanced circuits, simply tie the "minus" input to the ground lead.

Adequate gain is available for testing low-level circuits. Frequency response is quite flat, with a slight roll-off at low frequencies due to the output coupling capacitor.

As usual with such circuits, other uses come to mind. The LM386 will drive a 600 Ω load near line level (unbalanced), so the unit can be used as an emergency line driver or boost amp.

If balanced output is absolutely necessary, the chip will drive a transformer or repeat coil nicely.

Although not an optimal circuit, it can be used in a pinch to hook consumer equipment to boards such as LPB and Autogram which require a low-impedance source.

Speaking of boards, many early solid state (and many tube-type) boards accommodated headphones (or earphones) by bridging across the program line through a resistive pad.

Low-impedance headphones have virtually zero output under such conditions. This circuit can be installed in such situations with ease, or added outboard.

I think you will find this to be a slick little unit. Only one problem remains. What do you do about all that *bad* audio you hear that your high-tech box doesn't tell you about!

Bill Higgs has been CE for WXLN/WFIA for six years and has also done station consulting work. He has a PhD in Theology which helps explain his patience with small market radio. He can be reached at 502-583-4811.

Get Off The Financial Treadmill

by John Cummuta

Downers Grove IL ... I'm sure, after a hard day's work, you can't wait to curl up in front of the fireplace to read a good Department of Health, Education, and Welfare study. But just in case you missed their publication 13-11727, let me tell you the unsettling statistics it unveils.

By the time the average set of 100 Americans reaches retirement age (65), only five of them have achieved financial independence, being defined as having too much money to qualify for government benefits.

But if you look deeper, you find that only one out of 100 can be described as wealthy, meaning that they can afford to do what they want, when they want.

These numbers are shocking, but they look even worse when you turn them around. What the study really says is that 95 out of 100 people in this country do not achieve financial independence.

That means that they require either government aid, charity, family assistance or they must keep working just to survive. Think about that.

It means that as you look around the station at all your co-workers, 95% of them are on a conveyer-belt to financial dependence. They will not achieve the golden future that each of them thinks awaits them. They will likely end up on Social Security or worse.

But the scariest thing of all is that you could be staring at one of those doomed "ninety-five percenters" when you look in the mirror each morning.

It might be a good idea for us to try to determine what allows the "five-percenters" to succeed.

Winners, those who achieve true success and financial independence, maintain positive attitudes about themselves, those around them, their opportunities —about life in general.

They don't put themselves down with negative self-talk, and they believe in their own talents, dedication and capabilities.

Winners all persist. They never, never, never give up.

Let me tell you a story of persistence in action.

He failed in business, going bankrupt in 1831. He was defeated for the legislature in 1832. He went bankrupt again in 1834, then his fiancee died in 1835. This all gave him a nervous breakdown in 1836, so to give himself a lift he lost an election in 1838.

He was then defeated for Congress in 1843, 1846, and 1848. So he tried for the Senate, where he was defeated in 1855. He was defeated for Vice President in 1856, and lost again in a Senate bid in 1858. Sounds like a real loser doesn't he?

But he persisted, and he was elected President of the United States in 1860. His name was Abraham Lincoln.

Would you and I have continued to pick ourselves back up after as many discouragements as he endured?

Do we realize that our families will be eternally grateful if, like Abraham Lincoln, we don't let stumbling blocks knock us out of this game for success and financial freedom?

I don't want to begin a mass exodus of people from their jobs, turning to a life of gambling and vice to make their elusive fortunes.

Engineering-Manager

But I will say that J.O.B. usually stands for Just Over Broke. If you wish to make your way to the 5% side of the scale, you need to look within yourself for special talents and abilities that can raise you above the ninety-five-percent crowd.

You must find out what makes you exceptional, and stop hiding it.

Only exceptional people get paid exceptional money. You need to become your own greatest supporter. Immediately cease any and all negative self-talk.

What you've got to stop doing is saying things like, "I'm no good at this. I can't do that. I'll never be as good as so-and-so." These are self-destructive messages and that's all that they can accomplish.

Next, begin feeding positive energy into other people and you'll be amazed at how much of it comes back.

Feed your mind with positive information. You've probably heard the computer axiom, "garbage in—garbage out." The same applies to your mind, and if you want to bury it in "garbage," just watch plenty of TV.

My advice is to avoid any kind of news in the morning, as if it were the plague. Sounds kind of radical for someone in the media business, doesn't it?

Well, you can take this to the bank: there's no such thing as "Good Morning, America." All they do is fill your head with all horrible things that happened overnight—all of which you are powerless to change.

The first hour is the rudder of the day. Fill it with the powerful and the positive. Go to your neighborhood book store. Their shelves are packed with motivational books and tapes.

There are even many good motivational videos coming onto the market. Get yourself a copy of *Success* magazine. Read about how successful people think and operate.

It just makes sense. If you want to become a better tennis player, you wouldn't ask someone of your own skill level to be your instructor.

You'd seek out someone much more like what you want to be—exceptional. It's the same thing in the game of life. If you want to become more successful, you should sit at the feet of successful people, or at least study them.

It is really more like a formula. When you begin doing the things that breed success, and they are commong to almost any field of endeavor, success results naturally.

But you cannot opt out of making a decision, because a decision to do nothing about your chances for a successful future is a default decision to ride the conveyer belt to the ninety-five-percent side of the financial scale.

And if you have been listening to the morning broadcast and printed blues, you've undoubtedly heard that there may very well be no Social Security by the time you get to that age.

The truth is that your only security in this world is what you have in your skills, your abilities, and your reputation—all of which are products of your attitude.

The way you think, and what you feed into your mind, will inescapably affect your Health, and your Education. If you choose to do nothing, well, there's always Welfare.

John Cummuta is president of Marketline, a broadcast management and marketing consulting firm and a regular **RW** *columnist. He can be reached at 312-960-5999.*

Phone Interfaces Are Hot

(continued from page 23)

designed for use in the Part 94 (Private Fixed Microwave) service band of 928-960 MHz which can be used for broadcast service except for the final hop of an STL path.

This may be the only choice for a multi-hop system in the top markets, and this equipment is available today.

For stations looking to install a new telephone system in their studios, the Telnox L-O system from Quebec might be just what you're looking for.

The system can conference up to ten callers and has many features designed specifically for broadcast use.

Another specialized phone device available through Allied is the Contest Computer from DSI Communications.

When the contest begins, the unit automatically answers each incoming line and tells them "Sorry ... " and what call number they are.

When the winner is received, it is routed through a back panel jack to external equipment (like a phone hybrid) for the air talent to handle, and the calls following the winner hear "Thank you, we have a winner."

All in all, there are some great new products for the creative station in a competitive market at NAB '88.

Geary Morrill is DE for Mid West Family Stations and an occasional **RW** *contributor. He can be reached at 517-393-1010.*

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Circle Reader Service 37 on Page 38

Network Series Combination

by Tom Osenkowsky

Brookfield CT ... When we investigate the operation of common matching and phasing networks, we often find components in series.

It is often the practice to place a variable coil in series with a fixed capacitor in the shunt leg of a Tee network; because vacuum variable capacitors are far more costly than a tapped coil.

The practice is OK provided the XL to XC ratio isn't excessively high. Another common circuit is that of the "zero degree" phase shifter.

A coil and capacitor are placed in a series circuit within the phasor just prior to the J-plug feeding the transmission line. The circuit is normally set to resonance (XL=XC @Fo).

The inductor is front panel adjustable and is used to compensate for minor phase variations on the tower by virtue of the fact that the phase shift equals ATN(X/R) where R usually equals 50 Ω, the transmission line Zo.

Too steep of an XL to XC ratio will cause radical variations at the sideband frequencies, however. If the zero degree phase shifter had a −j1000 to +j1000 ratio at Fo, a radical phase departure would occur at the sidebands.

Pattern and impedance bandwidths would suffer as would the stability of the pattern since, say, +/−3% change at j1000 is far greater than +/−3% at jlOO.

I do not cite a particular example, especially the simplistic linear case (where I would state that R⁵50 for carrier and both sidebands) because the departures at the sidebands would rely on the impedance slope of the radiator itself, the component reactance variations of the ATU components, current phase shift on the (mismatched) transmission lines, power divider and phasor variations, etc.

Equation 1.

$$C(\mu F) = (Fc / 2 * Pi * Xs * Fr^2) - (1 / 2 * Pi * Xs * Fc)$$

where Fc = Carrier Frequency (MHz)
Fr = Reject Frequency (MHz)
Xs = Shunt reactance as required by network

Equation 2.

$$L(\mu H) = (Fu * Xu) / (2 * Pi * Fu^2 - Fc^2)$$

$$C(\mu F) = 1 / (4 * Pi^2 * Fc^2 * L)$$

Equation 3.

$$Op\ Current = Current\ Rating * SQR(Fc)$$

The simplest way to start towards improved bandwidth is with the lowest amount of variations, period.

Variations can be reduced by using tower operating reactances as part of the ATU arms. After all variations have been minimized, an analysis on the array can be made to see if and where improvements are possible.

On occasion a broadcaster is faced with the problem of intermodulation—the mixing of his signal with that of another, creating unwanted spurious products in or out of the broadcast band.

One solution is to employ a pass/reject trap at the tower base. The purpose of the trap would be to pass your frequency and reject your neighbor's.

The intermod arises from mixing of the unwanted signal in the final amplifier of your transmitter. There is, however, a simpler solution.

Remember when there was a First Class license? When you went for that test, you memorized the rule of SARL PARC, or "Series Above Resonance Inductive, Parallel Above Resonance Capacitive."

Let's relive those glorious days of SARL PARC in Equation 1. Figure 1 shows an example of a −90° ATU matching a tower whose base impedance is 59−j.8 at 800 kHz. The desired reject frequency is 1600 kHz, the second harmonic in this case.

The formula gives us the required capacitance value for the shunt leg; the inductance is obtained by the simple equation L=XL÷2*Pi*Fc. The amount of Xc=½*Pi*F*C.

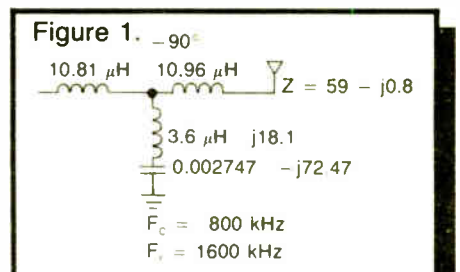
Lagging networks always have reject frequencies *above* Fc while leading networks always have reject frequencies *below* Fc.

In a directional array, such a scheme may be used in each ATU. In severe cases, a trap may indeed be necessary. This arrangement is most often used when it is impossible to perform equipment performance measurements due to demodulation of your neighbor's signal.

The method described here allows you to have the correct match at the required phase shift and reject a frequency of choice. No substitute can be made for the capacitor, however.

Only one combination of C and L will meet the reject criteria, so a vacuum variable may indeed be necessary. Some experimentation may be done with the phase shift so that a standard component may be realized.

A series network can also be used to cancel the upper and lower sideband reactances at the common point or ATU input.



(1) The Phantom Tee network as described by Ed Edison of Hammet & Edison

The criteria that must be met are that the reactance is negative at the upper sideband and that the reactances are nearly equal in value and opposite in sign.

Equation 2 gives the formulas for determining the required values of C and L. Sideband reactance can be accomplished at the common point or at the ATU input terminals of a DA or non-DA.

An evaluation of line length will help in that determination. In this type of broadbanding, the voltage ratings of the series components must be carefully considered. The junction voltage can be very high and corona easily developed.

When dealing with transmitting capacitors, keep in mind that they are rated at 1 MHz. You must calculate the scaled rating at your frequency.

You can use Equation 3 for this. Keep in mind that the matching network input arm can be used as part of the series network, possibly reducing the component count by one.

Tom Osenkowsky is a radio engineering consultant and president of MASTER Software, and a regular **RW** *columnist. He can be reached at 203-775-3060.*

Spring Cleaning Time At Hand

by Barry Mishkind

Tucson AZ ... Well, now that spring has sprung all over our wonderful land (what do you mean, there's still white stuff where you are?), it's an appropriate time again for a look around your facility to see what may need attention after the winter.

Of course, it's not just damage we're looking to find. Taking full advantage of the situation, many engineers decide to do a complete check of the station, seeking things that need attention, including new projects to improve operations.

You might even call it a sort of traditional spring cleaning project.

This kind of project can take many forms, such as a predetermined check list that the station engineering department prepares to completely and thoroughly inspect every piece of equipment.

It could also be a check of compliance with all FCC rules and an analysis of what new items the staff might like to have installed. Or, you may just want to walk around, electronically "kicking the tires," so to speak.

Right to the top

For those who do endure a lot of snow and ice, it's important to check the antenna and tower for weather damage. Not only can the elements bend or twist antennas (especially STL and TSL antennas), but the guy wires deserve attention, perhaps even a tensioning.

What of rust or other deterioration of the guy anchors, tower base insulators, etc. Are the ball gaps in good condition? It's even a good idea to check for weepholes on the tower that may have become blocked and thus allowed water to sit inside the tower legs, attacking the metal from the inside.

Since the towers just stand there year after year (we hope!), we might become a little neglectful of the painting and lighting requirements.

If the tower is not clearly visible to approaching aircraft due to fading or peeling, you may be liable to a fine.

In fact, the FCC has been making this a priority check item of late. Also meriting attention is the photocell system. Is it turning the lights on early enough?

Preempting the weeds

At this time of year, the local flora has yet to reassert itself, so it's a lot easier to clear away areas that may provide grass or weeds later. Some stations apply a chemical to retard growth near the towers and building.

Naturally (pun intended), the building itself may be in need of attention. You might like to check the roof periodically, to ensure that the wind, for example, has not lifted some material, or caused cracks around the air vents from the transmitter.

The last thing you'd want is to open the back of the transmitter and find that water and dust have been getting into it. Worse yet is finding this out immediately after the transmitter has failed!

Even if you are logging the transmitter readings regularly, make a special effort to read *all* the meters of *both* transmitters, tweaking the tuning.

> ***... many engineers decide to do a complete check of the station, seeking things that need attention.***

Haul that 1.2 GHz counter out there and do a frequency count. Are they all there? A quick check to ensure the STL signal strength has not deteriorated can save a lot of trouble later.

The air conditioning system also deserves attention—not just the filters, but the whole unit. Will it continue to keep the transmitter room cool as the temperatures climb?

A well working air conditioning system will not only help prevent transmitter failures, but also extend the life of those expensive tubes hiding behind the PA cavity door.

Meanwhile back at the ranch

At the studio, you can start with the air conditioning system there. Although DJs do not fail like a transmitter in excessive heat, they do become rather crabby when their overload relays trip; thus, it's easier to work with them in a comfortable studio.

Similarly, the exterior of the studio building deserves a full inspection, as do the various STL, RPU, satellite and other antennas mounted about.

Inside the studio may be the easiest part of your inspection, as you may have been indoors all winter, fixing everything in sight.

On the other hand, getting into the spirit of a spring cleaning and inspection, you can again do a complete once over, starting with the FCC checklist.

Is your paperwork trail sufficient to prove that your operation is legal? Is the operator's manual current? Is the public file up to date?

Often it's only the station engineer or contract engineer who knows what is required. This is a wonderful opportunity to show the GM your value and diligence in an area that can be understood.

After you have determined that all the studio equipment is working well, is aligned to an actual standard, and the nicotine has been scraped from the control room windows, etc., maybe you might poll the DJs to see what is on their wish list for easier operation in the control room.

Perhaps moving a source from one pot to another will help, maybe adding a new remote button. In any event, knowing what the staff thinks about the operation will help you in planning a better, more functional facility.

Following tradition

Traditionally, spring is the time for a thorough cleaning and overhaul of most households.

The radio engineer might emulate this by observing all the quick fixes made over the past year, and cleaning them up. Some stations do a root canal on their wiring, and find enormous amounts of wiring doing nothing more than bringing RF into the station audio chain.

Even if you are a much more careful technician, is the wiring diagram for the station up to date? You'll likely enjoy a vacation some day. Whoever stands by for you will appreciate your accurate records.

Certainly, you can add to this list other points that you have found to be valuable in helping keep your facility running at optimal efficiency. Or make your own up.

Just be sure to be complete and follow through with whatever repairs or adjustments are needed. You will be rewarded with months of smooth, solid operation. Have a good spring!

Barry Mishkind, aka **RW***'s "Eclectic Engineer," is a consultant and contract engineer in Tucson. He can be reached at 602-296-3797.*

Effects Of Amplipath

(continued from page 28)

talk into subcarriers, quieter received signals and improved coverage area.

Synchronous AM may well be the last widespread factor which substantially limits all other technical achievements in the FM broadcast chain.

This "final frontier" affords the engineering community a unique opportunity to make a significant contribution to the overall quality of FM broadcasting.

On-Air Consistency From CDs

(continued from page 26)

all volume level, already very low, went further down.

I performed the same test with the Columbia LP issue of the Mahler and the output of the unit was more consistent.

However, the tremendously high tape hiss in the original recording tracked the gain changes, revealing the dynamic action, while the utterly silent background of the CD concealed much of the gain-riding.

We may draw some conclusions at this point. First, CDs are much wider in dynamic range, from 5 to 30 dB greater than older analog LPs.

CDs will also tend to be brighter in loud passages than LPs and CDs frequently have no audible background hiss and can take more compression with less revealing artifacts.

Aiming for consistency

I have concluded that there are several things an engineer can do to maintain consistency of audio when CDs and albums are both used as sources.

First, insure that the phono playback response is absolutely flat to 15 kHz. Don't just assume that it is correct. I have measured enormous variations in combinations of well respected cartridges and preamps.

At one station, I found the top end to be down almost 10 dB at 15 kHz when checked on the CBS Labs RIAA test record. LPs sounded much duller than CDs until the imbalance was rectified at the phono preamp.

Next, attempt to replace old LPs with CD copies; these will have inherently less audio peak limiting and will sound closer to the dynamic range of modern recordings. Tape hiss will be lower, and the absence of vinyl noise will reveal less of the gain-changes of broadcast processing.

Then, exercise extreme care in carting CDs. High frequency spectra will be stronger on CDs than on LPs. Use hot tape oxides and carefully bias for clean transients, and make sure peak levels are under the tape saturation point.

Some engineers have successfully employed judicious audio processing at this point and even have tried using small amounts of high-frequency limiting when carting music.

If you do this, be sure that the equipment is not just the old junk you took out of the air chain. The limiter must sound as transparent as your air processor, and must not over-compress the top end before it hits pre-emphasized AM or FM limiting.

I have seen excellent results achieved when the production and air processors were the same brand of product.

Improve the player

Use second-generation CD players with oversampling and digital filters. There *can* be a shocking difference in sound quality between CD players.

I have A/B'd the same recording in two machines and have heard a glassy, constricted sound on a cheap player give way to a warm, open clarity on a machine with oversampling.

This cuts down on some of the CD harshness that fatigues critical listeners and brings digital sound closer to the naturalness of the old direct-to-disk collectors' items.

You may want to consider the use of sub-mixing in your audio console to permit adding a little extra compression right at the CD players themselves (I've used a dbx unit set for a 1.5:1 curve with great success).

Or try the dbx Model DX5, a CD player with a built-in variable compressor, enabling you to tailor the dynamics of CDs to approximate the range of the LPs in your playlist.

For pop music, use multi-band processing, but don't expect it to make an old recording sound brand-new. The best you can hope for is to smooth out the hardness in old pop albums that were mixed in the 50s and 60s on the conventional horn-tweeter studio monitors of the era.

Boost compression

You may find that with more CDs in your playlist you can use a bit more compression than was necessary in the past with less fear of tell-tale noise modulation.

However, be careful of gating levels and expander functions. The wide dynamics of a CD may fool a circuit designed to cope with the techniques used to record LPs thirty years ago.

Don't over-limit the high frequencies in your final stage of processing. We don't have to turn the transients of modern recordings of cymbals into the kind of garbage can lid crashes we used to hear on most FM stations in the 1960s.

Finally, I think we all realize that it is best to employ the type of audio processors that were designed and tweaked by their manufacturers since CDs came on the market.

That means that they can accommodate the levels and transients of CDs without gulping or wheezing.

But advising which ones to buy in this most subjective of all fields is not my intention; I need all the friends I can get!

Stephen Waldee is CE and PD of KBOQ-FM and CE of KOFY-AM, San Jose, and is also a consultant. He can be reached at 408-384-5755.

New Antenna Products

(continued from page 21)

dual-channel (35 and 17). Tennaplex anticipates several new installations in addition to re-engineering some earlier installations for heavier equipment loads.

Stainless Inc. is gearing up to make complete turnkey installations. According to Owen Ulmer, Stainless has started doing its own construction so complete responsibility for the job can be kept under the control of the company. Call them for further information.

Some of the newest news in antennas —AM—comes from Pinzone Communications Products. It's a new antenna for the AM broadcast band designed to reduce skywave, and it's called the Corum antenna, after its designer.

Pinzone had a small model of the Corum on display. It has a low profile—35 to 50' high—and is broad-banded with a low radiation angle. According to Basil Pinzone, Jr., President, the Corum antenna has a pattern nearly equal to that of a normal 190° tower.

The antenna is reported to reduce skywave radiation, thus the wall where cancellation occurs is pushed further out from the station.

Shively Labs, a long time player in the FM antenna market, stresses quality of product and staying abreast of technology.

According to Bob Surette, manager of RF engineering, Shively has a commitment of "staying tuned" on a personal basis with users of Shively products. The company continues to expand the line of antennas, antenna combiners and coax components.

SWR Inc. was featuring a two year warranty on coax and wave guides! SWR Inc. has developed some interesting features on its UHF Posi-Lock Wave Guide System. The "O" rings are recessed and captive to give a good gas seal and help prevent pinching.

The wave guide sections have "sexed positive lock flanges" to eliminate alignment pins. Etched RF contact surfaces are used for better RF conductivity and a positive RF seal at each joint.

Another item of interest at the SWR display was the "Patchless Panel." The manually operated switch is a lower cost alternative to the powered changeover relay for transmitter switching or antenna switching. It takes about two seconds to make a change, with no finger stock to bend or break, and is available in three flange sizes.

In addition to the turnkey installations of antennas, structures and feed lines for both TV and FM, LDL Communications is now offering emergency restoration services for broadcasters as the company has done for the telecommunications industry for several years.

This ERS service guarantees to have a structure and antenna in place within 72 hours of notification of a disaster. This does not mean that the equivalent of the original structure and antenna will be in place, but that ERS will have a structure and antenna up and ready to take signal to put the facility back on the air.

United Rope Works was left to last because we need something to hold many of the towers, and the guys go up as the structure rises. We usually use the trade name Phillystran when referring to this company.

Phillystran is the alternative to wire rope or steel cable for towers up to 500' and can partially guy towers up to 1200 or 1300'.

Some of the advantages of Phillystran are its light weight, non-radiating and non conducting nature.

And that about covers the transmitting tower end of things.

George Riggins has experience in radio and electronics dating back to the 1930s. He is also a licensed ham operator and has his own broadcast sales and service company, Riggins Electronic Sales, and is RW's *Old Timer. He can be reached at 213-598-7007.*

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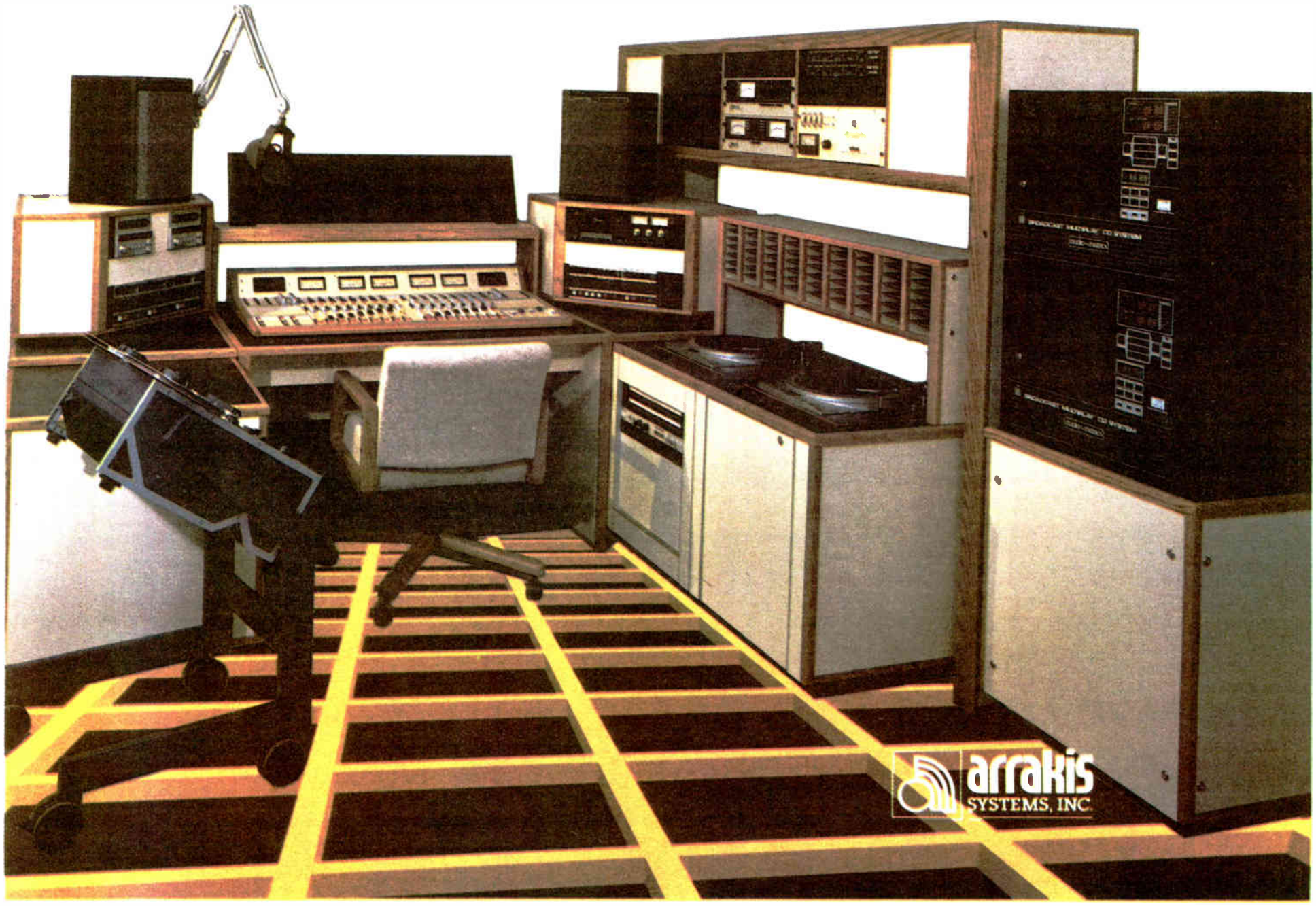


Digital Delay Device

(continued from page 27)

you should also know that delay time, dynamic, and panning modulation can occur simultaneously. Of course the TC 2290 also samples up to 32 seconds at full 20 kHz bandwidth.

As with the Yamaha Rev 7, you can create your own preset effects and store them by number for quick recall. Keep in mind that storing audio samples eats up the digital memory.

I have had the opportunity to use this box on radio spots, on an album mixdown and on several A/V soundtracks. After using it for several months, I still haven't unlocked all of its secrets.

Top features for me are the variable speed auto-panning of both (or either) the direct or delay signal, the "learn" button which lets you set the echo repeat time by tapping along with the music, and the ability to suppress the delay effects while the direct signal is present while allowing them to increase in volume after you stop speaking (or playing).

I took the box to Bill Mueller, CE of Sheffield Audio/Video just outside of Baltimore. After three days Bill said it was "easily the quietest processor I've seen—quieter than the 3324 Sony 24 track digital recorder and almost as quiet as the SSL."

Bill Brady, studio manager and CE of Omega Studios in the DC market, felt the panel layout should be more logical and commented that the TC 2290 would probably not fare well in the equipment rental market because it is so complex.

He also felt that while the manual was long, it was sometimes vague and difficult to interpret. However, he felt that while the PCM 70 and SPX 90 were a better buy for simple effects, the TC 2290 was cleaner and quieter. For him, the dynamics processing was of special interest.

Jim Mikles is the studio manager and CE at Baltimore's Flight Three Studios. He and I worked together with the unit during the production of an album.

He agreed that the panel was not obvious, and that the book was important. His favorite features included the long delays with full bandwidth, the dynamics on the delay returns and the learn button.

The TC 2290 is not cheap. Without sampling, the stripped down version comes in at $1995, but $2400 will get you the unit with four seconds of sampling.

If you choose, $2800 will get you four seconds of sampling with the ability to layer and sequence your samples (the sample trigger is set at 500 μs with 3 μs retrigger accuracy) and a note counter for pitch shifts.

Additional seconds of sampling cost $30 each with a maximum of 32 seconds. Big budget users will probably want two units linked together for stereo (if you can live with a 1 μs delay between units).

Ty Ford, a radio audio production consultant, helps stations optimize their use of production and airstaff skills. He can be reached at 301-889-6201 or via MCI mail (user name TFORD). For more information on the product call Marc Dronge at (201) 384-4221.

Grounding

(continued from page 29)

so already, this is a good time to do a full "proof" on the console, and verify its standalone performance.

At this point, audio wiring should be fairly straightforward. Remember to connect the shield wires at one end only, and leave the other floating.

Which end grounded?

There are different schools of thought as to which end should be grounded, but again the important point is to be consistent within your system.

As each audio line is connected from source equipment to the console, run the gain wide open and listen for noise.

Correct any difficulties noted as they come up, and you won't have the trauma of trying to figure out which of 50 or more cables are interacting to produce oddball ground loop problems.

With all the wiring connected proof the console again. Any dramatic increase in noise or decrease in HF response is being caused by audio wiring problems and should be investigated.

If RF interference is experienced, it may be necessary to connect a .01 uf ceramic disc capacitor from the floating end of the shield to ground.

Confusion often exists about how to ground patchfields. The best system is to let all cable shields float at the jack end, grounding them only at the equipment end.

The jacks should all be bussed together with bus bar wire and a single insulated wire run to the studio ground point.

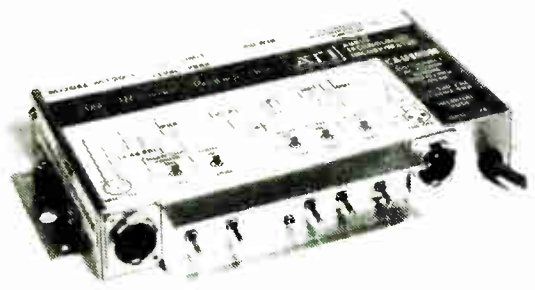
Shielded remote control cables should be handled the same way as audio wire. Ground the shield at one end and let the other end float.

Installing a noise-free power and ground system in studios takes careful organization, planning and follow through. This time is much less, however, than the time spent running down a myriad of intermittent noise and hum problems in a studio with a haphazard powering and grounding scheme.

Tom Vernon, a regular RW columnist, divides his time among broadcast consulting, computers and instructional technology. He can be reached at 717-249-1230.

Radio World Marketplace

If your company has a new product you wish us to consider in *Radio World Marketplace*, please send a press release and black and white photograph to Radio World Marketplace, P.O. Box 1214, Falls Church, VA 22041



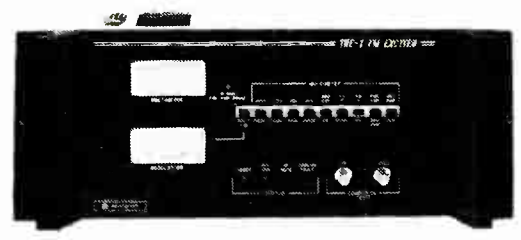
Mic preamp

ATI introduced a new microphone amplifier, the M100. It is an extremely low noise, high CMR, direct balanced input instrumentation amplifier, according to the company.

The M100 boasts servo operating point stabilization, and drives a distortion-free transformer isolated line output.

Features include a variable gain input, switchable limiter, two pole active low cut filter and 48 VDC phantom power.

For more information, call **Ed Mullin at ATI: 215-443-0330**, or circle **Reader Service 79.**



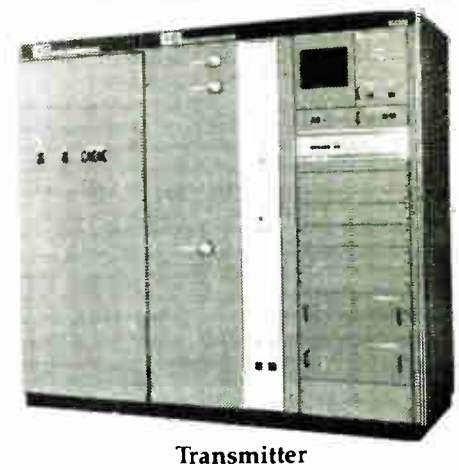
FM exciter

Harris Corporation recently introduced a new 55 W or 15 W solid state FM exciter, called THE-1.

THE-1 features monaural, composite and SCA subcarrier inputs as standard and is FCC type notified for direct replacement of older generations of FM exciters.

The exciter uses an ultra-linear voltage controlled oscillator operating at final carrier frequency. It features exceptional immmunity to mics and externally induced hum.

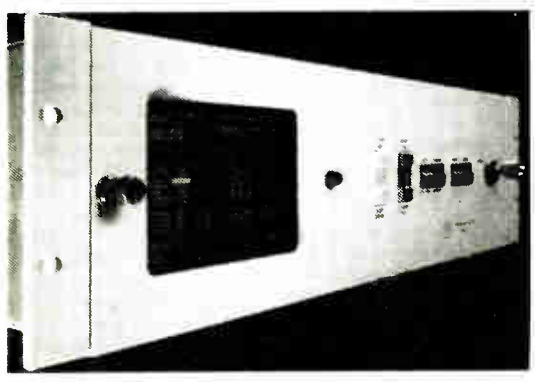
For more information contact **Ron Frillman at Harris: 217-222-8200**, or circle **Reader Service 74.**



Transmitter

Broadcast Electronics' new FM-20A 20 kW transmitter features a patented half-wave output cavity and an advanced automatic power control system. The intermediate power amplifiers are modular for easy access and require no tuning over the entire FM band.

For more information contact Bill **Harland at BE: 217-224-9600**, or circle **Reader Service 78.**

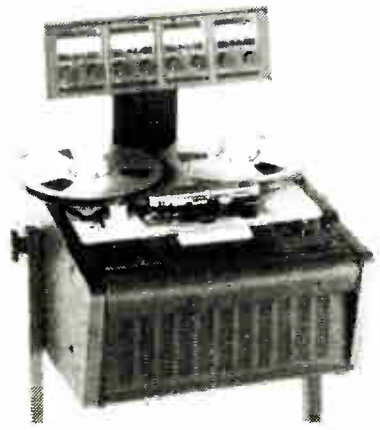


PC programmable controller

Potomac Instruments' new 1500 PC Programmable Controller is an 8085 microprocessor based unit which functions as a stand alone intelligent controller.

It may be linked via land line or radio to the optional 1510 ST Studio Terminal for automatic remote control applications.

For more information, contact **Dave Harry at Potomac: 301-589-2662**, or circle **Reader Service 70.**



Four-track recorder

Studer Revox's new A807 4½" VUK 4-track machine is available in the line's high speed version with overbridge metering. It features three speeds and servo controlled DC capstan motor and spooling motors.

For more information, contact **Charles Conte at Studer: 615-254-5651**, or circle **Reader Service 75.**

TSL system

TFT's new 8700 series TSL system was designed for use in the 450 MHz group "P" frequencies. Up to four users can share a single TSL system.

This data multiplexing system employs DTMF codes to open the squelch of the proper receiver in the network at the proper time.

A data stream is then sent at a rate of up to 1200 baud from the shared central transmitter to one of the receivers.

The basic price for this system is $2750. The DTMF option is an additional $920 for the transmitter and $420 for the receiver.

For more information contact **Jesse Maxenchs at TFT: 408-727-7272**, or circle **Reader Service 71.**

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Circle Reader Service 25 on Page 38

BUYERS GUIDE

Antennas, Towers & Cables

Jampro Reduces KNHC RF

by Kelly Alford, CE
KNHC-FM

Seattle WA ... RF radiation from FM and TV towers has grown to be a major issue here in the Pacific northwest over the past few years. In Oregon, the city of Portland and Multnomah County have both enacted strict local laws limiting power density levels at broadcast facilities.

King County, WA, has been studying the issue for the past year, and a community coalition group called the "Tower Task Force" has drafted a recommended ordinance for consideration by the board of supervisors.

User Report

In this environment, the city of Seattle saw the handwriting on the wall, and began to investigate the problem inside the city limits, with an eye towards drafting its own regulations.

In the course of investigation, the city became aware that one of the worst offending towers might be the transmitting antenna of KNHC-FM, operated by the city's own school district.

KNHC's studios are at Nathan Hale High School, and the transmitter is located a few miles away at Wedgwood Elementary School.

The antenna sits atop a 144' tower on the roof of the elementary school building. KNHC uses a six-bay circularly polarized antenna and a 3.5 kW transmitter to obtain its licensed ERP of 10 kW.

Serious RF interference

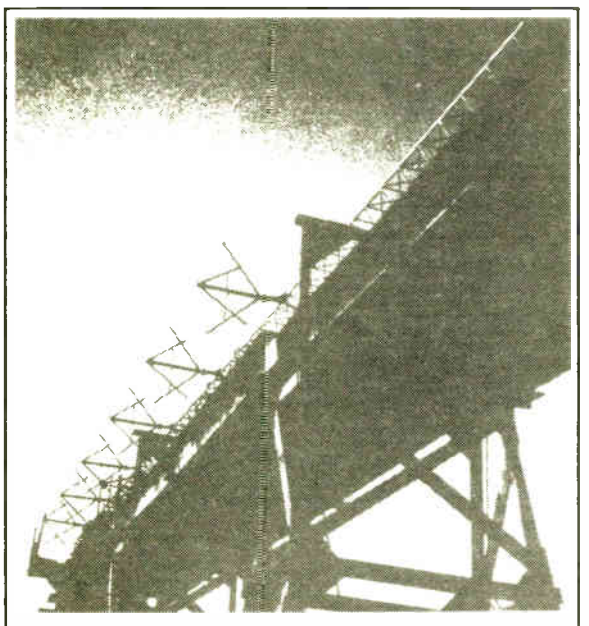
RF interference from the station was always a problem at the elementary school. There were many parts of the building where electronic equipment would not work properly.

To make matters worse, Wedgwood Elementary is the home of a special education program for handicapped students. RF interference was causing some students' electronic wheelchairs to malfunction.

After a near accident, in which the brakes of a wheelchair released while a student was being discharged from a school bus, an ultimatum came down from the administration: KNHC must reduce the RF level on the school property before the start of classes in the fall, or go off the air.

A new antenna was clearly required. Alternatives were studied, and several manufacturers proposed half-wave spaced antennas.

While this method would resolve the immediate problem, it created another: half-wave spaced antennas reduce radiation levels below the horizon, but they do so at the expense of antenna gain. To maintain our ERP we would need to replace six bays with ten, and we were concerned about exceeding the windload rating on our Rohn 45G tower



Jampro built a custom antenna with 0.8 wavelength spacing to alleviate KNHC's RF problems.

John Schneider and Bob Arnold at RF Specialties approached us with a unique alternative. They proposed that Jampro Antennas build for us a custom antenna with 0.8 wavelength spacing.

The gain would be identical to a six-bay full wave antenna, but the downward suppression would be almost the same as a half-wave spaced antenna.

Same gain, less money

Further, the cost of the six-bay antenna was almost $10,000 less than the half-wave ten-bay antenna. These cost savings would allow room in our budget to order range test measurements to verify the downward radiation suppression.

Jampro was willing to guarantee a minimum downward suppression of 20 dB. In short, we could have our cake and eat it, too! An order was placed for the antenna in mid-June.

Jampro built the antenna using a modified version of its standard JSLP antenna bay. Because of the fractional inter-bay spacing, they used a parallel feed system with a six-way power divider.

Each bay is fed from the power divider with its own length of 7/8" air dielectric transmission line.

The antenna was assembled on a 70'

(continued on page 40)

Panel Antenna Furor on Decline

by Marlene Lane

Falls Church VA ... Just a few years ago, it seemed that the increased interest in panel antennas signified a trend towards a much greater usage of them in this country.

Now many manufacturers have found that, while the panel antenna market is growing steadily, it is likely to remain a very small part of the whole, especially with regard to combined systems.

"Now that Docket 80-90 has sort of gone out with more of a whimper than a bang, a lot of the furor over combining in panels has died down," says Jon Clark, marketing manager for Shively Labs.

Industry Roundup

And manufacturers do not always agree that the panel antenna is the best solution for stations faced with 80-90 concerns or the enactment of local RF and other environmental regulations which force them to relocate.

Some companies which make panel antennas appear hesitant about advising their use, and in fact are urging their customers to examine their options carefully.

A cautious choice

"In most cases it would be hard for us to justify that a broadcaster would have better coverage and better quality, and be better off to share his marvelous site with a bunch of strangers," says Charles Peabody, VP of marketing and sales for Shively Labs.

Manufacturers such as Shively, Jampro and Electronic Research Inc. seem concerned that both the advantages and disadvantages of panels be brought to light, and they are quick to propose possible alternatives when appropriate.

"As people become more aware of the strengths and weaknesses of panel antennas, they realize that our cavity systems have far more to offer" says Alex Perchevitch, VP and GM of Jampro Antennas.

Shively says that in 90% of cases, a sidemount antenna is the preferred solution—at least for RF problems.

"A panel antenna doesn't always solve

(continued on page 42)

BUYERS GUIDE INDEX

User Reports:

BUYERS GUIDE

Star Quad Cable Remedies Noise

by Barry Brenner, GM
Canare Cable, Inc.

Burbank CA ... If you are in the process of specifying or installing new equipment or upgrading an existing studio, take a moment to consider an important, often overlooked link in your audio chain—cable.

Not all cable is created equal. Careful research and investigation will help you select the right cable for your installation.

One of the most important features to look for in any audio cable is its ability to reject noise (EMI and electrostatic).

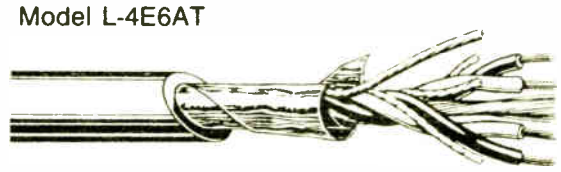
Let's assume that there is noticeable and annoying hum, buzz or RF garbage creeping into your mic lines. Unfortunately, it is clearly audible throughout your entire facility.

Technology — Update

You've ruled out ground loops as the cause because all of your equipment was installed with a unified and well thought out grounding scheme.

The noise problem may be emanating from your transmitter, power lines, lighting dimmers, transformers or any number of things.

Model L-4E6AT



Remedy for noise

Canare offers a remedy to the problem, a microphone cable called Star Quad that can greatly reduce this type of induced noise.

Microphone cables typically carry 600Ω line level signals at +4 dB to +24 dB (1.23 V to 12.3 V). But when they are used to interface mics to mixers or preamps, the signal levels may be very low, on the order of −70 dB to −120 dB (0.3 mV to 1 μV).

Because such signals are subject to a large increase in level due to the high gain of microphone preamplifiers and subsequent amplifier stages, even the smallest noise signals entering the mic cable can become a significant factor.

Noise can "invade" the cable from external sources, by means of electrostatic coupling or electromagnetic induction (EMI)—sources that most engineers are well aware of.

The longer the cable, the greater its susceptibility to potential sources of noise. With runs of 100 m (328') or more, mic cable quality is critical.

Magnetic fields are radiated from power cables, motors and power transformers.

Often power line frequencies can become contaminated by a rich harmonic spectrum which is generated by saturated transformers, the reactive ballasts of fluorescent lights and most drastically, by the clipped waveforms emitted by SCR (Silicon Controlled Rectifier) dimmers.

Four-conductor cable

The magnetic fields radiated by these sources cut across the conductors of a mic cable and induce a voltage that is heard as hum (or buzz at higher frequencies). The higher the frequency, the greater the induced voltage.

Twisting the inner conductors of a cable minimizes susceptibility to this electromagnetically induced noise.

Canare Star Quad mic cable obtains its name from a four-conductor, overall shielded style of construction. The main benefit of four-conductors (versus the common two-conductors found on ordinary mic cable) is to minimize the "loop area" between twists of the conductors.

This in turn reduces susceptibility to electromagnetically induced noise. The worst offender, SCR dimmer noise, is reduced to less than 1/10th the level found in good two-conductor cables.

Electrostatic hum may be present when the power line and mic cable act as two plates of a capacitor, causing the AC voltage to be electrostaticallly coupled into the cable.

This capacitive reactance more readily admits high frequencies, and the higher the impedance of the mic circuit, the greater the induced noise voltage.

A grounded, electrically conductive screen (shield) around the cable offers a low-resistance path to ground and can thus shunt the electrostatic hum.

However, the effectiveness depends upon the percent of coverage afforded by the shield.

Canare Star Quad mic cables are available in two different application (shield) types: Model L-4E6AT and Model L-4E6S.

Model L-4E6AT features a fully wrapped, aluminum tape shield with drain wire for 100% coverage. The outside jacket employs a tough PVC compound to resist tears and stretching.

Inside the quad bundle is KEVLAR 29, a fiber filler that is also used in bulletproof vests and jetfighter aircraft wing skins. The result is a pulling strength of more than 121 lbs.

This model is recommended for fixed installations and when pulling through conduit.

Model L-4E6S is used in places where flexibility, appearance and noise rejection is a consideration. A flexibile PVC jacket surrounds the quad conductors, overall braided shield and cotton pack fillers.

Canare does not use spiral or serve wrap shield because these can open up with use and degrade cable performance. Our high density braided shield offers good flexibility and excellent (96%) coverage.

Model L-4E6S

In some wiring situations, using a multichannel audio snake in place of individual harness bundles can reduce labor time and material costs. Star Quad is available in a multichannel version. Both foil and braided shield styles can be ordered in 2- to 24-channel configurations.

Editor's note: For more information, contact the author at Canare: 818-840-0993.

KNHC Gains Custom Jampro Antenna

(continued from page 39)

section of Rohn 45G tower, which duplicated our tower in Seattle. Full-scale pattern measurements were made on Jampro's test range.

Downward radiation was measured, and the inter-bay spacing was adjusted to provide maximum suppression. The radiation suppression was measured at 20 dB or better below −74°. The gain was measured and verified at 3.2, the same as a standard model.

The antenna was on its way to us by mid-August. We were off the air for seven hours while a crew from SeaComa Communications removed the old antenna and installed our new Jampro.

Unexpected benefit

When the new signal was turned on, improvements were immediately noticed in the school building. A/V equipment worked in places where it had not previously. Wheelchairs operated essentially without problems.

Additionally, there was another benefit we had not anticipated: we immediately began receiving calls from listeners commenting on our improved signal quality.

Listening tests in the community confirmed that many former multipath areas had been cleaned up with the new antenna. We theorize that signal reflections from the roof of the school had previously been interfering with the primary signal.

Jerry Leitch from the Seattle office of the EPA had measured the power density levels in the school building prior to the antenna change using a Holaday meter.

He returned on 15 December and took another set of measurements on the new antenna. The results confirmed our hunch: the signal levels had been dramatically reduced.

Before the change, the hot signal areas had been in the auditorium and gymnasium, with power density levels of 100 to 265 μW per square centimeter.

The "after" measurements in the same areas were in the range of 13 to 20 μW. Radiation levels in all other parts of the building were similarly reduced, and many were unmeasurable.

The Jampro antenna has performed precisely as promised. We have experienced no problems with the installation or performance of the antenna. We recommend this approach to anyone concerned about RF radiation suppression.

Editor's note: Kelly Alford is also involved in special engineering projects at several other Seattle radio stations.

For more information on Jampro antennas, contact Alex Perchevitch at Jampro: 916-383-1177, or contact John Schneider at RF Specialties: 206-363-7730. The author may be reached at 206-281-6215.

BUYERS GUIDE

WCKW Combines with Tennaplex

by Sidrey J. Levet, Pres & CE
WCKW-FM

Laplace LA ... WCKW and KHOM are Class C FM stations operating in southeast Louisiana. One is licensed to Laplace and the other to Houma.

Both stations wanted to retain their full Class C rating, which meant an antenna height center of greater than 300 m or 984'.

Retaining full Class C status is important; along the Gulf of Mexico, FM stations suffer from weather-related "skip," which means that a station hundreds of miles away can clobber your 70 dBu signal.

The FCC noted this problem in the TV rules and has increased the separations between all classes of TV stations. However, there are no such increased separations for FM stations.

The result (especially in the spring and fall) is that FM station coverage is severely limited when this "tropo" or "skip" is present. The interference can last for hours—even days—just when the fall and spring ratings book is being compiled.

It soon became apparent that separate sites were hard to find, with the FAA voicing the most objection (it appears that sectional aeronautical charts do not show every airway). So a combined site of sufficient height was the answer.

With the cooperation of Clair Billington of the FAA's Fort Worth, TX office, an approved site for the erection of a 2000' tower was found.

With such a facility both WCKW and KHOM would place a city grade signal over the most populated sections of Louisiana.

The selection of the proper antenna was begun. With the assistance of Bob duTreil, of duTreil-Rackley, several design requirements were defined.

User Report

The first was that a city grade (70 dBu) signal be placed over Laplace, Houma, New Orleans, Baton Rouge and Hammond. Second, the resultant pattern had to be really omni-directional.

Another requirement was that the antenna had to emit a truly circular polarized signal and be able to withstand the rare ice storms, hurricane winds and industrial pollution. Finally, it had to be reasonably priced.

Side-mounted antennas for each station were quickly eliminated from consideration. The interaction between the tower and each antenna and between the antennas themselves made precise pattern projection and, more importantly, final actual radiation almost impossible to determine.

The antenna selected was a Tennaplex/Kathrein 12 bay, 36 element panel antenna. Many studies have proven that after the first four miles there is no difference in signal strength between a low gain and a high gain antenna. Also, using a high gain (12 bay) antenna, direct operating costs are greatly reduced.

Compared to a low gain antenna, the Kathrein Starpoint combiner is smaller, costs less and requires no forced air cooling. It is about as large as the boss's desk.

George Klauser, an engineer at Kathrein, designed the cross dipole, twisted sister panel. The twisted sister design has bays 2, 4, 6, 8, 10 and 12 rotated 90° with respect to bays 1, 3, 5, 7, 9 and 11.

This 90° bay phasing allows for automatic VSWR compensation. Ice on the antenna causes no problems, so antenna heaters or radomes are not required.

The antenna has 12 bays, with each bay composed of three panels. Each panel is face-mounted on a 6' wide triangular tower. This tower, 125' in length, is mounted atop an 1875' Stainless G-10.

Each station has a Broadcast Electronics model FM-30 transmitter. Using unflanged 3 1/8" line, each transmitter is connected to a coax switch, and then to its separate input port on the combiner.

The output port of the combiner is connected to 2000' of 4 1/16" rigid SWR Inc. K-Line. At the main power splitter the line goes into an expander that is 4 1/16" in and 6 1/8" out.

The main power splitter is composed

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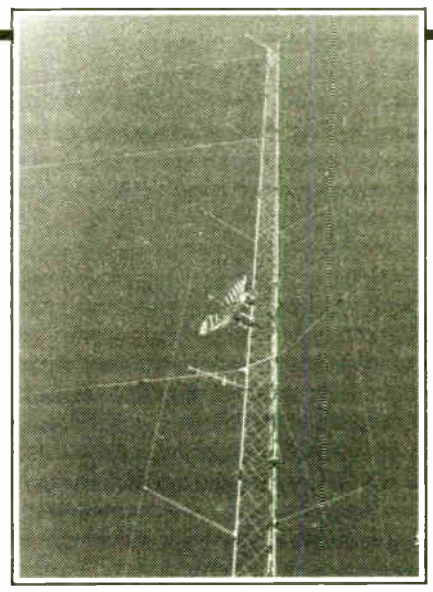
KENN Selects Unipole from Cortana

by Kenneth Kendrick, GM
KENN-AM



Farmington NM ... For almost 30 years, KENN operated at 5000 W daytime non-directional and 1000 W nighttime on 1390 kHz with a two-element directional antenna at the same site.

Then the state highway department decided to build a bypass around the city which went right through the middle of our site, forcing us to move.

We finally found a suitable new site on the famous B Square Ranch owned by the Bolack family, but found that the DA would have to be changed to a three tower dogleg which was a much more complex array than our old one.

User Report

The original DA had been designed and installed back when FM was not yet competitive with AM, so broad band width and high fidelity were not of much concern.

But now that FM has taken the lead in listenership, we felt we should improve the sound as much as possible and consider AM stereo to regain listeners.

We heard of good results from the folded unipole antenna kits from Cortana Corporation, we inquired about them.

Cortana assured us that they could improve our audio quality. The company claimed that because of the broader bandwidth, we could expect an increase in our effective range.

They also pointed out that with a new installation, we could realize other savings, such as eliminating the cost of base insulators and isocouplers for the STL-TRL antennas.

We contracted with Mullaney Engineering to design the new array incorporating folded unipoles as the elements. Then we hired George Howard to tune the array and broadband the phaser and all the networks.

Tommy Bolack, manager of the B Square Ranch, lent invaluable assistance to the project.

With six nulls in the pattern and radials that extend through mountain rivers and up 500' high stone cliffs, the tuneup procedure turned out to be a real challenge. But the end results were phenomenal.

The Cortana unipole antenna system makes the station stand out against our competitors' like the difference between AM mono and FM stereo.

Our first morning to sign on, we had about 30 calls before the first hour was up. People were asking, "What have you done? Your station sounds great."

In several communities where once our signal had been weak or down in the noise, we now have a clean, quality signal. A listener in southeast Utah now hears us in areas where he could not hear us at all before.

Because of the broad bandwidth, low Q system, the array is very stable with variations in the weather. We are very pleased with our folded unipole DA system and would not hesitate to recommend it to anyone.

Editor's note: Kenneth Kendrick is the current president of the New Mexico Broadcasters Association.

For more information, contact Ron Nott at Cortana: 505-325-5336. The author may be reached at 505-325-3541.

BUYERS GUIDE

Panels Not a Trend

(continued from page 39)
the problem; a sidemounted antenna may solve it much better if downward radiation is the problem," says Peabody, who added that Shively has solved RF problems more often with a sidemount than a panel antenna.

ERI president Tom Silliman agrees that, while local regulations regarding radiation may be the driving force behind a station's move, a panel antenna is not always the best answer.

"Clever array design can significantly reduce tower radiation, whether you use a panel antenna or a sidemount antenna," says Silliman.

While Silliman says he does recommend panels to stations interested in combining, they are his second choice to a top mount design, such as ERI's cog wheel antenna.

"You can achieve better circularities with a cog wheel than you can with a panel antenna; it's our best approach to solving multiplex problems," says Silliman.

"After that I would go to a panel because you get about ±2 dB pattern circularity," he adds. (ERI recently designed a new panel antenna with a metallic enclosed pressurized feed system to reduce the effects of weather on the feed system.)

Possible drawbacks

Antenna companies also say there are some disadvantages of panel antennas that must be reckoned with.

"They are very heavy, have high windload and are very expensive," says Peabody.

Perchevitch says that there may be problems with the tracking of the vertical and horizontal azimuth patterns of a flat panel antenna.

"The patterns may not be as desirable as one might like," he says.

Another perceived problem is that the idea of multiplex systems goes against the grain of competitive American broadcasting.

"Is the individual, privately owned American station best served by an equality of signal?" asks Clark.

Yet others remain strong advocates of panels, such as Dielectric.

"I think panel antennas are the way stations are going to have to go, unless someone can come up with some new kind of coil FM antenna," says Stan Thomas, VP of broadcast sales for Dielectric.

"Panels are the only antennas that really have the bandwidth to take the whole FM band," he adds.

Competitiveness not affected

LDL Communications' VP of sales and marketing Ray Tattershall says he does not agree that sharing an antenna affects the competitive spirit of broadcasting in this country.

"Once management realizes that someone else is going to come into the market anyway, and they're not going to be able to stop it," says Tattershall, "at least if they're on your antenna they'll go down the same time you do!"

Tattershall says he sees a definite change in the attitude of station management towards combining.

"A lot of GMs are beginning to get over their paranoia about giving the competition any kind of break," says Tattershall. "This is evidenced by the fact that it's easier to put together (multiplex panel antenna) deals than it used to be," he adds.

Although perhaps the interest in panel antennas has not grown into the trend some believed it would, it is enjoying steady growth, a fact those in the industry readily agree upon.

"We definitely see more interest in panel antennas; our office never even used to hear about them just a year and a half ago," says John Schneider, president of RF Specialties Washington Inc.

Industry Tidbits

New Directions ... Those interested in **FMX** will look forward to **RE Instruments'** development of two of the first **FMX stereo test generators** which the company is now testing. The RE505 and RE506 generators will allow independent control of the M+S, S' and 10 Hz ID signals ...

Also in the news is **Gentner Electronics Corporation** which recently **bought Microprobe Electronics** from company founder Dave Collins. MEI developed **Digisound,** a random access digital audio storage system, which Gentner is now actively marketing.

People ... Broadcast system consultant **Ron Schiller** has joined **Tele-Measurements Inc.,** a communications systems equipment and service company based in Clifton, NJ, as a **senior project engineer ...**

Also, **Radio Systems** has announced that **Bill Wohl** has rejoined the firm as its **custom projects manager.** Formerly a sales manager with the company, Wohl has returned to oversee the sales and coordination of projects involving custom cabinetry, RF and studio turnkey installation and custom engineering projects ... **Michael Sirkis,** president of Peak Audio in Holland, PA, and formerly working under contract to Fidelipac, is now also working with Radio Systems ...

In Quincy, IL, **Broadcast Electronics** recently hired **Gary Hunziker for the newly created position of manager of contract administration** for the sales department. Hunziker is helping to establish a **computerized order entry and invoicing system** for BE ...

Studer Revox has gained a new southwest regional sales manager, **Mike Halleck,** who has an extensive background in broadcast sales and engineering ...

And those of you who noticed that **Southern Broadcasting's** US representative **Hugh Heinsohn** was missing from the company's NAB display of its DAMS system (digital audio mass storage system) at the Media Touch booth can find him at **Gentner,** where he has been hired on as **director of market development** for the company's entire product line.

If you have industry/equipment news to report, send it to **Radio World Buyers Guide,** *PO Box 1214, Falls Church, VA 22041.*

Tennaplexing at WCKW

(continued from page 41)
of 6 1/8" line, which splits into two 3 1/8" lines.

Each 3 1/8" line feeds a splitter that has six output ports.

These 12 ports are connected to the individual bay splitters by 1 1/8" Flexwell line. Each bay splitter has six output ports that feed the two crossed dipoles on each panel with 3/8" Flexwell line.

From the output of the combiner to the input of the crossed dipoles all lines are pressurized. For the total system (combiner, transmission line and antenna) each station has a bandwidth in excess of 1 MHz with a return loss greater than –35 dB.

Once every 10 to 15 years, south Louisiana has snow and ice. On 5 February 1988 the snow and ice came. Since this kind of weather occurs so infrequently, very few stations have antenna heaters. Ice does cause them problems.

Most stations had to drop power, and one apparently had a VSWR trip and was off the air.

WCKW and KHOM operated at 100% power throughout the storm. Looking at the antenna the next day from the ground up, it appeared to be a big Christmas tree flocked with ice. The twisted sister design passed its test with flying colors.

From the reports of listeners, the coverage is great. One even sent in a poem to that effect.

Robert Mury and his crew from SG Communications, Inc. did the installation of the tower and antenna. They hung 2000' of 4 1/16 hard line in 10 hours. Robert Paradise of Tennaplex assisted in the installation.

The antenna has been in operation for about three months. We've experienced no problems.

Editor's note: Sidney J. Levet III is a 1961 graduate of the University of Southwestern Louisiana with a B.S. in electrical engineering and is a member of the AFCCE. In 1979, he purchased the firm of L.J.N. duTreil.

For more information on the Tennaplex/Kathrein antenna, contact Marvin Crouch at 613-226-5870. The author may be reached at 504-524-9292.

BUYERS GUIDE

KSGR Debuts with the Tunipole

by Kip Guth, Pres
Contemporary Media

Nampa ID ... We knew we were in for an interesting challenge when we purchased our station, KSGR. It has become a classic study in how to optimize a "Class IV" AM facility (1 kW-U at 1340 kHz).

We were competing in a market with some incredible AM signals: two 5 kW fulltimers at 580 kHz and 630 kHz, a 10 kW fulltimer at 1140 kHz and a 50 kW fulltimer at 870 kHz.

In order for us to make a success of the new property, three things would have to happen. We needed to move closer to our larger market in Boise, clean up the technical aspects of our sound to compete with the existing primary market stations, and provide top quality programming to compete and make KSGR a top contender.

It all came together, and when the results were tabulated, in our first Arbitron we debuted as the #2 rated AM station in the market with the 25 to 54 adult demographic (6 AM to 12 noon, Monday through Sunday, Metro, AQH Spring, 1987).

User Report

We think this is great success against all those other strong and well-established stations.

Protecting the directional

After studying various alternatives with our technical consultant, we determined that a move was indeed possible. However, given the local terrain and the available land constraints, the best location for our new tower was very close to an existing directional array.

We were aware of the signal disruption which could be caused by reradiation close to a directional array and we also knew that it could be a disaster if we could not economically protect the array pattern!

That was when we were put in touch with the people at LBA Technology, Inc. We understood that they are experts in the design and manufacture of folded unipole devices and that they offered both a folded unipole antenna system (The Tunipole™) and a method of detuning which they call The Detunipole™.

We asked if they could give our new station the punch it would need to be a winner while we protected our neighboring directional array for a reasonable investment. Their answer was a resounding yes.

Cost effective design

The system they designed gives us more than we asked for. It combines a folded unipole driven half-wavelength tower "tuned" to our frequency combined with a detuning system operating at the array frequency—a true marriage of function and technology. It worked and was very cost effective.

We did not have to install either a base insulator or sectionalizing insulators to break up the tower into pieces which would not reradiate the array signal.

And, we received all the advantages normally attributed to the folded unipole driven tower—excellent bandwidth, lightning protection, no lighting chokes, increased signal efficiency and a tower on which we can mount other antennas without requiring the use of expensive isocouplers.

The installation of the system was supervised on-site by an LBA field engineer. He worked with our CE to supervise the tower crew, tune the system for our use and detune the tower at the array frequency.

He set up the system to give us the desired bandwidth, frequency response and a great sound without interfering with the operation of the array.

We believe that his expertise greatly facilitated the whole process. We recommend LBA involvement in the installation of its products if you do not have the in-house experience available.

Today, KSGR is becoming a major force in the Boise AM market. It has moved into this position from a standing start on the basis of the coverage provided by our new location, the great sound made possible by the folded unipole portion of the LBA system and our programming, which meets the needs of our market.

Editor's note: Kip Guth has spent 22 years in broadcast, primarily in major market programming. He became a station owner three and a half years ago, and started an FM station from scratch.

For more information on the Tunipole and Detunipole, contact Ron Chaffee at LBA Technology: 919-757-0279. The author may be reached at 208-376-6666.

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BUYERS GUIDE

New Station Erects Utility Tower

by Frederic Jung, CE
KHCC/KHCD

Hutchinson KS ... Towers may be the most prominent and expensive single purchase for a new radio station. Many of us never get an opportunity to oversee their purchase and construction.

When we do, we often feel unqualified. This was certainly true for us as KHCC prepared to build a 900' tower for its new satellite station in north central Kansas.

We needed to purchase as much height as economically justifiable, and also needed a low maintenance structure.

Furthermore, we wanted the tower to be built and erected by a company with a long and successful track record.

Tower costs versus height seem to follow an exponential curve, with the knee of the curve appearing in the vicinity of 800' to 900' for typical broadcast loading.

KHCC needed all this height to provide the coverage required for major communities situated up to 40 miles from its site.

As for structural integrity, Utility Tower Company heavily promotes the solid rod tower. This made sense to me as we began considering towers.

A solid tower will not rust from the inside out. Any corrosion or oxidation will only occur on outside surfaces.

Furthermore, I believe it makes non-galvanization a legitimate choice in some parts of the country. This is no small consideration as galvanization would have added some $20K to our tower. In central Kansas, our air is relatively clean—reducing the need for galvanization.

Many wanted to sell us a tubular tower. I learned they were generally cheaper—probably due to their greater strength per pound of steel.

Several questions never seemed to be fully answered regarding a tubular, galvanized tower. How could we know the inside was completely and evenly coated? Once the structure was erected, how could we keep water from accumulating in some tube and freezing?

Drain holes would invariably become clogged over a period of time. Sealing all open ends seemed only to be a gamble.

Because to my knowledge there was no way to inspect the inside, the nagging question would always remain—was it rusting? Would I find the tower breaking through to the tower inspector's pick-hammer at some point in the future?

User Report

It seemed our best choice was a solid non-galvanized tower. The risks of this combination seemed very low when one considered the number of decades that must pass for surface rust to have any noticeable effect on structural integrity of 2½" legs.

This risk was discounted even further by the normal maintenance of paint. The structure could exist virtually forever.

Tower construction scheduling is not the exact science that tower designing is. The first major hurdle is getting the crew on site.

The Utility crew assigned us was behind on a job in Iowa due to snow, ice and sub-freezing temperatures. After our prodding of Utility to get started, the crew did finally arrive—on their schedule, not mine. As I was to learn, you just cannot argue with the weather.

To get things going faster, we urged Utility to hire an outside contractor to dig all the anchor and base holes. Yes, their crews were planning on digging these holes!

Utility agreed but, despite the clear site diagrams provided, the contractor dug the outside anchor holes in the wrong spot!

When the tower crew arrived, things moved along rapidly unless the weather had a say. I quickly learned that completion time estimates are made without consideration of weather, mostly to encourage green tower purchasers such as myself.

If a completion date is important, be on the safe side and double the estimate —particularly in the winter or in Kansas.

Wind was our primary cause for delay. I was impressed with the crew's willingness to work in cold or snowy conditions. When conditions were good, they easily erected 100' of tower in a day.

On 1 January, the FM antenna was installed and tested—20 to 50 days past schedule.

Because another tower job was screaming for attention, the crew left earlier than they should have. As a result, Utility had to return to finish things they plainly overlooked in the details of the contract.

The finished tower looks good and its height is meeting our objectives. Only time will tell on the wisdom of the solid non-galvanized structure. We look forward to a long tower life with few structural surprises!

Editor's note: Ric Jung designed and built all new studios for KHCC in 1984, and designed and built KHCD, a satellite station for KHCC, in 1987-1988.

For more information on Utility towers, contact Rick Bales at 405-946-5551. The author may be reached at 316-665-3555.

Lease Your Vertical Real Estate

by Gary Hess, Pres
Silicon East Tower Co.

Melbourne FL ... I am sure by now that every engineer in every radio market has heard the speech from the GM that radio is a business and that cash flow is essential. Also, did you ever feel that the sales manager gets more respect than the chief engineer? Well, it's time to get some respect for yourself.

Here's the proposition: go to your GM/owner and apply for the newly created position of sales engineer.

What are you going to sell? How about the vertical real estate behind your radio station? Lease out your tower to tenants.

According to the NAB, even though 90% of all broadcasters own their own towers, only 1/5 of all radio stations lease space out on their towers.

This statistic doesn't come as much of a surprise because most CEs feel that their day is filled with enough work.

But that's the real surprise of the tower business. Once up and running, there is little effort in running a properly engineered tower facility other than cashing the rent checks and putting 15% of it in your own paycheck as a commission.

Okay, you say, so how do I go about finding tenants and how much do I charge?

First you must determine the capacity of your tower. Hopefully, somewhere in a file cabinet there exist the construction prints.

If not, call up the manufacturer of the tower for the design specifications. If that fails, consider retaining a structural tower consultant.

A structural analysis might reveal that structural modifications are necessary to upgrade your tower. The cost benefit of modifications might be worthwhile considering the income potential.

To help you make these decisions, here's a rule of thumb for establishing monthly rates for your tower: charge $1 a foot for two-way antennas. For an FM station, consider charging $2.50 per foot.

A savvy engineer with a limited capacity tower should look into combining. Many two-way services, as well as FM and, yes, AM today, combine various frequencies into a single optimized antenna system.

There are many benefits to this efficient use of your tower resources.

Consider the plight of an AM broadcaster with a 30- to 40-year-old site. The tower is old, the ground system is gone and the general condition of the building and fixtures leaves much to be desired.

Few engineers would disagree that a completely new site would give the station a better signal. Add the benefit that the tower property is probably worth a great deal of money if developed as a real estate site for whatever the real estate zoning will allow.

If this applies to your station, then consider a combined multiple AM site. The station that develops this idea not only gets a better signal but gets rental income from other AM stations involved.

FM is in the same state of flux with Docket 80-90 drop-ins and upgrades. A master FM antenna on your tower could become a considerable source of income.

Check out the short spacings of the FMs in your area. There are multiple computer services that can easily give you the answers you need to bring the FMs into a common site.

Taking the attitude that the competition is off-limits doesn't work. Let's face it, with FM stations going for such high prices today, very few are going to stand still and not develop their facilities.

Here are some other suggestions to keep in mind.

Limit the size of the transmission lines. It's the transmission lines—not the antennas—that create the greatest load to the tower.

Stay away from exclusive leases. Invariably, these leases will limit the future use of the tower. It's amazing how new services unexpectedly appear.

Have a provision in your leases to pass through to the tenants a pro-rata share of expenses and taxes.

Sell the advantages of emergency power and shared site supervision. A common site for the broadcaster creates a shared responsibility and thus good will among the stations.

I could give more technical reasons to get going but the most important part of all is to motivate you, the chief engineer or technical director, to take the initiative to become a profit center for your station. Your future trips to the GMs office will become a very pleasant experience.

Editor's note: Gary Hess is also president and owner of WVTI/WTAI. He received his degree in broadcasting and physics from the University of South Carolina in 1969.

For more information on leasing towers, contact the author at 305-984-1000.

BUYERS GUIDE

Pinzone Antiskywave Design

by Basil F. Pinzone, Jr., Pres
Pinzone Communications Products, Inc.

"Redirecting the high angle radiation and concentrating it along the horizon . . . would increase the commercial value of a radio station far more than a simple increase in power."

Chamberlain & Lodge
January 1936

Newbury OH . . . The control of skywave radiation has been a major engineering consideration since the early days of radio. For the majority of AM stations today, skywave radiation represents wasted power. Almost 85% of what is radiated by a typical BC array goes off into the sky.

Technology Update

Skywave radiation contributes to the general interference level of distant cochannel stations and establishes a limitation on the nighttime local market area.

If the elevation plane pattern could only be made to hug the ground closer, many stations could deliver less interference to distant broadcasters while at the same time actually provide a stronger signal in their local market.

Clear channel and other high power stations have another historical problem associated with high angle radiation—the nighttime fading wall.

The nighttime fading wall actually occurs well inside the daytime coverage area. These high power stations need an antiskywave antenna to lower the elevation plane pattern and push the fading wall out beyond the periphery of the daytime service area.

Pinzone Communications Products, Inc.'s new Corum Antiskywave Antenna significantly decreases high angle radiation while simultaneously increasing ground wave coverage.

The daytime ground wave service area of a high power station may actually exceed the nighttime area.

This is not because the signal is weaker (it's the same ground wave), but because at night the skywave signal can be greater than the ground wave signal well within the daytime service area.

During nighttime hours, the received signal consists of two components—a groundwave signal and a skywave signal. At certain distances these two components are within an order of magnitude and will interfere with one another, causing serious fading and envelope distortion.

The annular region surrounding the transmitter where this self-interference starts to occur and cause unreliable reception is called the incipient fading wall.

Merely increasing the transmitter power will *not* push this "fading wall" further out since both the ground wave and the skywave will increase proportionately.

No increase in the transmitted power, however great, can extend the night service area since this coverage is definitely limited by the position of the fading wall and *not* by signal deficiency.

There is plenty of usable groundwave field strength present but this signal is virtually worthless because of the destructive interference which is occurring.

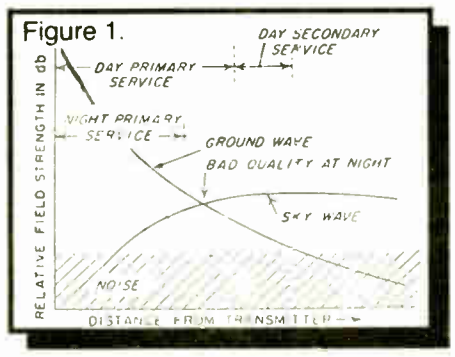
This article's lead quote (from Chamberlain & Lodge's classic 1936 paper "The Broadcast Antenna") indicates that the early pioneers of broadcasting were well aware that the solution was an "anti-fade antenna."

Figure 1, taken from Terman's old text on radio engineering, shows the case just discussed. Clearly, there is plenty of groundwave signal at the fading wall—it's just not usable because of the presence of the skywave. What is needed is a suppression of the skywave.

For anti-fade antennas, the critical thing is to suppress radiation at elevation angles between 45° to 70°.

Stuart Ballantine, in a series of classic papers on "High Quality Radio Broadcasting," in the mid 1930s, proposed that the solution was not to maximize the low angle radiation (by using a 5/8 wave tower, as he had disclosed in the mid 1920s), but to minimize the high angle

Figure 1.



skywave radiation by employing towers 180° to 190° high.

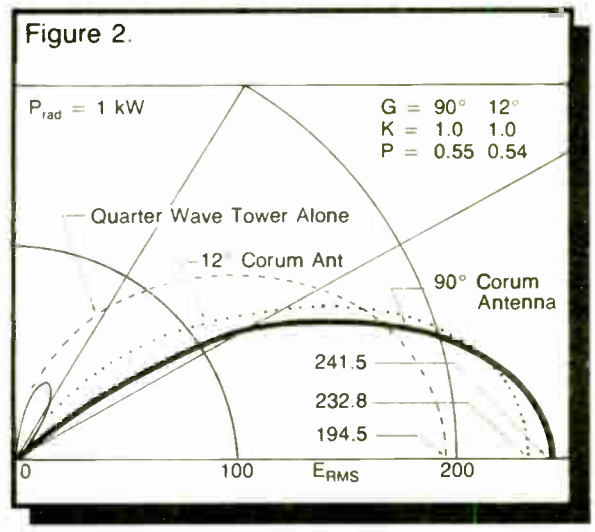
The latter do not possess the high angle lobe that reduces the nighttime effectiveness of the 5/8 wave tower. (The optimum height depends upon frequency and ground conductivity.)

The result is a striking improvement in groundwave coverage. However, especially at the low end of the broadcast band, half wave towers represent a substantial expense.

A somewhat different skywave problem exists for many other broadcasters. Here, the issue isn't fading, but rather nighttime co- and adjacent-channel interference limitation.

The practical question to be resolved is, "How can I optimize my nighttime ground wave coverage while simultaneously eliminating radiation launched at certain critical skywave angles into the protected contours of distant stations?"

Figure 2.



As most consultants know, the resolution of this issue is often pretty bleak.

In contrast to the various antiskywave antennas tried since Frank Conrad first surrounded the KDKA tower with eight short vertical antennas in 1929, Pinzone Communications has procured the low and medium frequency rights to a self-resonant, vertically polarized, omnidirectional low profile radiator.

This newly patented structure looks like a circular array of loops, but its electrical properties resemble those of a large annular slot circling a vertical monopole.

A low profile self-resonant antenna which delivers vertical polarization is very important for groundwave excitation and overall radiation efficiency.

Unlike classic broadcast antennas, the engineering and tuning of this new class of radiators is considerably more complex.

By varying the electrical height of the center monopole (G), the circumference of the Corum Element (K) and the power division (P), a wide variety of elevation plane radiation patterns may be tailored to fit specific station requirements.

The structures may be retrofitted around existing towers to produce the desired effects.

The elevation plane patterns for 12° and 90° Corum Antennas are shown in Figure 2. The elevation plane pattern of a standard quarter-wave tower is shown for comparison. The radiated power is 1 kW in all cases.

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Tracking Down Spurs

by Bill DeCormier, Mgr Elec Eng
Dielectric Communications

Raymond ME . . . Any FM radio broadcaster can be generating spurious emissions on the air. This may not be a common occurrence but it can happen in spite of our best intentions to the contrary.

Spurious emissions are not difficult to measure, but the methods of measuring are subject to misinterpretation and error.

The easiest way to measure them is to hire a consultant who has all the necessary equipment; let him worry about the technique and the possible mistakes.

But economics may force you to do it.

Typically, to measure these emissions you should install a directional coupler in your transmission line. You can use a single one that can be reversed or a pair of them, one oriented forward, the other reflected.

Each coupler should be set to sample a small amount of the power in the line. If you are operating at 20 kW, your sample should be sufficiently small to protect the measuring instrument with input limits as low as 0.1 W.

In this example, a 53 dB coupler would protect the measuring instrument and retain maximum sensitivity.

It is also important to use a coupler with good directivity. Directivity of 30 dB or better will provide adequate forward-to-reflected isolation, thereby clearly separating the forward from the reflected signals that you measure.

You will also need a spectrum analyzer and a tunable notch filter. With this you are ready to look for the spur.

Tracking down spurs

At this point it is helpful to understand the mechanism that produces the spur. Spurs are most commonly found at sites with multiple transmitting facilities. The

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BUYERS GUIDE

Measuring Spurious Emissions

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most common product is the third order intermodulation product.

It is produced when the signal from another co-located station is received by your antenna and proceeds down your transmission line to mix with your second harmonic.

The resulting spur will be found by solving the formula S=2A–B where S is the spur in megahertz, A is your frequency in megahertz and B is the incoming frequency in megahertz.

By first using the spectrum analyzer to sample the incoming signals, you can determine all of the potential B frequencies and calculate all of the likely frequencies where S can be found.

Then sample the forward coupler, setting the full power carrier level as the 0 dB reference to which all spur levels will be compared.

Now scan the calculated S frequencies, looking for any signal stronger than –80 dB below your carrier reference. If you find a spur above –80 dB you must determine if it is real or if it has been created in the spectrum analyzer.

This is where you use the notch filter in your sample line. If the spur remains unchanged when your carrier has been notched from your sample line, then the spur is in the line, not in the equipment.

Once you have established that an intermodulation product exists above the 80 dB limit set by the FCC, you must reduce it to the 80 dB level.

Reducing IMD

Dielectric Communications builds a complete line of filters that can reduce any intermod to an acceptable level. Either bandpass or bandstop filters can be used to reduce the intermod product.

Technology Update

The filters can be tuned to suppress either the incoming signal from the adjacent channel, the outgoing spur or both signals. The choice, like most choices today, is a matter of performance versus cost.

For purposes of comparison each Dielectric cavity costs the same whether it is utilized as a notch or a pass cavity, so the relative costs can be readily compared.

For cases where only a single spur needs to be reduced, bandstop (notch) cavities can be more economical. Two characteristics of the spur are critical to the cost impact: the necessary attenuation and the proximity to the carrier.

For the worst case, if the incoming signal is 800 kHz below your frequency and the resulting spur is 800 kHz above, we are somewhat limited in the attenuation we can provide with a single notch. The skirt of the notch will extend into the carrier frequency, causing unwanted insertion loss regardless of whether we tune the notch to the incoming or the spur frequency.

Under these conditions each notch will be limited to approximately –35 dB. Since they are also very narrow at the peak of attenuation, you will need two or more to get adequate bandwidth.

When you stagger-tune the two cavities about the offending signal, you can chose within limits between more bandwidth and more notch depth.

For cases where multiple spurs have been detected, a bandpass type of filter is more suited. It will pass your carrier and reject all other frequencies above and below yours, in effect attenuating both the incoming signal and the outgoing spur. It will reduce the spur by twice the attenuation value at the spur frequency.

The spurious mixing is reduced by the attenuation to the incoming signal on one skirt of the filter and by the attenuation to the spur on the other skirt of the filter.

Dielectric currently produces these bandpass filters in two-, three-, four- and five-cavity designs as well as in combination with notches to produce the optimum VSWR, insertion loss, group delay and attenuation for any FM or TV application.

All filters are convection cooled and temperature stable for drift-free operation in excess of 40 kW.

Editor's note: For more information, contact the author or Jay Martin at 207-655-4555.

Phasing in Kintronic

by **Terry Gaiser, CE**
KERI-AM

Bakersfield CA ... KERI-AM recently installed a new two-tower, 50 kW antenna phasing, power dividing and matching system manufactured by Kintronic Laboratories.

User Report

This project, which involved a daytime power increase from 10 kW to 50 kW, had several exciting aspects.

This was the first, and so far the only, 50 kW grant to the southern San Joaquin Valley area. Also, we were one of the first to put a Nautel, all solid state, no-tune 50 kW transmitter on the air.

Our project started from the ground up. After economical considerations and investigation of other users of its products, Kintronic was the obvious choice for building the phasor and antenna tuning units.

The open panel phasor and antenna tuning units were purchased through RF Specialties of Washington. The equipment was delivered in October of 1986.

Now that it is said and done, we would not have changed anything. The working relationship provided by Kintronic Labs made the planning, construction and tune-up all go like clockwork.

Kintronic's preset adjustments were so close to actual settings that it was scary. No follow-up maintenance has been necessary. The directional system has been rock stable and trouble-free since it went on the air.

Even through our seasonal weather changes that bring temperatures of 100° F in the summer and 32° F in the winter, the system has not required any tweaking.

There has been no more than a 0.4° phase change or 0.3% current ratio change for the year it has been operating.

We had a 1 kW Nautel solid state transmitter in nighttime operation for a year prior to the 50 kW project. Now here we are with a new antenna system.

The excellent bandwidth at the common point provided by the Kintronics antenna system, combined with the performance of the Nautel 50 kW transmitter has resulted in superb audio quality.

The KERI GM, Mike McKutcheon, has received many comments on how good the station sounds. It is modulated with well-processed, high average audio, and retains all the clarity and presence of the source material.

The contributions of Kintronic Laboratories to this industry are certainly appreciated by us, and it goes without saying that there was no hesitation in selecting them to build our new 10 kW, 8-tower phasor for our nighttime power increase coming up.

Editor's note: Terry Gaiser has worked in broadcasting in the Bakersfield, CA area for 17 years. He is a contract engineer for KERI.

For more information on Kintronic Labs' phasors and antenna tuning units, contact Tom King at 615-878-3141. The author may be reached at 805-324-6777.

Pinzone

(continued from page 45)

Clearly, there is a dramatic reduction in the skywave radiation above 30°. It is even possible to shift a pattern null in this region if desired. Also note that there is a modest increase in the azimuthal plane field intensity.

The Corum Antennas manifest at least five significant advantages. They are constructed at or near ground level; they may be used to retrofit most existing antennas and they narrow the elevation plane pattern of the host antenna.

They also permit pattern tailoring which would otherwise be impossible with traditional radiators.

And, concentric Corum Elements may be used to trade off going out in horizontal extent for going up in tower height, to achieve elevation plane directivity. Of course, a single Corum Element may be used as an alternative to a short vertical tower radiator.

Editor's note: For more information, contact the author at 216-564-9093.

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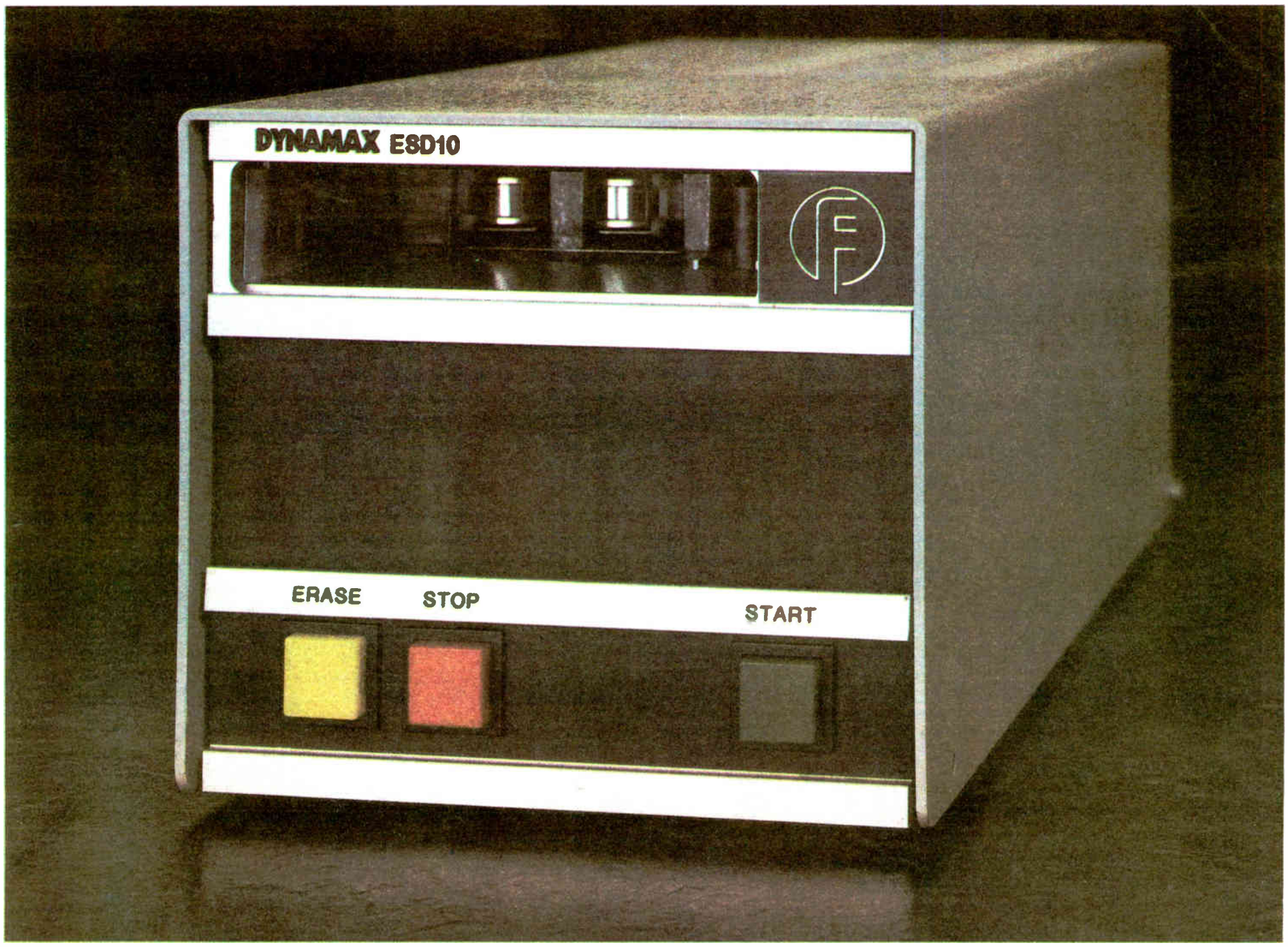

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