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Buyers Guide  
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PO Box 1214, Falls Church VA 22041

October 15, 1987

Volume 11, Number 20

## Mixed Reaction to FM Plan

by David Hughes

Washington DC ... Broadcasters have mixed feelings about a plan to allow increased use of FM directional antennas in some short-spaced situations.

According to comments filed with the FCC as of September, many broadcasters said they supported an April proposal from the Commission to permit "the limited use of directional antennas for short-spaced transmitter sites (which) may provide more efficient use of FM broadcast spectrum."

However, they also warned that the directional antennas should not be used on a widespread basis.

Carrying that concern a step further, the NAB, fearing increased clutter and interference on the FM band, turned thumbs down on the plan.

The FCC, in its proposal, maintained that by allowing greater use of directional antennas, "the opportunity for new, enhanced or expanded (FM) service" will be increased.

The Association of Federal Communi-

cations Consulting Engineers (AFCCE) said it supported the FCC plan "permitting the use of directional antenna on a limited basis to provide more efficient use of the spectrum through more liberal transmitter location requirements."

"Directional FM antennas can be successfully employed to provide service to a desired area while not adversely affecting other operations," the AFCCE said.

The organization said the use of short-spaced transmitter locations "will result in substantial improvements without a material impact on other operations."

However, the AFCCE warned against the widespread use of directional antennas. It urged the FCC not to authorize directional antennas "which are not

used for any protection reasons."

The AFCCE said that the plan would "not significantly affect the spectrum efficiency and will leave the door open for modification of such antennas should the need arise for a station to relocate or provide service to different areas."

CBS also said it supported using directional antennas "for limited purposes" such as in order to permit the use of "transmitter sites otherwise prohibited by short-spacing."

It said the plan would give stations greater flexibility in selecting their transmitter sites.

However, CBS also cautioned the Commission to "take steps to guarantee existing stations at least the same degree

of protection against interference as is presently available."

Other broadcasters, such as Malrite Radio and TV, let the FCC know they favored the plan. Malrite said that by shifting from an allotment system based on distance separation to a system based on interference criteria would permit stations to tailor the coverage to their communities.

"The time is ripe," said Peter Onnigian, a Sacramento-based former licensee of AM and FM stations, "for the FM service to provide additional stations in the larger markets thru the use of directionalized antennas in short spaced allocations."

However, the NAB said it "strongly opposes" the use of direction antennas maintaining that they would "degrade existing FM service."

It warned the FCC that the plan to "shoehorn-in" additional stations, similarly to what happened on the AM band, would lead to "the AM-ization of FM radio."

"Although the Commission's directional antenna notice suggests that comment is sought only on a 'modest alteration' in the station assignment process, the notice goes on to state the obvious—any change the Commission might adopt for limited assignment purposes might be extended to the 'allotment'

(continued on page 3)

## Group To Discuss FM Boost

Washington DC ... The NAB's FM Transmission Subcommittee has set 21 October, when it holds its next meeting, as the date it will determine its position on a blanket power hike for Class A FMers.

At its 23 September meeting, according to group member and NAB Engineer Mike Rau, the subcommittee devoted the bulk of its time to the Class A plan, which is contained in a petition filed 1 September by the New Jersey Class A FM Broadcasters Association.

The New Jersey group wants the FCC to raise the current 3 kW Class A power limit to the 6 kW, or equivalent, level.

However, there have been questions about whether the NAB would support the plan since its FM radio members also consist of Class B and Class C owners, some of which fear increasing congestion from the Class A blanket hike.

No conclusion, yet

While the FM Transmission Subcommittee debated the Class A hike at its September meeting, it did not come to any conclusion, Rau said. "Clearly, the discussion was not finished," he noted.

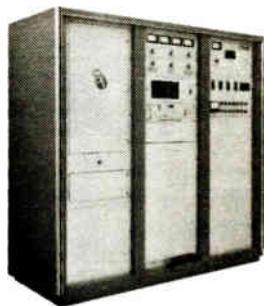
A final decision on the plan was deferred until the 21 October meeting, which will be held at the NAB's head-

(continued on page 17)



The 33rd Broadcast Engineering & Management Seminar brought several hundred attendees to Madison, WI. See story on page 10.

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## NBC Talks Uncertain

by Alex Zavistovich

Washington DC ... At press time, yet another attempt to end the strike against NBC by members of the National Association of Broadcast Employees and Technicians (NABET) had failed, as negotiating committees for the two sides adjourned a round of bargaining which had begun earlier in the day.

Reportedly, no further negotiations were being planned.

On 22 September at 7:25 PM, the Federal Mediation and Conciliation Service (FMCS), which has been presiding over the past several sessions of talks, called an end to negotiations. News of the new bargaining round had reached the media only the day before.

NABET has been on strike against NBC since 29 June, when NBC unilaterally implemented a final contract offer to replace the previous four-year master contract with the union. That contract, affecting 2,800 union members, expired 31 March.

The last round of negotiations ended

(continued on page 2)

# FCC Rejects FM "Index" Plan

by David Hughes

Washington DC ... The FCC has rejected a plan that would use an "index" method in order to classify FM stations that do not fall into specifications for particular classes.

While the full, detailed text of the rule change was not available at RW's press time, FCC Engineer Jay Jackson indicated that comments the Commission received on the proposal were largely critical of the index method.

The index method, according to the FCC, involves the establishment of a "formula reflecting the maximum permitted distance to the expected service contour (1 mV/m) of each class."

Antenna height could exceed the class maximum if the radiated power is reduced to maintain the maximum class specified in a mathematically determined "index method," the FCC said when it proposed the plan in early 1986.

It added that powers could not exceed the maximum powers for the class, regardless of the distance to the 1 mV/m contour.

The NAB indicated that the FCC would have replaced the minimum power and antenna height requirements, including the equivalence definition in Section 73.211, with a formula reflecting the expected distance to the 1 mV/m contour.

The plan was proposed in order to remove disparities which could arise in classifying facilities with certain power/height combinations, the NAB added.

## Plan criticized

Among those critical of the plan was the engineering consulting firm A.D. Ring and Associates which said the index method was "inaccurate, unnecessary and will create as many new ambiguities as it will resolve."

While the NAB did not come out against the index method policy, it said the plan raised additional questions about the FCC's intention to downgrade FM stations that do not upgrade their facilities to their classification, in line with the Docket 80-90 policy.

"One important consideration is how to treat those licensees and applicants that, under the Docket 80-90 criteria, were not previously candidates for downgrading but would become so under the proposed index method," the NAB said.

The NAB pointed out that even with the proposed index system, the FCC indicated that those stations "would automatically be waived to retain their classification based on their 1 mV/m contour."

In its September ruling, which takes the form of a Second Report and Order, the FCC "declined to adopt the index

method" Jackson said. "The commenters did not support it."

The rule changes, which specify a method for classifying FM stations according to their effective transmitting power, promote efficiency in the allocation and licensing areas of FM, the FCC said.

## Index method out

Instead of accepting the index method, Jackson said that the FCC adopted rules that allow the classification to be determined by the location of a station's 1 mV/m contour level.

"Class determination will be made by the location of the 1 mV/m contour if it is difficult to classify the station by (antenna) height and power (level)," he said.

In another rule change in the docket, the FCC amended Section 73.213, which allows routine technical modifications to certain short-spaced FM stations "by simplifying it to permit only modifications that do not increase the potential for interference."

Jackson explained that the change largely affects FMers that were short-spaced before November 1964.

The full text on the rule changes, which will explain it in greater detail, was due out in late September or early October. The items are contained in FCC docket MM 86-144. Contact Jay Jackson at 202-632-9660.

## FCC Clips

### Presunrise operations

In comments filed with the FCC, the NAB has supported granting presunrise power authority for some daytime-only AM stations, pending review of the FCC interference standards.

The FCC proposed a minimum of 10 W presunrise authority power for daytimers affected by the advancement of daylight savings time in April.

The extended operations for daytimers would run between the first Sunday in April and the last day of April each year from 6 AM local time until local sunrise.

Originally, the FCC had proposed allowing a 50 W minimum for the daytimers. That first proposal was opposed by many fulltime and clear channel AM broadcasters, who contended it would cause unacceptable skywave interference before dawn.

The 10 W minimum plan subsequently offered by the FCC is an attempt to balance presunrise operations against "undue interference," the Commission stated.

In its filing, the NAB recommended that until the Commission reviews its AM interference rules, daytimers should be granted "the highest 6 AM until sunrise power that can be utilized without causing interference to the 0.5 mV/m groundwave contour of other stations."

No protection should be given to the stations' skywave signals, the NAB continued.

FCC docket is MM 87-3. For additional information, contact Louis Stephens at the FCC: 202-254-3394.

### Dawson undecided

According to some industry accounts, FCC Commissioner Mimi Dawson has not yet decided whether to seek renomination after her term expires next June. Dawson maintained, however, that she is not examining employment opportunities outside the Commission.

Rumors have mentioned Dawson, former aide to Oregon Senator Bob Packwood, as a candidate for chief lobbyist for the NAB. That role had previously been filled by John Summers, who will leave the NAB at the end of this year.

Dawson, however, reportedly has no interest in pursuing the chief lobbyist position.

Should Dawson choose not to seek another term, the FCC will again be saddled with finding a new Commissioner. Currently, a hunt is under way to fill the Commission slot vacated when Dennis Patrick succeeded Mark Fowler as Chairman.

Contact the FCC news media information office at 202-632-5050.

### Broadcast station totals

As of 31 August, the Commission announced a total of 10,144 licensed radio stations in the US. Of that number, 4,893 were AM broadcasters, and 3,975 were FM stations.

FM educational stations accounted for 1,276 of the total stations licensed. Contact the FCC news media information office at 202-632-5050.

# Future of NBC Strike Talks Unclear

(continued from page 1)

on 1 September when the two sides were deemed by FMCS to be too far apart on basic issues. The return to the bargaining table so quickly after the last session was terminated left many insiders hopeful that a speedy resolution was in sight for the strike, the longest in NABET's association with the network.

Instead, however, the bargaining was again terminated, reportedly with no progress having been made.

Neither NABET International Representative John Krieger nor NBC VP/Labor Relations Day Krolik, spokespersons for the opposing sides, could be reached for comment at press time. However, a NABET source said angrily that the NBC negotiating committee "refused to look at a list of 10 items" the union wished to discuss.

Included in the list were points such as remote jurisdiction, status of daily hires, and the status of those NABET

members who were employed by the NBC Radio Networks, recently sold to Westwood One.

NBC's Krolik, leader of the NBC negotiating committee, has made it clear during the past talks that NBC did not plan to make any but the most minor changes to the network's final offer.

NABET is apparently upset over a statement made by Krolik during the negotiations on 22 September. The union was addressing a mid-September letter from NBC CEO Robert Wright, in which he reportedly said the negotiations were "close" to settlement.

According to NABET, Krolik maintained he was the "only official spokesman" for NBC in the negotiations.

For additional information contact NABET at 301-657-8420. Contact NBC at 212-664-4444.

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# Antenna Plan May See Changes

by Alex Zavistovich

Washington DC ... A presentation made during the September broadcast symposium of the Institute of Electrical and Electronics Engineers (IEEE) may have added another change to the NAB's project to develop a skywave-minimizing antenna.

Ogden Prestholdt, who has designed a two-element array for the antenna project, offered his antenna as a location for testing the effectiveness of elevated radials to reduce skywave and improve power gain.

At press time final plans to obtain a Beltsville, MD site for Prestholdt's antenna were underway.

Prestholdt's offer followed a presentation during the symposium in which the Numerical Electromagnetic Code (NEC) was used to evaluate the performance of four elevated radial elements compared with 120 buried.

Prestholdt commented that use of

elevated radials was "very intriguing." He said he would propose to Tom Keller, NAB's VP/Science and Technology, that his project be expanded to include the testing.

## Elevated radial ground systems

The paper which prompted Prestholdt's offer was a NEC modelling of AM broadcast antennas with elevated radial ground systems.

The paper was co-authored by Al Christman, of Ohio University, Al Resnick of Cap Cities/ABC, Jim Breakall of Lawrence Livermore Labs, and Dick Adler of the Naval Postgraduate School.

Those same names were responsible for a paper at last year's IEEE symposium which analysed by NEC modelling the operation of Prestholdt's antenna, as well as a modified single monopole design by Richard Biby, of Communications Engineering Services.

Both of the antennas were determined by NEC to perform less adequately than

the designers' calculations indicated.

In particular, the monopole design by Biby was criticized for some of its additional aspects. The Biby antenna includes a ring of 10° antennas located 5° from the monopole, buried under the test site.

This year's NEC evaluation continued analysis of the performance of radials, but this time it compared the effectiveness of buried radials against that of elevated radials.

In the analysis, presented by Roger Radcliff of Ohio University, the NEC code for Ground Screen was used to model several vertical monopoles over various types of ground.

The report concluded that as few as four radials, if they are off the earth, would provide superior performance over 120 buried radials. Power gain at low angles would be enhanced, according to the study.

Other conclusions drawn by the study maintained that four elevated radials improve groundwave radiation while attenuating skywave radiation.

Radcliff stressed it would be "foolish" not to verify the conclusions of the NEC study with measurements. He said the Marine Corps is interested in funding actual field measurements of the antennas used in the study, beginning in October.

Prestholdt made his offer during the routine question and answer period following the presentation.

Better performance over average soil and very good soil was also recorded.

Increasing elevated radials did not appreciably improve their performance, Radcliff said. Performance improvement gained in an increase from 4 to 120 radials was "not worth the effort of installing" the added radials, he said.

The conclusions drawn in the study for radials 50 inches over the ground hold true up to 20°, he added. Above 20°, the buried radials begin having better power gain.

For additional information, contact the 1987 IEEE Symposium Coordinator, Robert du Treil, at the engineering firm of du Treil-Rackley: 202-659-3055.

## FM Plan Reaction Split

(continued from page 1)

process as well," the NAB said.

"Indeed, widespread use of directional antennas could be achieved only by a major departure from long-standing FCC allocations policy," the association added.

In opposing the plan, the NAB pointed out that those attending its June Radio Board meeting determined that "there are many radio broadcasters that might seek to use directional antennas to modify their service to the public."

It added: "However, on balance, it is NAB's institutional position that any pursuit, whatsoever, of the directional antenna concept would lead, uncontrollably, to their use as an allocations tool and to an accompanying deterioration of service quality and signal reliability in FM radio broadcasting."

The NAB added that predicting directional FM signal propagation "is a complex matter involving many factors such as shadowing, terrain roughness, building and foliage attenuation, reflections and refractions."

It said that the pursuit of the directional antenna concept "should consider—in great detail—the problems associated with measuring and maintaining the pattern of directional FM stations."

"However, these are some of the very factors which the Commission has chosen to ignore totally in its notice," the NAB said in its comments. "Indeed, the Commission eschews the notions of antenna proofs and/or subsequent analysis of antenna patterns."

The FCC docket number is MM 87-121. Contact Bernard Gorden at 202-632-9660.

## Modelling procedure

In the NEC experiment, radial length was equal to monopole height—¼ wavelength—and the antennas operated at 1 MHz. The same modelling procedure

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# Radio '87 Visits Fantasyland

by Judith Gross

Falls Church VA ... The carnival-like atmosphere of Disneyland was somehow fitting for Radio '87, probably the most upbeat of all conventions.

This year the Dixieland jazz of New Orleans was replaced by the music of giant boom-boxes everywhere you turned ... including the bright yellow



one at the entrance to the Anaheim Convention Center which had everybody humming and whistling "In The Mood" for the duration of the show, primarily because that's the only song it played (or it seemed that way).

Inside the hall it was fun and games as usual ... digital innovations were big draws. There was the Concept Productions R-DAT automation designed to be used with the company's music libraries, Paul Schafer's digital audio system using Sony consumer Beta machines, and

Systemation's automation using R-DAT, 8mm or anything a programmer's heart desires.

NRSC was big news, with an NAB booth featuring five prototype NRSC receivers: Delco, Ford, Sony, Pioneer and Matsushita. These plus two additional ones not at the show—Denon and a GE portable—give AMers reason to be optimistic that the radios will be on the market quickly, once enough conversions are made.

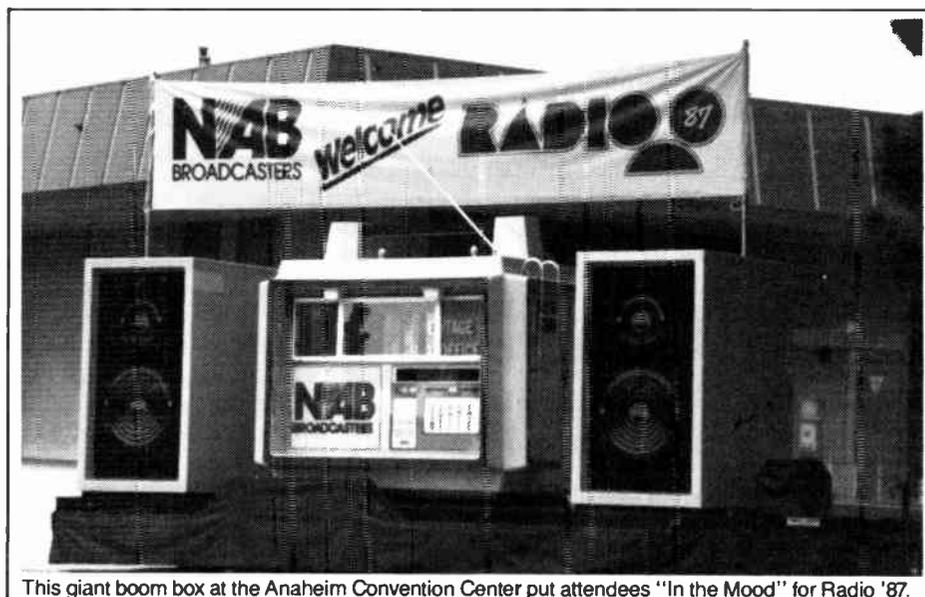
Also exciting from the NRSC is news of a splatter monitor. Motorola is doing the honors with this one, which will hopefully help clean up the AM band even more.

In fact, Motorola's Chris Payne told the group the prototype "works too good, almost," because it lets you see what you're doing to your neighbor's signal, or what your second adjacent neighbor is doing to you—garbage that you never even knew was out there on the band.

Heard at the NRSC seminar ... in answer to a question from Michael Rau as to what he would like to see the AM band be in 100 years, Delco's Dick Kennedy replied simply "clean." (Amen to that.)

☆☆☆

The panel that almost wasn't ... One of the best sessions at the show was ac-



This giant boom box at the Anaheim Convention Center put attendees "In the Mood" for Radio '87.

tually one that had officially been cancelled. Interestingly enough, it was called "AM Quality: Does It Matter?"

When some 50 attendees showed up to hear a distinguished panel's views, they might have thought that the answer to the title question was an unqualified "no"—since all of the panelists save the trade press "reactor" had been unable to show up.

Undeterred by this turn of events, consultants Ron Rackley and Bob du Treil rose from the audience to put together an impromptu panel which also included Otis Connor of Otis Connor Productions.

Jim Wychor, formerly of the NRBA and active in daytimer concerns, acted as moderator, and the audience featured a few well known players active in AM issues including Glenn Clark of Texar.

Although no one had anything prepared, things went well. One attendee said, "These people were determined to talk about AM, and they didn't want this panel cancelled for anything." He also said it was "one of the best and liveliest panels" he went to.

☆☆☆

Who's out, who's in? ... There have been a few more personnel changes at Harris Broadcast. Gary Thursby, who was VP of marketing, resigned in September for "personal reasons," along the lines of Joe D'Angelo, mentioned a few columns back.

Also at Harris, Ron Frillman, who had been working with video sales, was appointed radio domestic sales manager and was at the radio show. Ron is a St. Louis native, a Cardinals fan, who began a 20-year broadcast career as an engineer at WAVY-TV in Norfolk, VA.

Russ Geiger has retired as president of Delta Electronics and John Wright has taken his place. Meanwhile, Joe Novak is now VP of marketing, Bob Stebbins VP of Finance and Friedel Groene VP of

manufacturing.

Bob Bausman, meanwhile, has left Delta, but the company recently welcomed back John Bisset, who used to be sales engineer there, then went on to become CE for Metroplex owned WCXR/WCPT. Now he's back.

But the one that will leave a lot of people scratching their heads is TTC's hiring of Ray McMartin as an independent consultant in the company's divestiture of the Ampro-Scully line.

McMartin, you may recall, went bankrupt as McMartin Industries in Nebraska (the company has since been revived, same name, different owners), then did the same as McMartin International in Colorado.

☆☆☆

Products to keep an eye on ... Orban is introducing a stereo image expander, the Model 222A. It uses analog, not digital technology and was tested on air in San Francisco and LA. It lists for \$895.

Pacific Recorders & Engineering, Martin Audio and Allied are the distributors for the Denon CD cart player. Allied had it at Radio '87. PR&E, meanwhile is building a dual rack mount for it.

And finally, the unexpected hit of the Radio show was a nifty little device called a "Target Tuner", from Target Tuning, Inc.

It's a Walkman-type radio which is quartz-locked to one station's frequency.

You can bet stations will be clamoring to give them away as promotional items. The company, which is located in (of all places) Moonachie, NJ (201-935-8880) hadn't really planned on going to Radio '87, changed its mind at the last minute, and couldn't keep the crowds away from its booth.

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.

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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).

Still supporting Kahn

Dear RW: It amuses me to see you wrestle with the facts.

On every page you tout the "great Motorola C-QUAM AM stereo system" and by every innuendo declare it to be the "de facto" standard of the country.

The facts are that after five years and many millions of dollars spent by Motorola, after many threatening insidious phone calls to AM station managers, after much misinformation to the press regarding such things as the actual performance of C-QUAM generators and misinforming the country as to the inability to produce a multimode receiver that would work on all AM stereo systems satisfactorily (this lie justified the production of millions of Motorola C-QUAM only low fidelity receivers), and despite the giving away of "loaners" to some stations, despite all this the Motorola thrust is getting nowhere.

Station managers are waking up and many are turning Motorola off.

Why? I'll tell you why—because they are finally listening with their own ears and hearing added noise in C-QUAM, hearing the swaying from left to right, and are seeing the loss of mono coverage.

WSKQ in New York took C-QUAM off in one week because of that. And they are hearing the poor quality of the Motorola C-QUAM only car radios.

I wonder why NTIA came to that weird conclusion.

Pure logic and the excellent report

from their laboratories should have led them to demand that the FCC ask receiver manufacturers to produce and sell multimode receivers.

(Sony already has done it, in limited supply, and beautifully in the XR-A33 and XR-A37.)

Then and only then can this situation be resolved and I'm quite sure that AM stereo (which is better than FM stereo) can become a reality and can help, not hurt AM radio.

Zaven N. Masoomian  
Former CE/WQXR, New York, NY

Editor's reply: "Doc" Masoomian is a respected veteran of radio engineering who now represents Ram Broadcast Systems and is affiliated with Kahn Communications in an informal arrangement.

His loyalty to the Kahn system is admirable.

But the facts are not something RW has to "wrestle with."

The facts are that all the growth in AM stereo in this country recently has been with the C-QUAM system, while Kahn stations are the ones losing numbers.

Internationally more countries have chosen C-QUAM as their AM stereo standard.

And despite the NTIA's assertion that multisystem radios are technically possible, manufacturers have no interest whatsoever in producing them.

A few more facts. AM stereo sounds terrific and the differences from one system to the next don't matter to the listener.

After all the ballyhooing about "platform motion" it remains a hard to document allegation. The C-QUAM stereo we've listened to sounds wonderful. (We'd listen to Kahn too, but can't find the stations or the receivers.)

And now the hardest fact of all. Receiver manufacturers are going to give up on AM stereo altogether if the AM stations in this country don't get behind a system.

That would make all the arguments pro or "Kahn" moot, and it would be a very sad thing for AM radio.

Get behind NRSC

Dear RW:

I wanted to relate to you our experience with the NRSC conversion.

About two weeks ago we received our kit for the Optimod to convert to the NRSC 75  $\mu$ sec user preemphasis and the 10 kHz bandwidth.

We quickly and easily made the installation.

After completing the installation I called the CE of a station on our adjacent channel (we're on 600 kHz, they are on 610 kHz) and told him that we had made the conversion.

I inquired as to whether or not they would be adopting the standard and was told that the Director of Engineering would make that decision. So I gave him a call.

The outcome of all this was that I got a call from the other station's CE telling me that they had ordered the kit to convert to the NRSC standard.

The grass roots effort on the part of Class A FM stations to obtain a power increase is gathering steam.

The plan, which is before the FCC as a petition for rulemaking, brings to light the same arguments raised with other recent proposals, such as the one to allow FMs to use directional antennas to increase short-spaced coverage areas.

On the pro side is the argument put forth by Class A's that they can better provide local service to their communities than Class B stations which may be farther away but have stronger signals.

This concern affects a majority of Class A's now, plus as listening habits and centers of population change, even more Class A's would benefit in the future.

Class A Power Increase

Arguing against the increase is the concern put forth by the NAB's FM transmission subcommittee about the possible "AMization of the FM band."

The power boost would affect a large number of stations so it's certainly one that merits consideration by both the subcommittee and the FCC.

If there are many cases where Class A's can increase their power without causing interference to other stations, then they should be allowed to do that.

But in cases where interference would be a problem, the protection of the Class B station should remain the important consideration and the power boost should not be allowed.

Overlapping signal contours, even if they are negotiated between two stations, are not in the best interests of the listener.

The Class A proposal should be evaluated on its technical merits in light of its potential to cause interference, and with regards to maximizing spectrum utilization.

Arguments from those station owners who fear increased market competition from stronger Class A's are not grounds enough to turn the power boost proposal down.

Stronger local stations and vigorous competition in the marketplace help keep the industry healthy and should be encouraged with sensible rulemaking.

—RW

We could quickly and easily make the conversion if everyone would get behind the move.

So when you adopt the standard, call just one station and support and encourage it to do the same.

And we will show the receiver manufacturers that AM means business.

Sam M. Mooney, CE  
NewMarket Media Corp.  
Winston-Salem, NC

Programming needed

Dear RW:

From the end of a tunnel of more than 50 years in commercial radio I offer a few crumbs of comment.

My work has involved engineering to station ownership, and I have experienced the FM expansion and AM's decline.

We lose sight of the one paramount reason for radio's existence: programming.

When I began in 1925 there were about 650 stations on the air. Today there are 10,000.

Perspiration and personality made AM grow, even before networks.

FM came along with superior sound but suffered the attempted sabotage of all networks and most big station owners, yet survived a complete change of the band assigned.

AM stereo is no panacea. What good does it do to hear talk-talk by one voice or a gable in stereo vs. good mono?

Music is gone from AM except for the sonic garbage of Top 40 and Bottom 100

records.

The warmth or local appeal of announcers has been supplanted by a Big Brother voice via satellite for 24-hour service, save local inserts.

Take away the weather forecast and most stations would be speechless.

How many AM (or FM) managers spring a surprise "drill" and ask their staffs to figure out a full day's program from local talent or events?

The dearth of imagination has led some desperate owners and managers to hire local sex perverts to introduce "shock radio" with dirty or salacious words or topics.

The diarrhea of words on radio is as boring as the monotony of the same 40 or 200 records played over and over.

Engineers are badgered to goose up the levels or strangle the frequency response to create a new image or sound.

Contests fill hours of wasted time, and the brag and puffery of station promos clutter up the dial to create more boredom.

Meanwhile the sound of older voices is rarely heard as the shrill cries of the young eager beavers ride the waves.

All the compressors and doo-dads and high pressure vocalizing will not save AM when so little effort is expended on better programming for the medium.

The vast competition of 10,000 stations surely warrants better and more diversified programming than we now get.

Stephen A. Cisler  
Orbit Radio & Video  
Louisville, KY

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# AM, FM Issues At IEEE Gathering

by Alex Zavistovich

Washington DC ... FM station multiplexing and AM synchronous transmission were among the topics highlighted at the 37th Annual Broadcast Symposium of the Institute of Electrical and Electronics Engineers (IEEE).

The event, held 17-18 September at the Hotel Washington in downtown Washington DC, hosted approximately 200 attendees, according to symposium Chairman Robert du Treil.

The two-day symposium devoted its second day to radio issues. The Friday morning session addressed overall the subject of multistation FM arrangements, although du Treil acknowledged that the emphasis was unintentional, and was a coincidence of the "call for papers" during planning of the symposium.

## Morning sessions

Intentional or not, the morning session of the symposium was dominated by three presentations addressing the theme of multistation FM antenna systems. The remaining two papers of the session involved computer modelling of AM antenna properties.

A sample multistation FM antenna was explained by Dean Sargent, of D.W. Sargent Broadcast Service. He used the example of a constant impedance bandpass combiner, coupled with an 8-bay antenna and computer-driven monitor/protection system.

The combiner specs were chosen, Sargent said, with an eye toward possible future technology. Careful consideration must be made of group delay and return loss, otherwise the stations could not take advantage of related systems, such as FMX, he said.

A computer monitoring system must also be employed, Sargent added. In Sargent's example, the computer system had ROM, but included a manual switch in case of power failure.

A CRT display registers a problem as an "event," and logs it before the trip point of the combiner has been reached. The system will be tripped in the event of excessive power or high Vertical

Standing Wave Ratio.

Further explanation of the combiner was made by Dielectric VP/Engineering Cole Plummer, who distinguished between constant impedance and non-constant, or "branch-type," combiners. The most widely accepted is the constant variety, he noted.

A variety of bandpass multiplexers are available, Plummer said, including 4-

port hybrids, reject load and bandpass filters.

Particular attention must be paid to keeping the system temperature stable. Modularity in design would speed construction and facilitate the addition of a new station, Plummer noted.

A paper was presented by George Harris on behalf of Robert Surette of Shively Labs. Harris elaborated on the variety of systems other than balanced, such as branch and runout networks.

The runout network, a phase-adjusted system, is largely obsolete, Harris said. The branch system is inexpensive to implement, but is not expandable.

Harris expressed support for the balanced system, which uses two connected hybrids. He stressed that group delay equalizers should be used to balance the delay effect resulting from energy storage properties of the pass-through filters used in the system.

## NEC modelling

The Numerical Electromagnetic Code (NEC) was used to model the effectiveness of elevated radials over buried radials in AM broadcast antennas, with the second element of each being a central monopole.

According to Roger Radcliff, of Ohio University, NEC modelling found the performance of elevated horizontal radials to be superior to buried elements.

Jim Hatfield, partner in the consulting engineering firm of Hatfield and Dawson, applied the NEC code to an analysis of AM directional antenna nulls and the proximity effect.

He said an accurate depiction of the behavior close in to an array using conventional means needs to use field parameters which are actually being produced by the array to get numbers that are realistic.

NEC modelling can be used, Hatfield said, to achieve analytical answers to a variety of AM directional problems.

At the symposium's mid-day recess, Broadcast Engineering consultant Oscar Reed, the luncheon speaker, addressed several points relating to AM synchronization, which would be the informal

*The study reported on the synchronization of WBBM, Chicago.*

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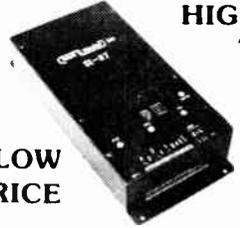
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# Symposium Addresses Radio

(continued from page 7)

sion without benefit of engineering counsel.

In the afternoon session, Gerald Berman of the Voice of America (VOA) described the evaluation procedure implemented by VOA in its search for new 500 kW shortwave transmitters.

In March 1984, VOA issued a Request for Proposals for "off-the-shelf" short-wave transmitters. Contracts were awarded to AEG, Brown Boveri, Continental and Marconi, and units were brought to the VOA's Greenville, South Carolina relay station.

Evaluation of ease of installation, reliability, operability and maintainability were made by the Corps of Engineers, a VOA expert panel and contractors from Mitre Corporation. Efficiency and RF phase distortion were also tested.

The VOA Evaluation Procedure was published as a guideline in April 1986, Berman said.

Berman noted that VOA is still engaged in final transmitter acquisition and declined to appraise individual unit performance.

Following the Berman presentation, Harris Corporation's Robert Weirather and Ihor Sulyma of J.S. Sherman and Associates addressed problems encountered in recent AM synchronization projects.

Weirather described the project under way at KKOB in Albuquerque, New Mexico, which has to directionalize its signal to protect WABC, NY.

By synchronizing its signal with KVSF in Santa Fe, KKOB was able to regain almost all of the area it had lost due to changing its signal pattern for WABC.

The station did, however, become the victim of a "zone of interference" or "mush zone" from the overlapping of the two station signals, Weirather acknowledged. The point of maximum interference occurs at 0 dB, he commented, decreasing across the ranges of 0 to 6 and 6 to 20 dB.

At 20 dB or more, the interference be-

comes inaudible, he added.

Sulyma described several different types of distortion which could result from synchronous operation of transmitters. In the case of frequency distortion, a "cancellation" effect is produced when the frequencies are "out of tolerance," he said.

Modulation distortion appears as an echo due to program lag, Sulyma noted.



The effect can be corrected using time delay, he added.

In carrier wave distortion, of the type described earlier by Weirather, the two signals create minima and maxima for the electromagnetic field.

Skywave interference, Sulyma said, is characterized by having the signal from the first transmitter enter the service area

of the synchronous facility.

According to the FCC, if field strength is within 6 dB, the potential exists for distortion and an unsatisfactory signal, he added.

## Digital audio and panel

A digital delivery system based on pulse code modulation (PCM) technology in the television frequencies was presented by WGBH Director of Engineering David MacCarn.

With FCC authorization, WGBH TV has been sending digital audio over a video signal in non-broadcast hours. According to MacCarn, the system delivers CD quality to the home without transmission loss.

At the studio end, left and right audio is connected to the PCM VCR for tape playback. The VCR video is then connected to the PCM encoder, the video output of which is sent to the transmitter.

To receive and decode, the home VCR is connected to the digital station output, leading to the PCM decoder unit. Left and right audio outputs from the PCM unit are connected to the home stereo.

Enough audiophiles in Boston own PCM decoders to make the experiment worthwhile and to obtain test results,

MacCarn said.

WGBH has been replacing the late night content of its VHF television station with PCM audio as an experiment, he stated. Listener reaction has been enthusiastic and positive, MacCarn reported.

Concluding the event was a panel discussion of FCC docket 82-334, which addresses the status of users of the 12.2-12.7 GHz band displaced by direct broadcast satellites.

Julius Knapp of the FCC's Office of Engineering and Technology explained that under a report and order released in February 1987, the spectrum of 1.9 to 6.88 GHz became available to cable TV for mobile pickup only. The 6.4 GHz band, formerly secondary to broadcasters, was opened for co-primary use with cable and private users.

Minimum pathlength and interference protection to satellites in a geostational orbital arc were also included in the report, Knapp said.

A number of petitions for reconsideration are pending before the FCC, primarily objecting to allowing cable use in the 1.9-6.8 GHz spectrum. Knapp maintained a final decision on the petitions is expected in the next few months, he estimated.

For additional information on the symposium, contact Robert du Treil at the offices of du Treil and Rackley: 202-659-3055.

## Still No Word on FCC Vacancy

by Alex Zavistovich

Washington DC... No new light has been cast on the selection for a new FCC Commissioner, although the front runner is still believed to be Bradley Holmes, chief of the MMB Policy and Rules Division.

The 33-year old Holmes served as Chairman Dennis Patrick's aide before moving to the Policy and Rules Division. He was reportedly Patrick's choice to fill the Commission vacancy created when Patrick succeeded Mark Fowler as Chairman.

A number of candidates have been mentioned throughout the selection process, but the Washington rumor mill has been silent since Holmes was reported by wire services in early August to be President Reagan's choice for the empty Commission seat.

The FCC's Director of the Office of Congressional and Public Affairs, John Kamp, joked, "I haven't heard a good rumor in three weeks."

Kamp agreed with previous accounts naming Holmes as the "apparent White House designee," and did not believe that any new names have been added to

the list of aspirants to the Commission post.

Talk in the nation's capital has Holmes stepping into the position as soon as a background investigation is completed on him. However, Kamp questioned whether the investigation has been started, noting that a number of other candidates are "still in contention" for the vacancy.

Among the names still circulating for the job is Craig Smith, director of the Freedom of Expression Foundation, a private foundation with close ties to Oregon Senator Robert Packwood. Smith is the Republican senator's choice for the position, according to Kamp.

If selected, Smith would not be the only member of the current Commission with connections to Packwood. Commissioner Mimi Dawson, whose term in office expires next year, was a former aide to the senator.

Also presumably still in contention for the Commission vacancy is Susan Wing, a communications attorney with the DC-based firm of Hogan & Hartson. Wing reportedly interviewed at the White House for the FCC position; her status in the selection, however, is unknown.

The addition of Wing to the FCC panel would create the first female majority on the Commission since its inception.

Still, there has been no official word at the Commission of the likelihood of Holmes' selection to the FCC seat. Kamp said the White House, which is handling the appointment, has not indicated when a final decision will be reached.

Kamp also noted there is no "official" requirement for a five-member Commission panel. The Commission has been convening with only four members since Fowler's departure this past spring.

A fifth member, Kamp commented, is desirable to ensure against a deadlock on the Commission.

For additional information, contact John Kamp at 202-632-5050.

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# NEC Models May Solve Dispute

by Alex Zavistovich

Washington DC ... A possible solution to the ongoing controversy over determining the near-field effects in AM directional antennas may lie in the Numerical Electromagnetic Code (NEC), a method of moments computer program.

In a presentation at the Broadcast Symposium of the Institute of Electrical and Electronics Engineers (IEEE) in September, Jim Hatfield, an engineering partner in the firm of Hatfield and Dawson, said there are "all sorts of applications" for NEC which are "just starting to open up."

AM directional problems are among those applications, Hatfield contended. He said measured versus predicted current distributions showed a "fair amount of confirmation" when a NEC model was considered alongside a set of current readings taken at various heights along an antenna.

Hatfield's NEC modelling for near-field analysis was prompted in part by a dispute over the use of a proximity correction method to counter the parallax effects close in to an array during field strength measurements. The method was cited in the 15 January issue of RW.

Concern over the issue has also prompted a study of the matter by an ad hoc committee of the Association of Federal Communications Consulting Engineers (AFCCE). At press time, the committee, formed in February, had not yet come to a decision on any action regarding proximity correction.

### Desired parameters

During the IEEE symposium, Hatfield maintained that NEC can be used to answer some practical questions, "such as how to adjust an array to achieve desired field parameters."

However, he cautioned, in comparisons, the point along a directional antenna at which the current is measured can affect how closely the actual field parameters are followed. Changing the field parameters of the antenna will also change the tracking of the parameters, he said.

This is particularly true, Hatfield continued, when comparing NEC models with theoretical parameters applied to the traditional near-field formula, or when comparing NEC results with those obtained from RADIAT, an FCC computer program.

The theoretical parameters applied to RADIAT will show eventual convergence between the approximations for near and far fields. This would diverge from NEC readings, Hatfield said.

He maintained, however, that parameters taken from

NEC current distributions and applied to the standard proximity or near-field equation show "good agreement" with the NEC model.

### Realistic numbers

Still, Hatfield said, accurate depiction of behavior close in to an array, requires use of "the field parameters that are actually being produced by the array, to get numbers that are realistic."

In FCC equations and standard com-

puter programs such as RADIAT, operating parameters are "the ratios in phases of the fields as they leave the radiating elements," Hatfield explained.

However, when such parameters are used in NEC modeling, "typically you find the pattern is not quite the same as might be predicted by RADIAT," he added.

If the antenna in an operating array is being monitored at the base, and the effects in current actually appear after leav-

ing the base, Hatfield maintained the "field ratios will not be the same as base current drive parameters, in terms of ratio and phase."

However, he continued, the NEC model shows currents at various points along the height of an antenna in rectangular and polar form.

Adding the rectangular numbers for each tower and converting to polar generally results in a number which Hatfield said is "pretty close to the operating field parameters for that array for the given drive conditions."

For additional information contact Jim Hatfield at 206-783-9151.

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# New Ideas, Products at Madison

by Dave Obergöner

**Madison WI . . .** Several hundred attendees gathered in Madison 14 through 17 September for the "33rd Broadcast Engineering and Management Seminar" put on by the University of Wisconsin (and supported in part by **Radio World** and **TV Technology** newspapers).

It was a great lesson in how Don Borchert (CE/WHA) and his fine staff can cram at least two weeks worth of information into less than a week of programs.

As a working engineer in the St. Louis market who has been part of the team putting on the last several years of regional and now national SBE conventions here, I can appreciate the large amount of work involved.

Perhaps because the size of the group is small, this conference gives more of a chance for one-on-one dialogue than a convention attended by thousands.

Although there was a sizable exhibition hall (more on that later), the emphasis at the conference clearly seemed to be on the programs.

There was so much good information presented here that some of the sessions had to be pushed into the evening hours, and nearly everyone attended all of them, even the nuts and bolts engineering forum, which ran till something like 2:30 AM.

## Management technique

The first day of the seminar was devoted primarily to engineering management. A lot of very good methods to improve management abilities were presented.

Dick Hiner, the director of Navy Broadcasting, believes that most business in the US (not just broadcasting) is "over managed and under led." In his view, there are plenty of managers and far too few leaders.

At a luncheon discussion, independent consultant Garrett Lysiak posed a question that made quite a statement in itself. His topic was, "Station Engineers—an endangered species?"

It brought to light the concerns that seem to be on the minds of many if not most of the other engineers I talked to at the conference.

It certainly seems to be a time of transition for engineering. The fast computerization of our facilities has greatly changed the emphasis of most of our day-to-day work routine.

It's not unusual anymore at many stations for the CE to spend as much time servicing computers and helping those who operate them as is spent on fixing cart machines.

Engineers who refuse to adapt to these new roles may find themselves much less in demand a few years down the road.

## Wheeling and dealing stations

Another topic of conversation was the incredibly inflated prices being paid for many stations lately.

A lot of new owners seem to have too little broadcast experience and a huge debt service.

It is understandable that once into such a situation some new owners may find it difficult to properly operate their station.

As they go charging through the station looking for places to cut costs, engineering may look like a fine target.

The emphasis should be on educating these new owners to the fact that a good engineer can be a very good investment and quite cost effective.

## Build-it project

Mark Persons presented a program on custom chassis building projects with tips on how to do it right the first time.

If, in your shop, you could build a piece of equipment for \$80 that would cost the station \$1000 from an outside source, you certainly could justify your worth to the station.

Persons made a very good point when he said, "The best electronics inside can be dwarfed by a questionable appearance outside—the nicer it looks, the more it's worth."

## Capacitors to blame

Did you know the type of capacitor chosen by a circuit designer will have an audible effect on its sound quality?

Bill Sacks of Straight Wire Audio does, and so do all the attendees in Madison after his graphic demonstration using a piece of custom-built equipment that amplified the distortion and microphonics generated by one cheap ceramic

capacitor. Hearing is believing.

Two programs and one panel brought a lot of us up to date on digital audio.

Charles Bates from ITC/3M gave us the basics of some technology put to use by the company in designing its digital tape cart machine and its audio switcher.

Then Rick Riggs, from Harris, showed how to apply digital technology to a revolutionary design of an AM transmitter.

## Studio of tomorrow

An excellent panel tweaked our imaginations of what tomorrow's radio studio might be like with touchscreens replacing conventional control boards, and optical and hard disk based systems for music and commercial storage—digitally of course.

Panelists included James Oliver, Media Touch Systems; Tom Ransom, IGM; Dave Adler, For-A Corp; and Matthew Martin of Digital Broadcast Systems.

Glenn Clark of Texar repeated his plea for an FCC approved standard for AM stereo transmission in his presentation "Technical Steps to AM Revival."

"While the patient lies bleeding to death on the pavement the two ambulance drivers are fighting over who will make the money from taking him to the hospital," observed Clark regarding

the AM stereo wars.

Both Clark and CRL's Bill Ammons voiced their strong support for the new NRSC standard for pre-emphasis and low pass filtering.

## Great ideas, and some not so

The nuts and bolts engineering forum featured what used to be called the "Great Ideas Give Away." The name has been changed now to "Cheap Tricks."

I don't know if this reflects the changes in many engineering budgets, but the ideas were interesting just the same.

The winner, Hal Schardin from WCCO radio, submitted an idea for a way to align STL antennas.

For his effort he took home a Phase-scope from Ram Broadcast. (Copies of the great ideas should be available through Don Borchert at WHA Madison.)

One interesting story that we heard during the forum was that of an engineer whose station was bought by a man whose only broadcast experience was that he owned a chain of pizza restaurants . . . ?

It was bad enough that he tried to run the station like a restaurant, but when the guy brought in people from his pizza places to be department heads at the station it was time for this engineer to hit the exits.

The moral of the story—this could happen to you—*be prepared*. Now was that pepperoni or anchovies?

## Product showcase

In the exhibit hall there were several products that were new to the show this year.

Full Compass Systems showed a new real time analyzer, the dbx RTA-1, which uses the music itself as the test signal.

This could allow the testing of nearly any piece of equipment in a station without interruption to run pink noise.

It also allows for a real-time analysis of factors such as processing in program signals—your station's or your competitor's.

Full Compass also showed a new and very flexible digital matrix patch bay system from Akai professional products.

A super expandable audio crosspoint switching system was also shown by ITC/3M.

Ram Broadcasting was showing the new McCurdy "S" series console which offers a typical 10 channel configuration for under \$10,000.

Broadcast Electronics showed its new PhaseTrak 90 cart machine which corrects for cartridge phase errors in real time during playback.

Straight Wire Audio showed generation four of its CDQue CD player with "slip que," a single knob allowing consistent pre-roll cueing of the disk.

With all the knowledge gained at this year's conference, I can hardly wait to see what the friendly folks in Madison have in store for us next year.

*Dave Obergöner is CE at Gannett's KUSA AM/KSD FM in St. Louis. He also does consulting work for several radio and TV stations in the midwest area. He can be reached at 314-997-5594.*

*Tapes of all the sessions will be available from Full Compass Systems, Madison, WI, 1-800-356-5844.*



# Antenna Designs Suit FM Needs

by W.C. Alexander

## Part III of IV

**Dallas TX . . .** In the last installment, we examined some of the electrical variables of FM antennas, their use in solving certain problems, and multipath effects.

This time we'll look at some of the specific antenna designs and their characteristics.

There are numerous antenna designs available on the market with various characteristics that are good and bad. Some designs are well suited to one application while other designs may work out better in different situations entirely.

Some common antenna types are the panel with crossed dipoles, shunt and series fed slanted dipole, ring stub and twisted ring, and multi-arm short helix.

There are several variations on these basic classes, some of which have become very refined over the years.

Antenna gain is accomplished by stacking a number of bays about one wavelength apart on a common feed. A single bay by itself usually exhibits a negative gain, while two bays provide near unity gain.

More than two bays will exhibit a positive gain, and gains of up to seven are possible with an antenna that has 12 bays.

Different manufacturers take a different approach to matching the antenna itself to the transmission line.

Perhaps the simplest and most common way is with the three-stub transformer. This matching section is inserted between the transmission line and the antenna interbay line, and is adjusted for minimum reflected power.

The net effect is to place an impedance in parallel with the antenna impedance to match it to the 50 ohm line.

The disadvantage of this method of matching is that it is bandwidth limited and it produces standing waves inside the antenna feed harness, behind

the transformer.

Perhaps the best way to match an antenna to its feedline is to design the antenna in such a way that the bay impedances are equal to 50 ohms times the number of bays for an end fed antenna, or 50 ohms times the number of bays on each side of the power divider for a center fed array.

This is accomplished by performing an impedance transformation in the horizontal part of each bay.

For example, a six-bay end fed array would have six 300 ohm bays which in parallel would yield an impedance of 50 ohms.

“ Different manufacturers take a different approach . . . ”

This approach is technically superior to the single transformer approach for several reasons.

First, it eliminates standing waves in the interbay feedline.

Second, since there are no standing waves present, the transformerless antenna can withstand higher input power.

Thirdly, it results in a matched system, where the feedline is matched from the point of connection to the transmitter all the way to each individual antenna bay.

Shunt inductances are easily tuned out using a ceramic stud on the inner conductor near the bottom of the antenna or power divider, but this type of tuning is so fine that it must be done with sensitive equipment and Smith charts.

One of the more critical specifications that an antenna has is its VSWR bandwidth.

Having a VSWR bandwidth of at least 260 kHz (with less than 1.08:1 across that band) is imperative for system performance.

Everyone knows how a narrow antenna system can cause synchronous AM noise, but IM products are also generated by narrow bandwidth systems, and this can cause more problems than almost anything else.

Consider a narrowband antenna system over which a station broadcasts a 67 kHz subcarrier.

The 67 kHz sideband energy (along with other sidebands generated by the high frequency components of the baseband) leave the transmitter and travel up the transmission line to the antenna.

If there is a mismatch at the sideband frequency some of the sideband energy will be reflected back down the line to the transmitter, where it will be reflected back and so on.

The reflected sideband energy that will be radiated after it has made three trips through the length of the transmission line will tend to interfere with the other power being radiated.

This is one prime cause of source-induced multipath. Some stations have observed that their multipath problems go away when they turn off their subcarriers.

If this is the case, then a narrow VSWR bandwidth or other mismatch should be suspected.

Some antenna designs are inherently

broadband, with up to 20 MHz of bandwidth for some community panel antennas and 4 MHz for single-user antennas.

This type of antenna has a great advantage over other, more narrowband antennas.

It is much less likely to produce IM products, synchronous AM noise and source-induced multipath than narrower antennas, and in many instances deicers are simply not needed. These are important considerations in most instances.

Elimination of deicing equipment tremendously simplifies antenna assembly, installation, maintenance and operation, not to mention the weight advantages.

When ice begins to build up on the antenna it is detuned low, as any antenna would be.

Assuming the antenna was tuned to the station's operating frequency at the time of installation (or slightly high, as is a common practice) the detuning effect of the ice will be negligible until it has detuned the antenna more than 2 MHz below the station's frequency!

In the final installment, we will take a look at some very practical ways to use antennas to solve specific problems.

W.C. Alexander is Director of Engineering for Crawford Broadcasting Company, and a soon-to-be-published novelist. He can be reached at 214-445-1713.

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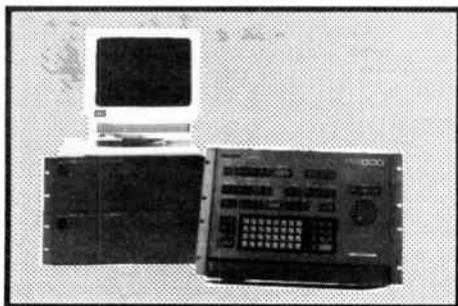
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# Station Monitoring: It's "On the House"

by Tom Vernon

**Harrisburg PA** ... Before getting to this month's Station Sketches topic, we'll wrap up some unfinished business on noise generators.

I would be remiss if I left that topic without mentioning the influence that digital techniques have had on it.

## Station Sketches

Historically the first noise generators used the shot noise in a tube type diode to generate noise from DC to the megahertz range.

As technology advanced zener diodes were used for the same purpose. Nowadays there are digital noise generators. These are made by connecting a group of shift registers together.

The input for the registers comes from Modulo-2 addition of several of the later stages. The output is a pseudorandom string of ones and zeroes. After appropriate filtering, analog white noise is the end result.

We refer to this as "pseudorandom" because the noise repeats itself at an in-

terval dependent on the shift register length. Not to worry though, the repetition interval can easily be months or years!

It's easy to build your own digital pink noise generator since National Semiconductor has done the hard part, designing a digital noise source on a chip.

Add a half dozen components, and you're in business.

Meanwhile, the house monitor system of many stations is often a nightmare of poor quality audio with hum, non-functioning L-pads and intermittents.

Often it evolves into a random series-parallel combination of speakers that frequently breaks down.

Let's look at how to do house monitor systems the right way, so that you'll have a reliable installation that can be expanded upon with little difficulty.

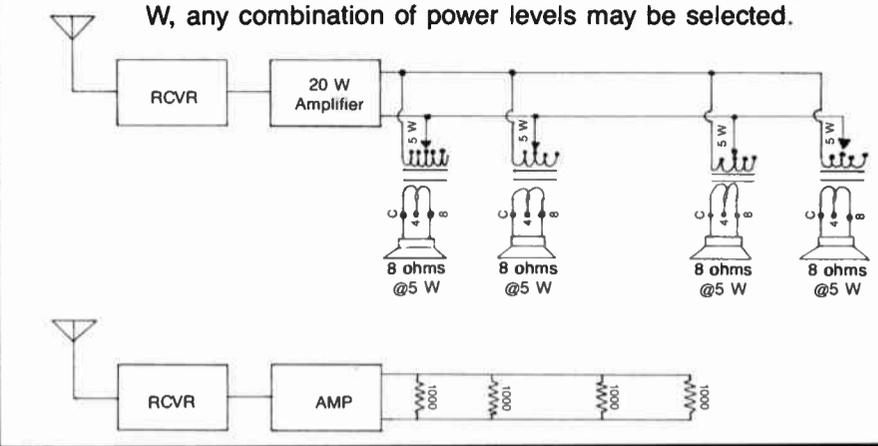
### Start at the source

To begin, the house monitor system needs a reliable, uninterrupted source of off-air audio.

Ideally, this should be a fixed tuned receiver with a good outside antenna.

Tuners have the disadvantage of occasionally drifting off frequency, and are easily tampered with.

Figure 1. 70.7 V house monitor system with 20 W amplifier, and its equivalent circuit. As long as the transformer primaries add up to 20 W, any combination of power levels may be selected.



A speaker system fed off the modulation monitor will subject the entire station to periods of silence and ear splitting tones whenever the monitor is calibrated.

The amplifier employed must have a suitable power rating for the number of speakers being driven. For a small system with a half dozen speakers, an amp with 20-30 W(rms) should do nicely.

Don't be fooled by output specifications listing "music power" or "peak power." When in doubt, check a transistor or tube manual for specifications of the output devices.

### Constant voltage

The easiest way to handle audio distribution from the monitor amp is with

a constant voltage system. The most common are 70.7 and 25 V arrangements.

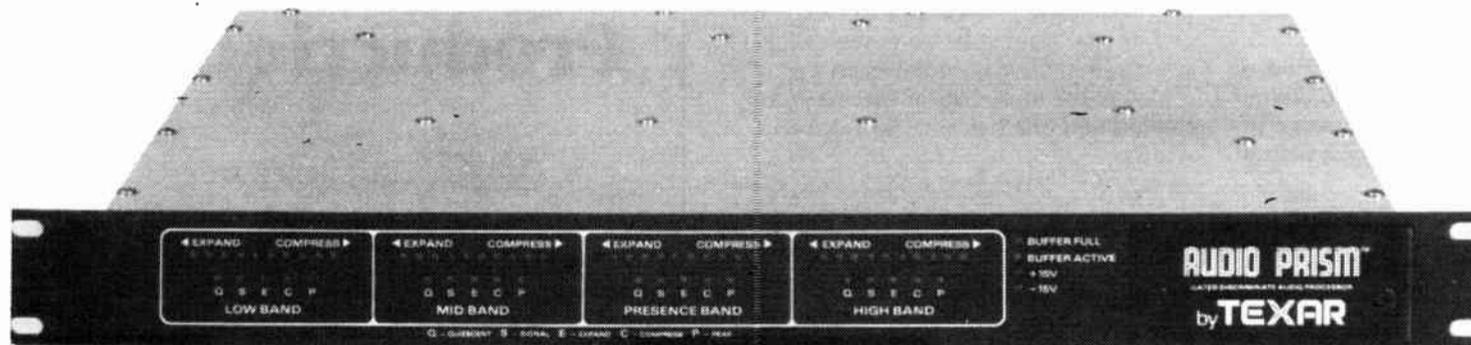
Some folks are confused by these since we're taught to match impedance in ohms, and 70.7 V transformers have their primaries specified in watts. As we shall see, there is logic to this system.

Getting back to basics, the source impedance of a transformer may be calculated as shown in Equation 1.

Thus for a 20 W amplifier, we would have an impedance (Z) of 250 ohms. The flexibility of the constant voltage system comes in the many ways we can split up this 250 ohm load.

Figure 1 illustrates a simple system with four 5 W speakers, and shows its **(continued on page 17)**

# ALL CD BY THE END OF THE YEAR!



That's the goal that many stations have set for themselves: to generate 100% of their music programming from CDs by the end of 1987. Using copyrighted station identifiers like "Lazer 104," broadcasters are able to position themselves in the listeners' minds as the high-quality music source. One promoted slogan is "Declare your independence from vinyl on July 4th 1987!" Surprisingly, it's not necessarily the big chain stations in major markets that are leading the charge. Medium and small market stations have shown themselves just as likely, if not more likely, to become leaders in their market.

Many of the early hurdles to on-air use of CDs have been removed. While early CD players were difficult to cue to music, making it impossible to run a tight air show, and were user-unfriendly, this has changed. Today's CD players (such as the Technics SLP-1200 and the Studer A725) feature instant start and incremental cueing, making it possible to cue exactly to any desired point in the music.

Many stations also questioned whether sufficient material, both oldies and current, existed on CD format to support all-CD operations. Oldies have come a very long way in the past few months. Several of the Beatles' albums have been released in CD format in just the past

few weeks, with more to follow shortly. And literally thousands of oldies titles are available on CD from Century 21 Programming in Dallas, Texas (214/934-2121). Each disc contains cuts from many different artists, so you don't pay for the album cuts that weren't hits. Each cut is a hit.

And more and more of the new release hits are being made available as a single-title CD. Under intense pressure from stations and also from influential program consulting firms like Burkhart/Abrahms/Douglas/Elliott, record firms are putting new emphasis on making hit releases immediately available on CD. Some record companies are getting the message slower than others, and are also finding themselves at a disadvantage when trying to get airplay for their new releases. Some stations simply won't add a title that is not on CD.

Why the big deal over CDs? Because today's listener has better equipment and is more quality-conscious than ever before. A higher-quality air product can translate into higher ratings and higher station revenues.

If you do or will originate a significant portion of your music from CDs, you should also consider the quality of your audio processing equipment. CDs deliver crisp, clear audio, but not all audio processors can preserve that quality. The digitally controlled TEXAR AUDIO

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\*Summer and Fall '85, Winter, Spring, Summer and Fall '86, and Winter '87 ARBITRON Ratings. Total Persons 12+ Share, Mon-Sun, 6AM-12M. (Used with permission.)

# The "Secret" of Your Success

by John M. Cummuta

**Downers Grove IL . . .** In the movie *The Secret of My Success*, Michael J. Fox uses his position in the mail room to create false communications which allow him to invent a phony executive position in the company.

He then spends the length of the film running back and forth filling both jobs.

From his communications base in the mail room he sends correspondence, reports and memos which eventually reveal his business genius and save the company.

The real secret to the hero's success in the movie was his position in the communications chain of the company. It was his upward correspondence that initiated all the things he accomplished.

## Engineering-Manager

However, in your case, you already accomplish things.

Your challenge is to effectively communicate those accomplishments to the people who write your paychecks.

Engineers, by and large, spend most of their time doing things that no one else at the station understands. And they do a lot of those things in spaces where no one else works, or at times when no one else is around.

What that creates is a public relations problem for the engineer. His worth to the organization is not as obvious as it is with some of the more flashy positions.

Couple that with the common impression that engineering is just a cost—a necessary evil—and you have an image problem that must be overcome.

### Enter the memo

Effectively used, memos could be the tool you need to propel your image to the status it deserves at your station.

It should be obvious that the more others understand the importance and scope of your contributions, the higher the esteem you'll be held in. So let's look at the actual mechanics of memos.

Many people think of memos as nothing more than short, informal letters that stay within a department or organization and are written on memo paper instead of letterhead.

While most memos are shorter and less formal than letters, and most are written on memo paper and stay within an organization, they are not simply second-rate letters. However, they do have limited uses and purposes.

Most often memos remind or announce.

They seldom persuade. You may write to alert readers to problems, to suggest solutions, or to set out the merits of competing positions, but seldom to change someone's mind.

In the case of the engineer, however, the memo takes on an additional purpose: to get him or her credit for performance.

### Disguised report

This is done under the guise of a report. The memo you'll be sending will carry itself as a simple accounting of your activities to your superiors.

But what it does is tell them what they're getting for their engineering

money.

Believe me, if engineers have a common problem this is it.

Many technical people would rather deal with machines than people, and so communications is not a developed skill.

Couple this with a tendency to talk in "technicalese" and you have a double wall between the engineering manager and station management. The memo can breach that wall.

Now that we've established the memo's purpose for the engineering manager, let's look at the basic elements of properly executed memos.

Memos are information documents.  
*(continued on page 14)*

# RADIO

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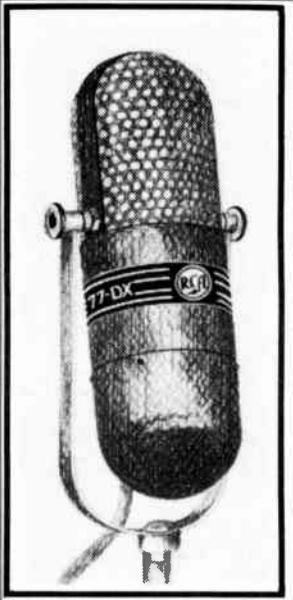
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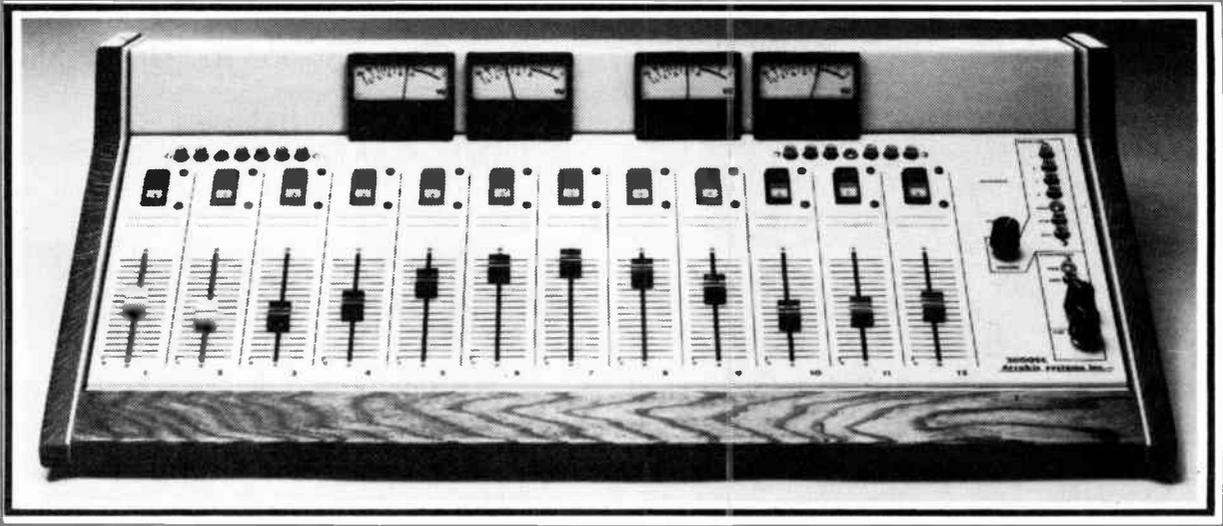
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# Success With Memos

(continued from page 13)

They should yield their information good or bad, quickly and easily.

Memos are office writing, brief and direct, to be read, understood and acted upon in the midst of the noise and routine of the station.

The memo should be written for the convenience of the reader: message first, background later.

Your audiences for a memo are almost always inside the organization and usually close to you: your manager or another department head.

Often you may write to groups of people: the sales staff, the announcers, the

business office.

Often you write about situations that you have already discussed with your readers.

However, even when you are dealing with a touchy subject, you should be direct about it. Indirectness in a memo always stands out.

Memos are usually less formal in tone than letters.

You naturally use fewer job titles, more abbreviations, and more in-house jargon than you would in letters on similar subjects.

The memo format itself, without salutation and closing, encourages both

directness and familiarity.

Normally, type memos single-spaced on memo paper, with a double space between paragraphs. Short memos are sometimes double-spaced.

Typing a memo on letterhead makes it seem much more formal, and some larger organizations have even institutionalized memo-writing to the point that they have a written procedure for them.

If such a procedure exists, by all means follow it.

Memo paper generally has "To, From, Subj, and Date" lines printed on it. These are usually aligned under each other at the left margin.

Traditional form calls for aligning the names, the subject, and the date under each other across from each appropriate title.

The "To and From" lines take the place of salutations and closings. They may refer to individuals by title or by name, or they may refer to groups by department or job title.

Job titles are usually used with the names in the "To and From" lines except in very informal memos. Memos rarely use salutations or complimentary closings.

The "Subj" line should reflect the point of the memo, not the general topic. Use "Saturday Parking" or "Change in Sick Leave Policy" rather than "Weekend Use of Facilities" or "Employee Benefits."

The "Date" line is usually the last line of the heading. The date is written in the style used in the organization, whether that be month/day/year or day/month/year.

Initial or sign only those memos out of the routine or those which may raise legal or organizational issues. By doing so you accept responsibility for the content.

Initial or sign a memo near your typed name on the "From" line. Initialing or signing routine memos, especially to colleagues, usually appears overbearing.

Begin the memo with the most important information.

Then explain the information, add details as needed, and finally fill in the background information necessary to put your points into perspective.

This allows your reader to decide how far into the memo to read.

After reading the first line, at most the first paragraph, your reader should know whether to toss your memo out, to act on it, to file it for reference, or to read on. Readers expect memos to be to the point.

Memos that focus on the writer and background instead of the needed information are ineffective. Memos should be direct. Anything else is annoying.

How do you relate all this structural information to your own memos?

Just keep in mind that when you've finished a hard overnight maintenance project, the place still looks relatively the same the next morning.

All anyone usually notices is that you're not there. "You're probably sleeping."

You have an opportunity to change that opinion by having the station manager sit down at his desk and find a memo with the subject line, "Projects Completed on Overnight Maintenance."

List the projects in reverse order of importance (Most important first), and list a reasonable amount of detail without intimidating him or her with technical jargon.

If such documents consistently appear after your maintenance sessions, and weekly thereafter on an ongoing basis, your image in the station should be sound: and so should your rewards.

Let's just say that keeping your bosses apprised of how much you're doing for them could just result in your success becoming less of a secret.

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.

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# The Power of Production Magic

by Tyree Ford

**Baltimore MD ...** As a part of last month's Radio '87 in Anaheim, I was fortunate to be chosen by David Parnigoni to speak on the topic of "How to Produce Your Radio Station."

Even though some of the material covered in that session has previously appeared in *Producer's File*, it seemed like a good idea to review some of the concepts and practices that are the foundation of a well produced station.

The scope of this year's presentation did, however, exceed the typical microcosmic approach to equipment and techniques.

The reason for this new approach was the realization that, given the same toys, people would inevitably come up with markedly different sounding stations.

## Producer's File

Way beyond the usual subjective and objective influences is perhaps the most powerful factor of all. Although there are many names for it, for the purposes of this article let's just call it *Magic*.

Most of us at some point in time have experienced *Magic*.

Whether it's the frantic hand of the airperson that lands the stylus in exactly the right groove just before the preceding spot runs out, the music bed which has hits that time out perfectly with your copy, or that promotional event that just fell into your lap ... it's *Magic*.

That same *Magic* is constantly at work in the momentum of your entire station. Listeners are aware of it too.

In focus groups responses that the station "seems to know exactly what I'm thinking about," or "plays the music I really like" are often as close as you'll get to a confirmation.

*Magic* is elusive. It cannot be made or forced to happen. The best we can do is

try to create an environment in which *Magic* is likely to occur.

In order to create this environment, the people involved must be aligned. Again, though hard work is necessary, pure force itself will not result in alignment.

Alignment occurs when an understanding of mutual respect and an agreement of a direction are present and accepted by everyone at the station. Only after your people are directed and aligned can you expect your station to make *Magic*.

Regardless of your position at the station, alignment can happen only if you  
**(continued on page 21)**



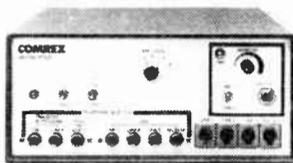
Ty Ford explains sound effects played from a demo tape at Radio '87's production session.

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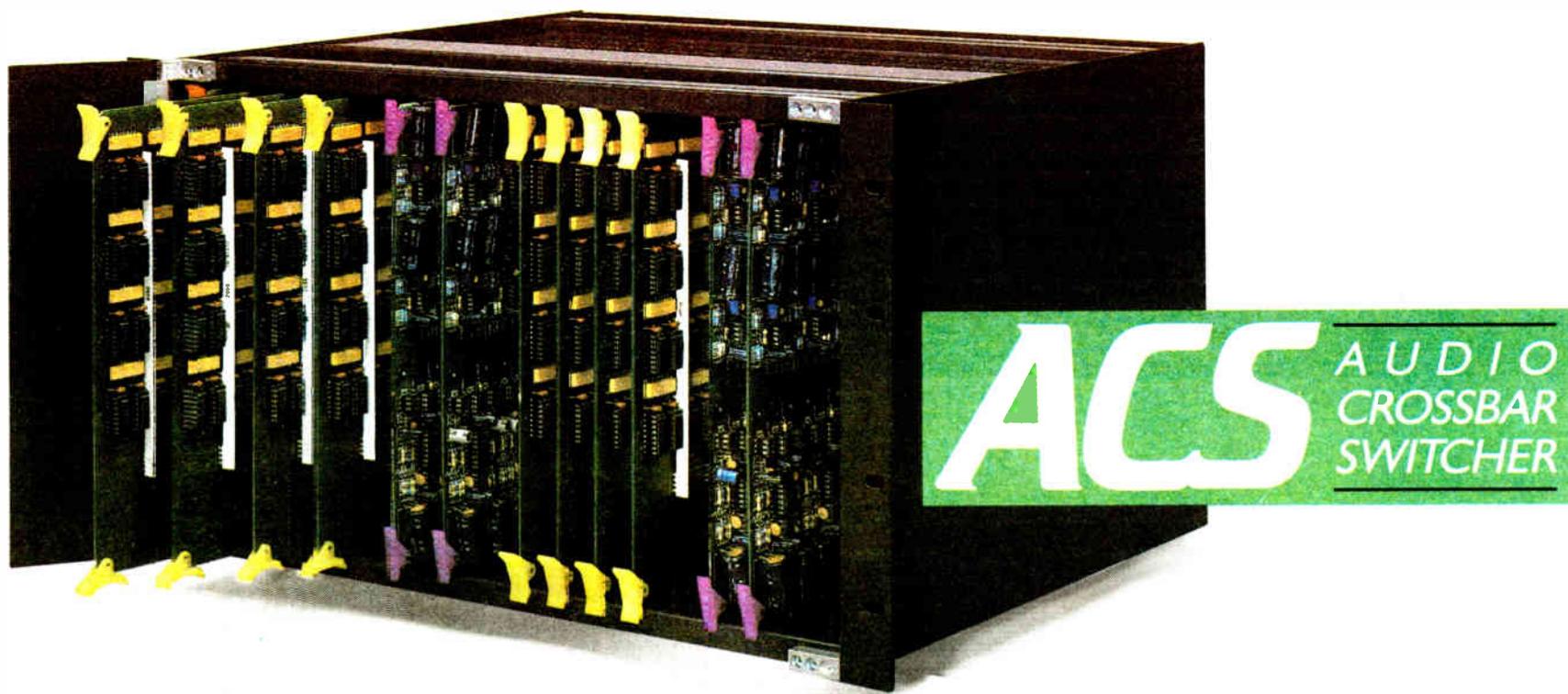
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Introducing the only high performance,\* programmable audio-routing switcher that can mix as well as route: the new ACS Series from Mitsubishi.

### EXCLUSIVE INPUT MIXING

The ACS Series Audio Mixing/Routing Switcher can do more than just handle a broadcaster's usual audio signal routing assignment tasks—it's also designed to electronically mix multiple input sources. Available in either mono or stereo configurations, the standard ACS System permits up to 96 inputs to be assigned to as many as 64 outputs. Larger custom configurations are available.

### FLEXIBLE CONTROL

The ACS System is controlled by a PC XT/AT-compatible computer, with easy-to-use, menu-driven software. Up to eleven (11) preset matrices can be instantaneously salvo-fired.

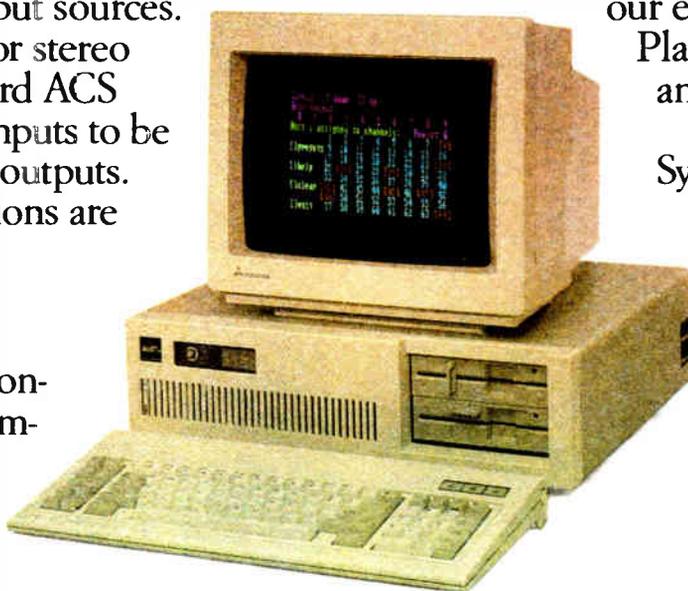
The system also features self-diagnostics, password security, fail-safe operation and RS-232C/422 bus control. If your facilities have unique control requirements, your in-house software systems can be easily integrated with the ACS hardware and software.

Any ACS System installation can be easily expanded on site. Available options include up to 32 remote control stations, our exclusive touch-sensitive Plasma Display Controller and a printer.

The affordable ACS System has been delivered to major installations and is available now. Contact us for complete technical literature.

PC Control:  
Assign and mix an unlimited number of audio inputs.

\*Typical specifications: 0.004% THD @ 0 dBv;  
+ 29.5 dBv maximum level.



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DIGITAL ENTERTAINMENT CORPORATION

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# Broadcast Telephone



P.O. BOX 27647, SALT LAKE CITY, UTAH 84127-0647

(801) 268-1117

VOL. 2 NO. 2

## Gentner - Telephone Interface Specialists

By Russell Gentner

The telephone has become a very useful resource for broadcasters. From talk shows to controlling your transmitter, the telephone line is generating profits and reducing overhead. Our company specializes in the field of broadcast telephone, offering a wide range of products that solve an assorted array of problems. This guide is intended to provide you with an overview as to the products we offer and to further educate you as to how you can use the telephone for fun and profit.

Some of the possible uses of our products include:

- On-Air Talk Shows
- News Interviews
- Sports Programming
- Automatic IFB
- Teleconferencing
- Listen Lines
- Transmitter Monitoring and Control
- Remote Machine Control

As a company, we are aggressively pursuing new products and continuing to improve on existing products. NAB '87 saw the introduction of our Digital Hybrid. This pro-

duct uses digital signal processing (DSP) technology to deliver the very best audio signal from the telephone line. The Digital Hybrid and its technology represent the dawn of a new breed of telephone and audio related products to be offered by this company. The performance improvement from this and future DSP products take a quantum leap forward.

We have just recently introduced our Remote Systems product line. This line takes existing Gentner frequency extenders and packages them into road ready travel cases. By doing this, we have been able to reduce your costs while offering a **complete** remote system. Please contact our sales office for more information.

We're continuing to improve and expand the capabilities of the VRC-1000 Remote Control Unit. This product contains many features that can reduce your operating costs. The VRC can keep you legal by automatically increasing or decreasing your transmitter's output power within safe limits. It can call you when there's a problem. It can even automatically

log all parameters at user definable intervals. If you haven't checked out the VRC-1000 in detail, you'll be surprised to hear about all of its capabilities.

For more information about our products, call Gary or Dave at (801) 268-1117 or contact your distributor.



Gentner's Digital Hybrid improves the sound of your on-air telephone calls with advanced digital and analog technology. For a description of the Digital Hybrid and other Gentner products, see page 2-3 of this guide.

### Uses for Gentner Telephone Systems

**On-air Calls.** Use Gentner hybrids for clean caller audio, understandable levels when placing callers "on the air." A Gentner telephone system will improve the audio quality of contests, request lines, talk shows, public opinion polls... any interface to your audience.

**TV Call-in Shows.** News roundtables, interview programs or the "afternoon movie" contest can benefit from improved audio quality with a Gentner telephone hybrid.

**IFB.** Gentner has telephone systems that make IFB simple and understandable. Auto-answer, auto-disconnect capability combined with superior hybrid performance give you clean telephone audio with easy operation.

**Remote Broadcasts.** Fast, good sounding remotes via the telephone are a Gentner specialty. Our Remote Systems reduce set-up time to a minimum while delivering return cue audio on the same line used for the broadcast. Use for sports, news or sales remotes... increase your station's visibility!

**News Feeds.** Gentner makes it easy to feed or record news reports and actualities. With a variety of telephone equipment that includes portable systems for use in the field to auto-answer systems with

automatic tape starts, we can help streamline your news operation.

**Information and "Listen" Lines.** Set up an information line - weather, sports, headlines, etc. with Gentner's TC-100 telephone system and your cart machine.

Gentner telephone systems can help you make the most out of a very valuable communications tool...your telephone. We'll be glad to discuss your specific application - just give our Sales department a call at (801) 268-1117.

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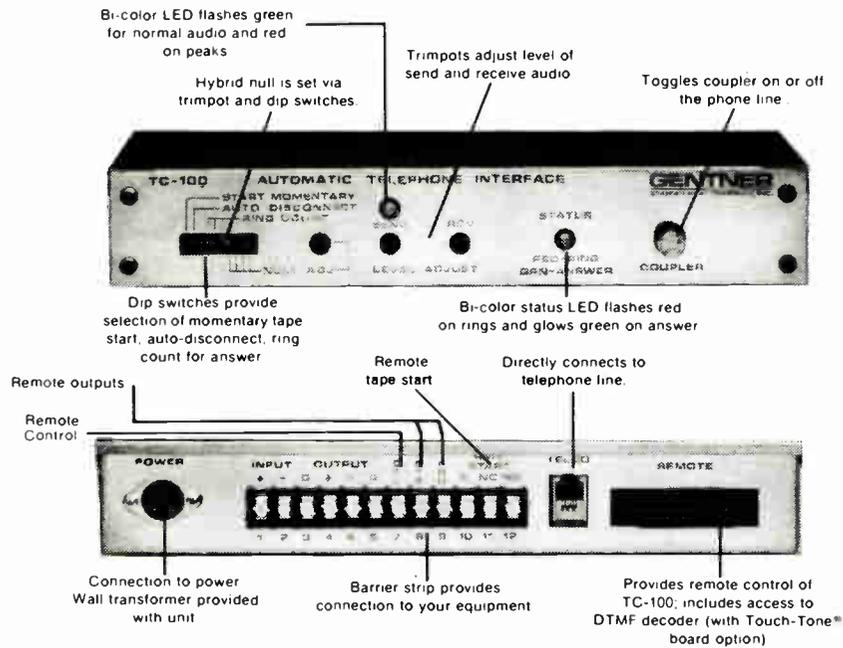
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**GENTNER**  
ELECTRONICS CORPORATION  
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# Telephone System Selection Guide

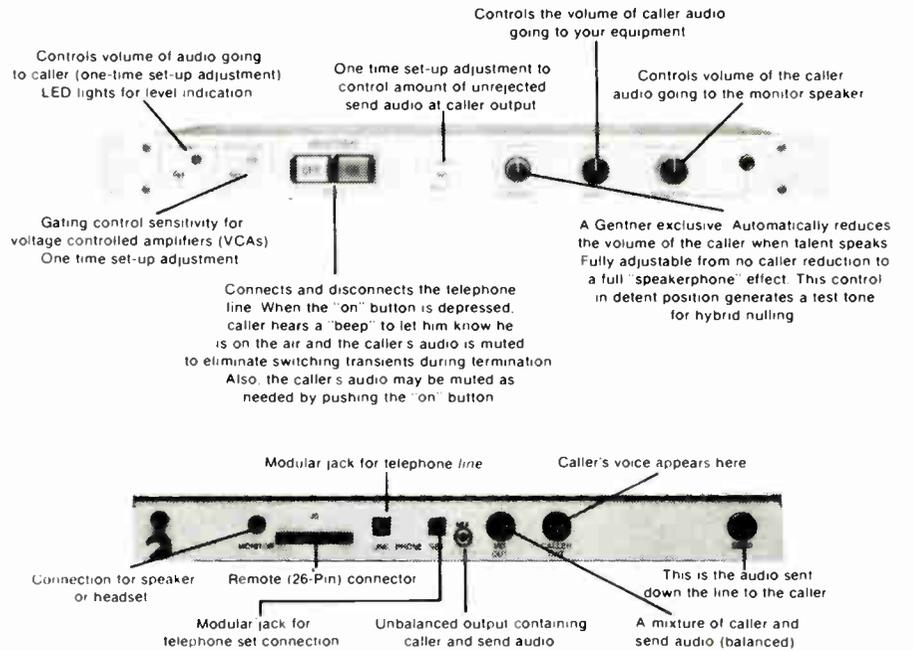
**Hybrids** - for on-air calls, talk shows, interviews, IFB, request lines

## TC-100 Auto-answer/disconnect hybrid



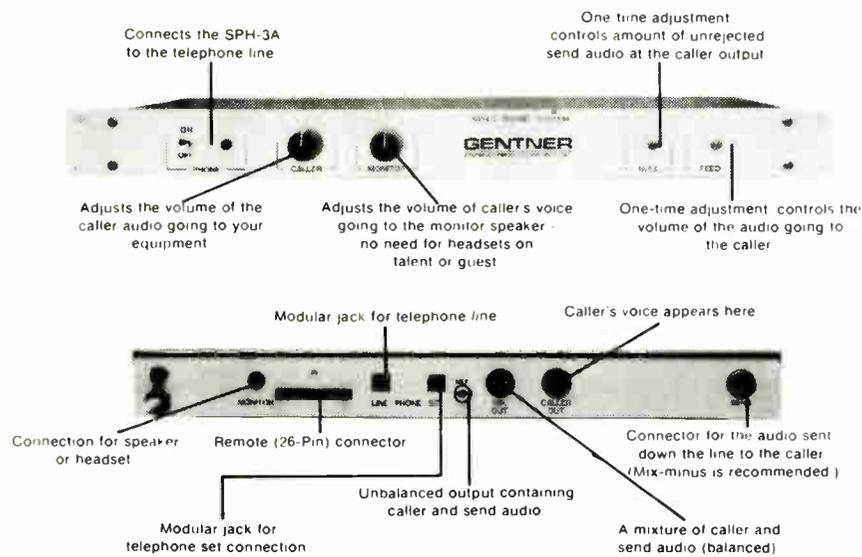
- Use for on-air calls, information lines or IFB
- Full two-way conversation, no caller cutoffs
- Automatic answer/disconnect capability
- Internal relay provides automatic tape start for feeding or recording information
- Optional Touch-Tone® decoder card provides up to 16 outputs for remote control via telephone

## SPH-4 Telephone System



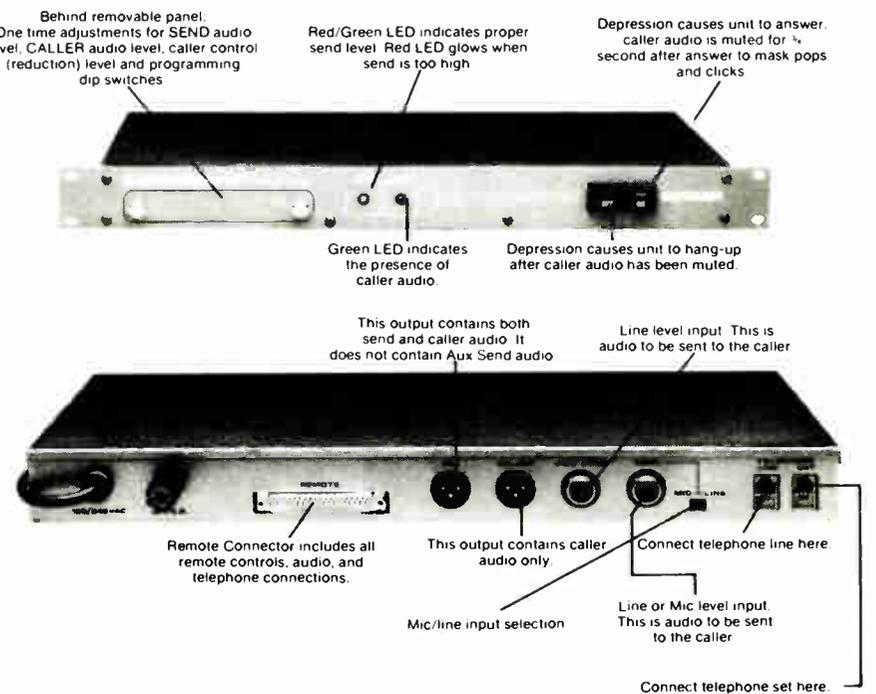
- Use for on-air calls, talk shows, interviews
- Quiet connection to phone line (no "pops" are heard)
- Full two-way conversation capability
- Adjustable "Caller Control" provides automatic reduction of caller audio when talent speaks (if desired)
- Built-in monitor amplifier with automatic dimming when talent speaks
- Easy to install and use

## SPH-3A Telephone System



- Use for on-air calls, request lines, news interviews
- Full two-way conversation, no caller cutoffs
- One-time hybrid null adjustment is relatively insensitive to line changes
- Built-in monitor amplifier eliminates need for headsets to hear callers
- Easy to install and use

## Digital Hybrid Telephone System

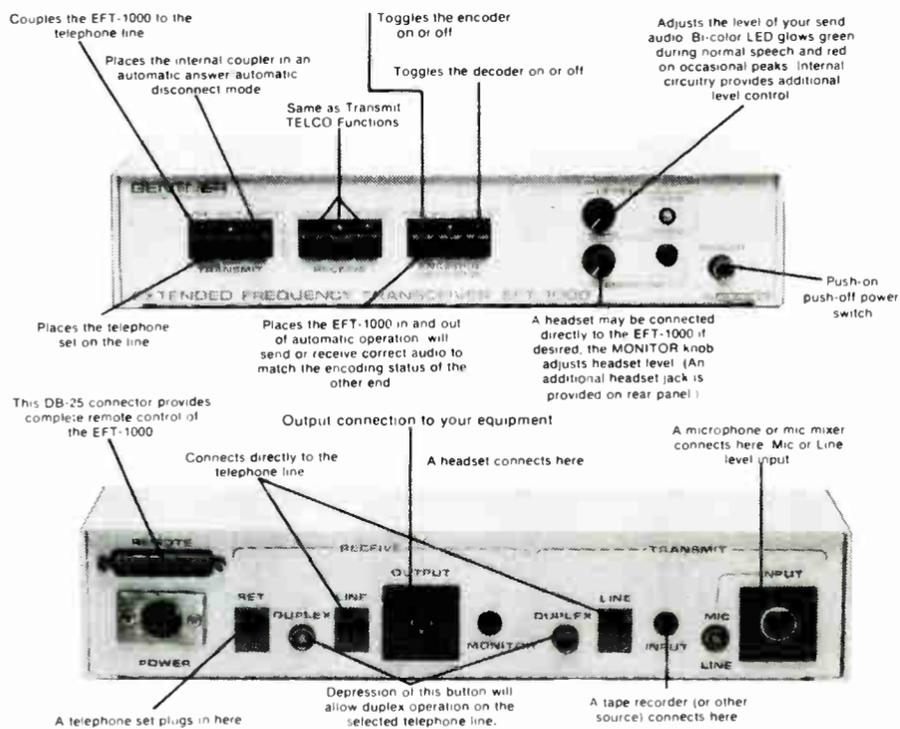


- Use for talk shows, on-air calls, IFB
- Automatically nulls to each line on connection
- Fine-tunes hybrid null whenever send audio is present
- Cleans up telephone audio with Digital Signal Processing, digital and analog filtering and audio processors
- Provides quiet connection to phone line, even when used with multi-line phones; automatically re-nulls as new lines are selected
- Auto-answer/disconnect capability



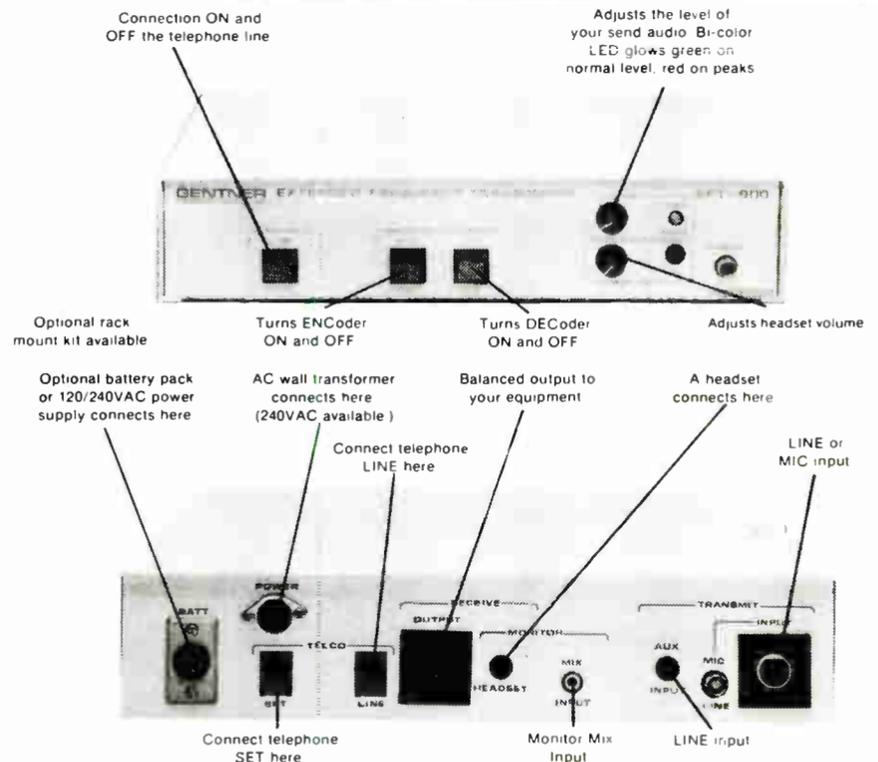
**Frequency Extension Systems - for remotes, election coverage**

**EFT-1000** Extended Frequency Transceiver



- Two internal telephone couplers allow independent send/receive paths or feeding two locations
- Two-way communication capability on either coupler
- Frequency Extension, noise reduction, sharp filtering improve telephone audio
- Auto-answer, auto-disconnect capability
- Automatic "Frequency Extension" encode/decode capability
- Inputs for mic or mic mixer with front panel level control
- Auxiliary line level input for tape or other source
- Built-in headset amplifier with front panel level control

**EFT-900** Extended Frequency Transceiver



- Built-in telephone coupler
- Two-way communication capability
- Inputs for mic or mic mixer with front panel level control
- Aux input for tape or other source to be sent down the phone line
- Monitor mix input places another source on headset output but not on phone line
- Built-in headset amplifier with front panel level control
- Frequency Extension, noise reduction, sharp filtering improve telephone audio
- Compatible with EFT-900, EFT-1000 other single line frequency extenders

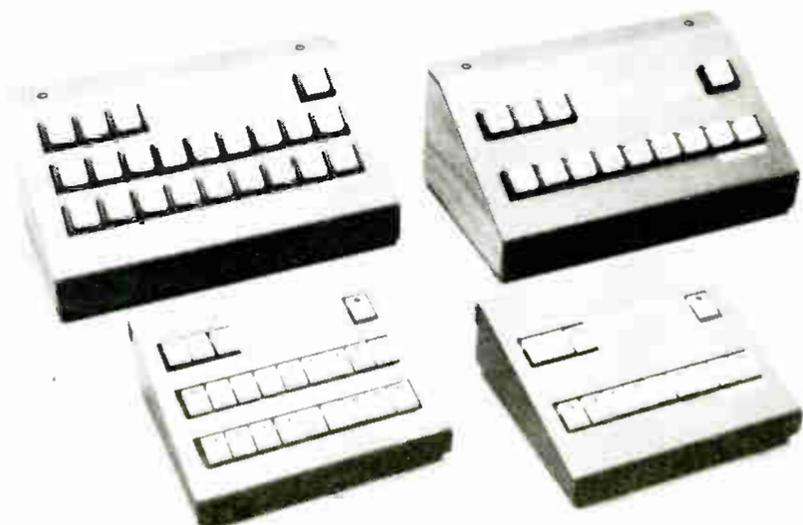
**Remote Systems**

Gentner now offers a line of pre-packaged remote systems that give you all the equipment you need for a remote in a single pre-wired case. Studio equipment is provided in each package as well. Call our Sales department at (801) 268-1117 for more information.

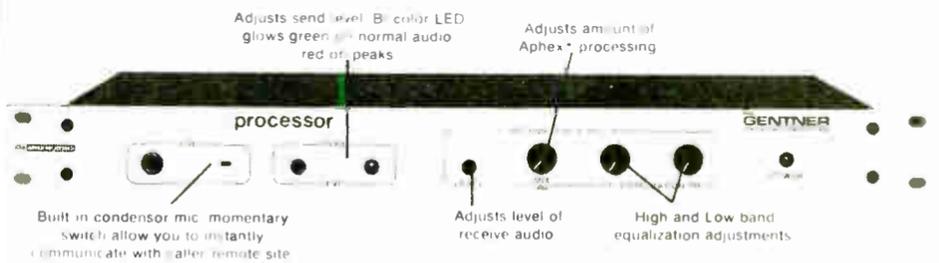
**Call Direction Systems - for on-air calls, talk shows**

**Telemix X**

Interface up to 18 telephone lines to your console with SIMPLE operation. Telemix X's modular design allows you to specify your own on-air telephone system with off-the-shelf delivery. Use for talk shows, conferencing of callers, or just talking to your listeners. Telemix X is available through Allied Broadcast Equipment, call (317) 962-8596 for more information.



**Teleprocessor** Telephone audio processor



- Use with frequency extension equipment to fine-tune the sound of remote broadcasts
- Connects between console and frequency extension equipment
- High/low band EQ, Aphex® enhancing are front-panel adjustable
- Built-in cue mic, momentary switch allow instantaneous cueing of remote site, interrupt receive audio
- Maintains consistent send/receive levels

**Microtel**

Excellent for news use, Microtel replaces the handset of a modular telephone to allow easy feeding of reports with actualities. The unit provides mic and headset amps and a variety of connections for feeding taped audio, recording from the phone line or feeding a broadcast loop. Microtel is also useful for IFB or hands-free telephone use, it runs on a 9V battery or wall transformer.



## Hybrid Installation Tips

By Keldon Paxman



A telephone hybrid converts the balanced two-wire medium into a four-wire circuit. This basic function is required in broadcast applications to separate audio being sent to the caller from audio being received from the caller.

When installing a telephone hybrid, a raw central office telephone loop (single line) typically provides the best performance and easiest set-up (you simply plug the line into the hybrid). However, since most broadcast studios use multiple line telephones, you'll probably need to access the telephone line from inside a telephone set to install the hybrid.

Analog and Digital Key Service Units (see page 7) typically route a tip/ring pair to each telephone. This pair is what you need to connect to the hybrid. Finding the tip/ring pair can be tricky at times and a little research and testing is required.

A quick "hands-on" way to find the tip/ring pair is to probe inside the telephone set with a pair of 10uF

isolated, high impedance headphones. Look for a set of RED and GREEN wires that enter the phone from the Key Service Unit; these USUALLY (not always) are tip and ring. Connect the headphones across these wires and select a line. You'll hear dial tone on each line selected if you have found the correct terminals.

**The best place to find information about locating this tip/ring pair is in your hybrid's User's manual.**

Another common problem in hybrid installation is the desire to route the output of the console to the input of the hybrid for feeding audio to the caller. Although simply sending console audio may seem like a good idea, it electronically sends the caller back to himself, thus creating a

feedback loop. Most hybrid installation instructions call for sending "mix-minus" audio down the phone line, which stated another way means "send the caller anything EXCEPT his own audio." Send audio, therefore, can be the microphone channel, a mix of other signals on the console, etc. Many consoles provide telephone interface modules that contain mix-minus outputs - contact your console's manufacturer for details.

A final note on "send" audio - keep the level as low as possible. ANY telephone hybrid will suffer from reduced performance if the send input level is too high.

If problems arise when installing a hybrid, feel free to contact Gentner Customer Service at (801) 268-1117.

## Installing Hybrids In Digital Telephone Systems

By Dave Pedersen



Broadcasters using so-called "digital" telephone systems for business calls can enjoy a great variety of features including speed dialing, call forwarding, and so on. However, these same systems that make business calls so easy tend to make the engineer's life a little more complicated when adapting them for on-air calls.

In most cases, a telephone hybrid can be installed into a digital telephone system with good results. Hybrids require a tip/ring pair, which is usually supplied to extension phones from the KSU when a line is selected. (If the telephone system digitizes the audio signal, it's virtually impossible to make a hybrid work from a KSU extension. In this case, you'll have to bring in telephone lines external to the KSU.)

The "standard" method of interfacing a hybrid is to simply connect a single telephone line to the unit. In this case, the line and attendant

telephone set both plug into the rear of the hybrid as shown in Figure 1. When the hybrid is in the "off" position, the phone line is routed through to the set, allowing normal operation such as dialing out. When the hybrid is turned "on", the phone is disabled and the line is routed to the hybrid.

Digital telephones, because they have more wires than the actual telephone line, are a bit more complicated. Digital phone systems can use as little as four or as many as eight wires. A typical four wire system is shown in Figure 2.

The tip and ring wires, usually the middle pair, carry the audio while the outer wires carry control information. A system with six or eight wires uses the additional wires for intercom or power. When interfacing a telephone hybrid to this type of system, the goal is to separate the audio pair from the rest of the lines.

Basic installation in a four-wire system is shown in Figure 3. Note that the control lines remain untouched.

This typical set-up permits the telephone to operate normally when the hybrid is off. When the hybrid is turned on, the tip and ring are routed to the hybrid but the control functions are still active at the telephone. This allows line selection commands to be sent to the KSU.

Some digital phone systems also use the tip/ring pair to provide DC power to the telephone set, or they might use a differential voltage between the audio and control lines to carry the DC power. This sort of phone system is easy to spot after you try the interface shown in figure 3. If your system has DC on the audio path, the telephone set will function normally when the hybrid is off but will go "dead" about 1-3 seconds after the hybrid is turned on. In this case, you need a DC path around the hybrid that does not allow the hybrid to load down the DC. This is accomplished with the addition of four components as shown in figure 4.

When operating your hybrid with a digital phone, bear in mind that the telephone set will have to be "off hook" to send line selection commands to the KSU. If you prefer to leave the handset on hook, you can try selecting the "hands free" mode on the telephone set (in many cases, this will route audio to the hybrid); you could optionally interface to the hook switch wiring inside the telephone.

Be sure to refer to your hybrid's User's manual for specific installation information. For further information, feel free to call Gentner Customer Service at (801) 268-1117.

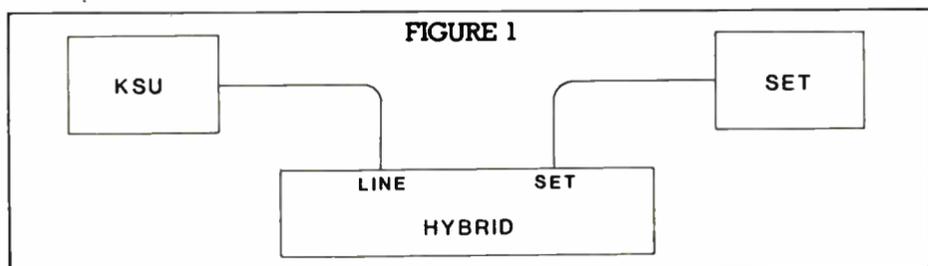


FIGURE 1

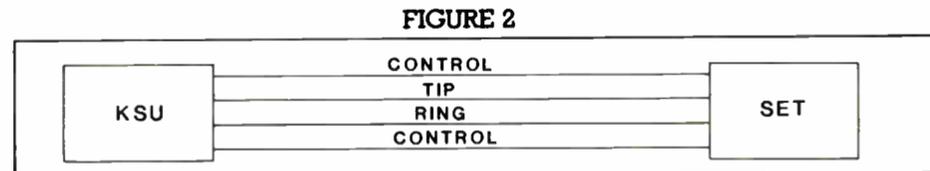


FIGURE 2

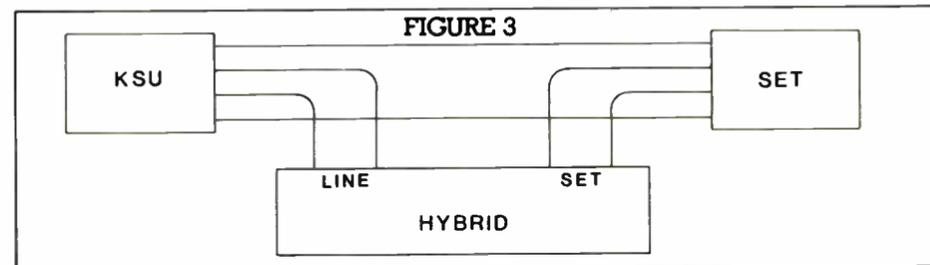


FIGURE 3

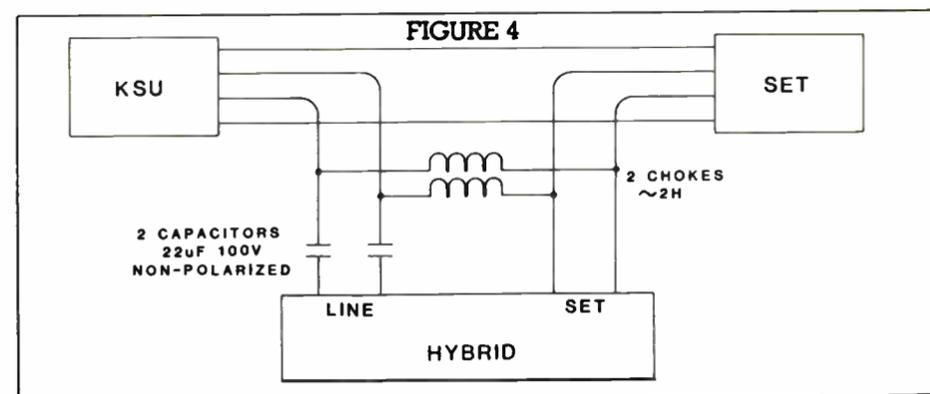


FIGURE 4



# Using Your Most Valuable Communications Tool

By Gary Crowder

## Telephone System Comparison Chart



Broadcasters worldwide are discovering a valuable communications tool in their stations...the telephone. With today's radio formats being more listener-oriented than ever, good quality telephone interfacing has become vital to daily operations.

Gentner manufactures a full line of telephone interface products that can help you create a link with your listening audience. Here are some ways to use the phone in your station:

- Call-in contests — while this is by no means unique, it's a great way to increase awareness of your station and key sponsors. Offer giveaways, etc. at specific times during the day and sell the time slot.
- Remote broadcasts — with RPU frequencies becoming overcrowded and the hassles of simply getting a signal out of a building, you'll find telephone remotes to be a great alternative. Gentner Remote Systems can give you good sounding telephone audio with fast, easy set-up. Sell a remote to an entire shopping center and spend some time at each store!
- Talk shows — many stations are finding talk shows to be an effective method of increasing listener awareness. Whether you have 24 hour news/talk or a once-a-week public affairs program, Gentner can help you put clean caller audio on the air.
- Information lines — this is a great way to get a message out to your listeners and make some money on the side. Put weather, ski reports, news headlines, sports lineups, etc. on cart and tie it to the phone line with Gentner's auto-answer TC-100 hybrid. Sell sponsorships to local merchants on a weekly or monthly basis.
- Religious programming — if your station broadcasts weekly or special religious services, Gentner equipment can help you deliver the services by telephone with improved audio quality and lower cost.
- News gathering — Gentner telephone equipment will allow your reporters to record actualities or complete interviews easily, with comparable levels between caller and talent. Feeding reports via telephone is also simple with Gentner products, whether it be across town at City Hall or a major story to the network.
- Sports — when your home team goes on the road, broadcast games

FEATURES	MICROTEL	TC-100	SPH-3A	SPH-4	DIGITAL HYBRID	EFT-900	EFT-1000
DIRECT CONNECTION TO TELEPHONE LINE	NO	YES	YES	YES	YES	YES	YES
TWO-WAY CONVERSATION CAPABILITY	YES	YES	YES	YES	YES	YES	YES
AUTO-ANSWER/AUTO-DISCONNECT	NO	YES	NO	NO	YES	NO	YES
CALLER REDUCTION	NO	NO	NO	YES	YES	NO	NO
BUILT-IN SPEAKER/HEADSET AMP	YES	NO	YES	YES	NO	YES	YES
TOUCH-TONE® DECODER	NO	OPTIONAL	NO	NO	NO	NO	NO
PORTABLE OPERATION	YES	NO	NO	NO	NO	YES	YES
INPUT CONNECTORS	XLR, MINI	BARRIER	XLR	XLR	XLR DC37P	XLR, 1/4"	XLR, 1/4"
OUTPUT CONNECTORS	MINI	BARRIER	XLR, RCA PHONO	XLR, RCA PHONO	XLR, DC37P	XLR	XLR
REMOVABLE	NO	YES	YES	YES	YES	NO	YES
RACK-MOUNT CAPABILITY	NO	OPTIONAL	YES	YES	YES	OPTIONAL	YES
EXTERNAL MONITOR INPUT	YES	NO	NO	NO	NO	YES	NO
APHEX® ENHANCING	NO	NO	NO	NO	NO	YES	YES
BI-COLOR LED INDICATORS	NO	YES	NO	NO	YES	YES	YES
A-LEAD CLOSURE	NO	YES	YES	YES	YES	YES	YES
MIC/LINE INPUT	BOTH	LINE	LINE	LINE	BOTH	BOTH	BOTH
SPEAKER DIMMING	NO	NO	NO	YES	NO	NO	NO
CALLER ALERT TONE	NO	NO	NO	YES	NO	NO	NO
TERMINATION CLICK/POP SUPPRESSION	NO	YES	NO	YES	YES	NO	NO
NOISE REDUCTION	NO	NO	NO	NO	YES	YES	YES

via telephone. Gentner Remote Systems let you do your broadcast with single, standard telephone line - and since you take ONE case to the remote site, set-up is simple.

I'd love to hear how your station is using the phone on-air, or your ideas for future programming with caller interaction. Our complete line of broadcast telephone equipment can help implement your ideas with great sounding results!

### Need More Information?

Gentner manufactures a full line of broadcast products including prewired patch panels, passive routing switchers, telephone products, remote controls and more. For free information on our product lines, clip and mail the coupon on this page.

## GENTNER

P.O. Box 27647  
Salt Lake City, Utah 84127-0647  
(801) 268-1117

Please send me more information about the following Gentner products.

- Gentner Telephone Interface Products (hybrids, talk show systems, portable interfaces, auto-answer devices)
- Gentner Remote Systems (complete system for remote broadcasts)
- Gentner RF Products (dial-up transmitter remote control)
- Gentner Audio Products (distribution amplifier, turntable preamp, routing switchers, intercom system, silence sensor)
- Gentner Pre-wired Patch Panels & Terminations (custom-wired wired audio patch panels, chassis-enclosed patch panels, terminations and accessories)
- Telephone Technology and The Broadcast Industry (by Bill Gillman)

PLEASE CALL ME at ( ) \_\_\_\_\_

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Telephone Number \_\_\_\_\_

Type of business

- AM     FM     TV     Cable
- Satellite/SNG     Pro Sound/Recording
- Production/Post Production     Teleconferencing
- Sound Contractor     Consultant
- Other \_\_\_\_\_

## Telephone Technology And The Broadcast Industry

By Bill Gillman

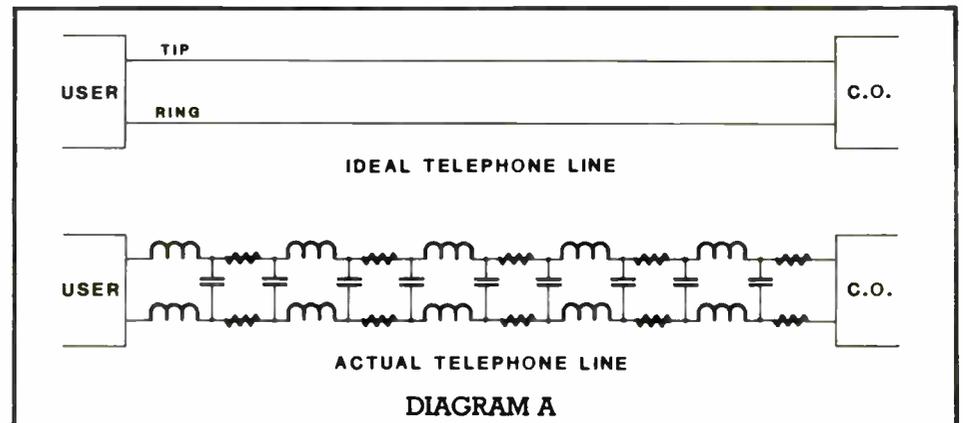


Gentner's Customer Service department receives daily calls asking questions not only on the installation of telephone hybrids, but on telephone theory in general. Here are some of the most-asked questions:

**Q. Why does the telephone line have a limited bandwidth?**

The direct dial telephone network is bandwidth limited because of two deficiencies in the system. One deficiency is found in the Central Office (C.O.) subscriber interface. Every telephone user is connected through a transformer. The transformers must therefore be very small to accommodate several thousand of them in a limited space. This

small design causes the transformer to perform poorly at frequencies below 300 Hz. Another deficiency is in the twisted wire pair that connects the subscriber to the C.O. Diagram A shows what the 'ideal' telephone line looks like (simply two conductors between the user and the C.O.) compared to the actual telephone line. Any wire conductor has a small amount of resistance and inductive reactance. As we increase the length of this conductor beyond 100 feet these two components begin to have significant effects at audio frequencies. In addition, two of these conductors are twisted together, creating a significant amount of shunt capacitance between the two wires. This distributed inductance, resistance and capacitance will cause a loss at the higher audio frequencies. These two deficiencies in tandem limit the frequency response of the telephone line to a band that extends from 300 to 3300 Hz. Since capacitive and inductive reactance both change with frequency, the complex impedance of the telephone line will be different at every frequency in the voice band.



**Q. What is a broadcast telephone hybrid?**

A telephone hybrid separates the full duplex (simultaneous send/receive) audio on the telephone line into separate ports for send and receive. Diagram B shows a simplified telephone hybrid. Audio from the microphone chain or mix-minus bus of the console is connected to the send audio input, allowing the caller to hear the announcer. The caller audio output of the hybrid is connected to an input channel of the console, allowing the caller's audio to

be mixed with other studio inputs and transmitted to the audience.

This separation of send and receive audio is very important to preserve the acoustic quality of the announcer's voice. When the announcer talks to a caller, his voice is transmitted on the telephone line. The acoustics of the announcer's voice become altered by the frequency response of the telephone line. If some of this altered announcer audio gets mixed in with the caller audio, the announcer's voice will have a 'hollow' sound.

# Aural hygiene for your phones.

**Digital Hybrid**

Now your telephone audio can have the consistent quality you demand for on-air use, interviews and IFB.

Gentner's new Digital Hybrid cleans up telephone audio with automatic nulling, digital signal processing and advanced digital filters. Call after call, your audio stays clean and clear – levels remain comparable.

Digital signal processing ensures maximum return loss possible in a telephone hybrid. That means talent sounds crisp and clear, not "hollow" when

talking on the phone.

And, like all Gentner telephone products, the Digital Hybrid is easy to install and use and is backed by our proven customer support.

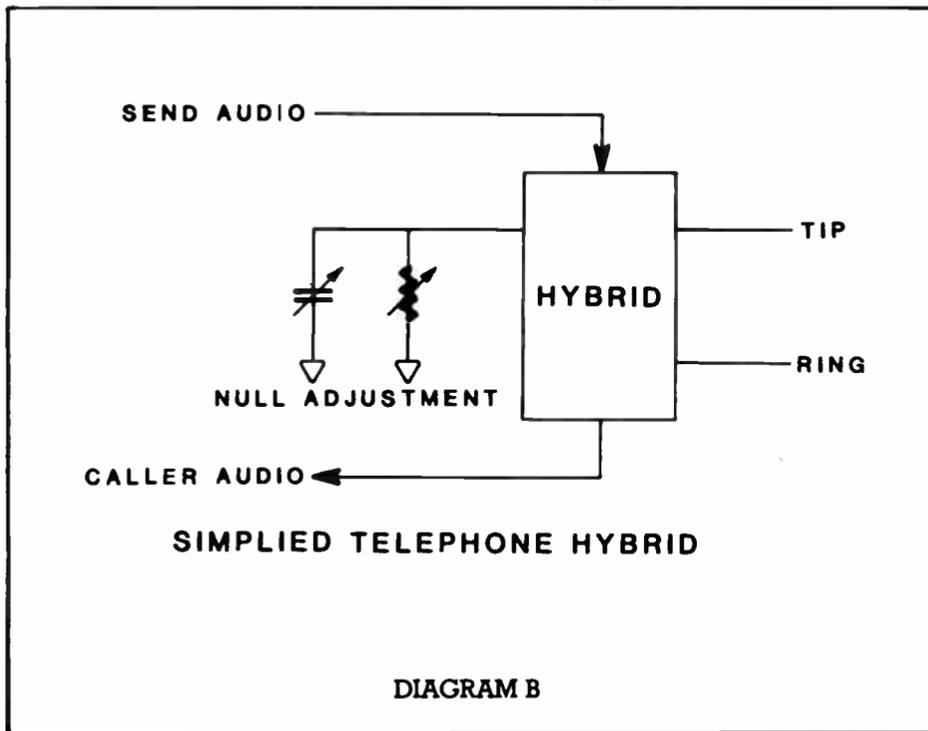
Call your distributor or Gentner today to improve your phones' aural hygiene with the Digital Hybrid.

- Automatic nulling
- Consistent caller audio levels
- Send level is consistent to callers
- Works with 1A2 and most digital phones



**GENTNER** © Gentner 1987  
SOUND THINKING

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



**Q. What is "hybrid null?"**

The measurement of performance of a telephone hybrid is how well it isolates, or attenuates, the send audio input port from the caller audio output port. A telephone hybrid provides 'null' controls which allow the user to optimize this attenuation. When the resistive/capacitive impedance of the null circuit matches the impedance of the telephone line connected to the hybrid, a perfect null or attenuation of the send audio will result. However, the impedance of the telephone line is different for every frequency in the voice band, thus making the perfect null impossible. However, satisfactory results can be obtained using this method for most broadcast applications.

Some telephone hybrids feature 'automatic nulling,' which means the hybrid will automatically adapt itself to the telephone line on connection. This feature is very useful due to the impedance changes from line to line.

Most broadcast hybrids contain audio filtering circuitry that eliminates the low frequency hum induced into telephone lines from adjacent power lines. In addition, these filters eliminate high frequency noise above the voice band that is often caused by telephone company multiplexing equipment. Gentner hybrids also provide all of the circuitry necessary for direct connection to the telephone line.

**Q. How does DSP (Digital Signal Processing) help a telephone hybrid's performance?**

The new technology of Digital Signal Processing has provided a new generation of hybrids that offer the best possible performance for the most demanding broadcast hybrid applications. Gentner's Digital Hybrid digitizes both the send and the caller audio and then, using an elaborate processing algorithm, care-

fully subtracts the send audio from the caller's audio. A distinct advantage of the Digital Hybrid is that its null is relatively uniform across the entire voice band.

**Q. What is frequency extension?**

Broadcasters who desire to do remotes, either within their telephone service area or from distant locations, may find the telephone network an attractive tool. In most cases, a standard telephone line is available from the remote broadcast location or can be installed quickly. However, the problem with direct dial lines is their frequency response of 300 to 3300 Hz. Almost all male broadcast announcers have significant vocal energy below 300 Hz, which is lost on the phone line.

A frequency extender takes the remote audio and shifts all frequencies up 250 Hz. Thus, 50 Hz becomes 300 Hz and 3000 Hz becomes 3250 Hz, placing the low frequencies within the bandwidth of the telephone line. At the studio, another piece of frequency extension equipment downshifts the audio, returning the 300 Hz to its original 50 Hz. This process preserves 2-1/2 octaves of critical low frequencies while sacrificing only 1/7th of an octave at the high end. Gentner's frequency extension systems employ patented circuitry for generating additional new high frequency components from the remote audio, thus giving the line an apparent increase in high frequency response. This yields a more natural sound from the telephone-transmitted audio.

Further information on the telephone system and the installation of telephone equipment in broadcast facilities may be found in Gentner User's manuals. Additional assistance may be obtained by calling Gentner Customer Service at (801) 268-1117.

(Bill Gillman is VP/Engineering at Gentner Electronics Corporation.)

**Glossary Of Broadcast Telephone Terms**

**"Broadcast Loop":** Refers to a special line set up by the phone company that has a higher bandwidth than a normal telephone circuit (usually 5kHz to 8kHz).

**Central Office (C.O.):** The local site used by the telephone company to bring in telephone trunks and distribute lines to business and residential customers.

**"Direct Dial Network":** Refers to the standard (3.3kHz bandwidth) telephone system.

**Frequency Extension:** The process of shifting audio to be broadcast up 250 Hz in frequency for application to a standard dial telephone line. At the receive end, the audio is shifted down 250 Hz to restore the audio to its original state, with 2-1/2 octaves of additional low end frequencies preserved.

**Frequency Multiplexing:** A process by which the phone company puts more than one audio signal on a single pair of wires or microwave radio channel.

**Hybrid:** A device that separates a balanced two-wire telephone line into individual ports for send and receive audio.

**Key Service Unit (KSU):** A device which brings multiple outside telephone lines into a business facility and distributes a combination of those lines to extension telephones. All functions required for proper operation of the telephones (hold, busy, lamp operation, etc.) are controlled by the KSU.

**Mix-Minus:** A combination of console outputs MINUS a specific output. Used for feeding console audio to a caller without sending any caller audio back down the phone line, thus preventing feedback loops.

**Null:** (Hybrid null, sidetone rejection): Measurement, in decibels, of a telephone hybrid's rejection of "send" audio from its "caller" output.

**Tip/Ring:** The pair of wires which carries the analog telephone signal.

**Quality — My Personal Obsession**

By Russell Gentner



At Gentner, we have one goal: To provide you with quality products at a reasonable price that cost effectively solve your problems. To accomplish this objective, our company has been built on a foundation of commitment to quality.

Our independent quality assurance department reports directly to me, the President of our company. This ensures complete quality "in-

dependence". All raw materials are carefully inspected **before** they become part of a subassembly. Each sub-assembly and final assemblies are burned-in, tested, and inspected to ensure they meet our stringent standards. These procedures have resulted in a positive service record that frankly even surprises me.

However, should you have a problem or question, we have a well staffed customer service department standing by to answer your questions, aid in your installation, or make fast repairs (our average turn around is less than 3 days). Of course the buck stops at my desk. If you have any problems that my able staff cannot solve, call me directly at (801) 268-1117. (Russell Gentner is President and CEO of Gentner Electronics Corporation.)

**Call  
Gary or Dave  
today...  
(801) 268-1117**

Note: the above material is adapted from a recent article on telephone theory written by Mr. Gillman. For a free copy of this article, call 268-1117 or send in the coupon on page 5 of this Guide.

## VRC-1000 - Remote Control by Telephone

By John E. Leonard, Jr.

The adoption of recent FCC policies has given broadcasters new freedom in remote control of transmitters. It is now technically possible, and totally legal, to remotely control your transmitter via a standard dial-up telephone line.

Many companies offer dial-up capability with their conventional remote control units...but unlike the other systems that have added dial access as an afterthought, Gentner RF Products' VRC-1000 was DESIGNED to operate via the telephone network. The VRC-1000, therefore, offers maximum flexibility in setup and operation.

The VRC-1000 Remote Control Unit may be accessed by the standard dial network, two-way radio equipment, STL/TSL, cellular phones, etc. Complete remote control is possible by either Touch-Tone® or modem operation. When Touch-Tone® operation is utilized, commands are sent to the unit by pressing the buttons on your telephone. The VRC-1000 responds in synthesized voice, giving you concise information on metering, status or command channels. With almost 800 "words" in its memory, the Unit can be programmed to say whatever you need it to say in reporting conditions at your transmitter.

The VRC-1000's Internal Modem Option allows remote control via a video display terminal or PC. In this mode of operation, all pertinent information is shown in full-page displays and commands are issued from the terminal keyboard. Automatic logging, either real-time or alarm based, is also possible.

### Input, Output capabilities

The VRC-1000 Remote Control Unit has 32 input channels, divided into Metering and Status channels. The 16 Metering inputs are used to measure analog signals such as voltage, current, room temperature, generator fuel level, etc. Each Metering channel has 4-digit presentation with four user-defined tolerance limits. The 16 Status channels are used for inputs with two states (on or off), such as tower lights.

Thirty-two Command outputs are available, configured as 16 channels of on/off, raise/lower, etc. Each Command channel can be setup for momentary or latching operation. If configured for momentary operation, a time frame of 1/15th second to 16 seconds per command can be programmed. This allows the unit to control older transmitters that require the engaging of motors, etc. to effect changes.

### Alarm Reporting and Correction, ATS

The VRC-1000 has the capability of reporting alarm conditions as well as issuing automatic commands. When setting up the unit, you determine what constitutes an "alarm" and whether the VRC should note the alarm, make corrections and/or call you. Up to five telephone numbers



can be programmed into the unit for alarm reporting; when an alarm call is initiated the unit will cycle through the numbers until it gets a response from an authorized human.

ATS/automatic commands are also possible with the VRC-1000. All

32 Command outputs can be activated from a) the tolerance limits on each Metering channel; b) changes in Status channels; c) time-of-day commands you have programmed into the system (20 possible). In all, there are 116 automatic Command possibilities!

The VRC-1000 can be used for primary remote control, backup to other systems, or as a diagnostic tool. With its comprehensive reporting and control capabilities, the VRC can help you trouble-shoot problems quickly and reduce down time to a minimum.

For more information on the VRC-1000 and its accessories, call John Leonard at Gentner RF Products Division, (408) 926-3400.

### VRC-1000 Options & Accessories

**Internal Modem Option:** Permits the use of the VRC-1000 with a video display terminal or personal computer. This option provides full page presentation of all metering, status and command channels; complete reporting of alarms is also available. Manually initiated commands are generated from the keyboard. This

option is also used when logging is desired. A video display terminal and printer may be purchased from Gentner RF Products Division; call for details.

**TERM Software Option:** With this software, virtually any MS/DOS personal computer will communicate with a VRC-1000 Internal Modem Option. Built-in script files allow the creation of many automatic functions and tasks, including automatic dialing and connection to the VRC-1000. Call for a list of compatible personal computers.

**Subcarrier/Radio Operation:** Firmware version 2.2R (or 2.2RM for units with Internal Modem Option) provides subcarrier, 2-way, microwave or other radio interconnections in addition to telephone use of the VRC-1000. Users access the unit with a 16-key Touch-Tone® pad; operation is similar to other firmware versions. When the unit is accessed by radio, the telephone line will be ignored until the "call" has been completed.

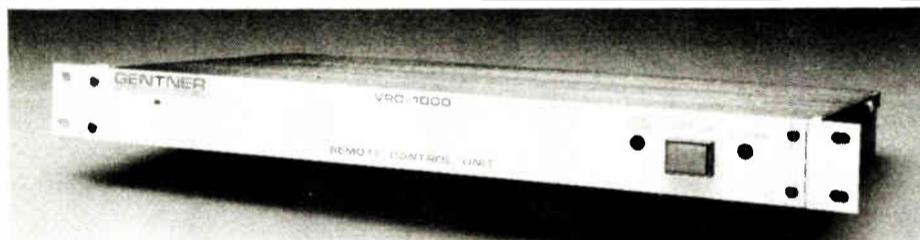
**Fail-Safe Unit:** Provides absolute carrier control of a transmitter by sensing the presence or lack of program audio. Activation times are selectable for up to 99 seconds or 99 minutes; audio inputs are left/right or mono (bridging). The Fail-Safe Unit provides a relay output to equipment.

**Battery Backup Unit:** Permits full operation of the VRC-1000 for more than 8 hours following the loss of AC power. Batteries are maintenance-free; internal battery charger provides both rapid and trickle charging.

**Command Relay Unit:** Provides sixteen relay outputs for the VRC-1000, interfaces to eight command channels (one D connector). Each output is rated to switch up to 5A at up to 240VAC (non-inductive) or 100VA.

**Interconnection panels:** Rack-mount interface panels provide easy interconnection to user equipment. Gentner Flexiblock, punch block and screw barrier strip panels are available.

For complete details or VRC-1000 options and accessories, call Gentner RF Products Division at (408) 926-3400.



## It's 3:55 a.m. Do you know what your transmitter is doing?

Now your transmitter can alert you to problems by phone—anywhere, anytime with the VRC-1000 Remote Control. A preprogrammed, synthesized voice quotes parameters, you make adjustments right on your Touch-Tone® phone. Or, you can dial from any-

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# In-House Monitoring Systems

(continued from page 12)  
equivalent circuit.

Referring back to Table 1, 5 W corresponds to 1000 ohms. Four paralleled 1000 ohm transformers present a load of 250 ohms to the amplifier.

Often it's desirable to have speakers with different power levels in different rooms, depending on room size, ambient noise and so on. In this case, transformers are selected with varying power levels.

### Separate volume control

To summarize, each speaker must have its own line-matching transformer, and all transformers are connected in

parallel to the amplifier. The sum of the transformer primary power ratings must equal the output power of the amplifier—no more, no less.

It's often necessary to have individual volume controls for each speaker location. There are two ways to do this, with a 10 ohm pot connected as a voltage divider between transformer secondary and speaker, and with an 8 ohm T- or L-pad.

The voltage divider scheme mismatches the transformer somewhat at its extremes of rotation. T- or L-pads soon become scratchy and intermit-

tent, and end up being a maintenance chore.

House monitor systems are often neglected in favor of higher priority projects.

With care in planning and installation however, the house monitor can reliably deliver your off-air signal throughout the station, and need not be a source of constant aggravation.

Tom Vernon, a regular RW columnist, divides his time among broadcast consulting, computers and instructional technology. He can be reached at 717-249-1230.

Table 1.

A listing of output powers and their corresponding impedance taps for 70.7 V. All figures are derived from the formula  $Z = 5000/W$ .

WATTS POWER OUTPUT	IMPEDANCE TAP FOR 70.7 VOLT LINE
5	1000
10	500
15	333
20	250
25	200
30	166
40	125
50	100
60	83
80	62.5
100	50

## No Decision On Class A's

(continued from page 1)  
quarters in Washington.

"We are trying to find ways to accommodate (the Class A) stations," Rau said.

Subcommittee member and Clear Channel Communications CE John Furr, who did much of the engineering work for the New Jersey group's petition, said he was optimistic that the subcommittee would accept the Class A hike.

"We are really hammering," he said. "We haven't come to a full consensus, and have to make some minor changes, but it is looking favorable."

The changes, which involve spacing issues, are relatively minor, Furr maintained. Before the October meeting takes place, "everyone will sit down with their calculators and charts and mull (the proposal and the changes) over," he added.

Subcommittee Chairman John Marino, of NewCity Communications, who could not be reached following the September meeting, had indicated that if the Class A hike could be performed without interference to Class B's and C's "then it would be a good thing."

### Other issues

While the Class A plan dominated the subcommittee's September meeting, other issues were discussed, Rau indicated.

The subcommittee gave its approval to a plan for a new Class C power category. The new Class C3 level, with the equivalent maximum power of 25 kW at 328', would be used mainly west of the Mississippi River.

One change in the plan was accepted, Rau explained. A protective contour of 60 dBu was adopted instead of 57 dBu.

At press time, Rau cautioned that the subcommittee's approval of the plan had not yet been formally sanctioned by the NAB hierarchy.

The subcommittee also continued its work on the development of an FM terrain algorithm. The work should produce a document by the end of the year. It will include a computer program, and be called "Site Evaluation Tool for FM Stations."

The group deferred discussion on using FM directional antennas for short spaced stations, a topic currently being examined by the FCC.

For more information on the FM Transmission Subcommittee contact John Marino at 203-333-4800, or Mike Rau at 202-429-5346.

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# Cases of Array Pattern Moding

by Tom Osenkowsky

Brookfield CT ... In many instances an array pattern will prove well on paper but be a nightmare in the field.

Two factors can come into play even if an array is designed to conform to FCC required protection criteria.

First, consider the pattern stability. How critical are parameter changes related to field intensity changes?

Second, what do the drive point impedances look like?

Very low resistances and/or near parasitic elements can make tune-up, long term stability and achievement of mini-

mum RMS impossible.

Almost every array has at least one additional mode. That is, another set of parameters which will produce identical radiation patterns but differing drive point impedances.

With different impedances, different power distributions can be obtained. The exception to the rule would be the array or pattern pairs with 1:1 field ratios.

Asymmetrical arrays, those with towers not equally in line or equally parallelogram, are moded by moving the position of the offset tower.

Symmetrical (multiplied pair) arrays with equal spacing are moded by first

determining the original pairs used to construct the pattern.

Each pair, one at a time, is inverted and the pairs remultiplied and the drive points recalculated.

For these arrays, there exists  $2^{n-1}$  possibilities of mode.

While it is possible to mode unequal height towers of symmetrical arrays, the practice is not legal. Let me explain.

When you apply for a CP the horizontal and vertical fields are specified in terms of standard pattern to the FCC.

The actual parameters on the antenna monitor should be representative of the parameters you told the FCC that you in-

Figure 1.

TOWER	RATIO	PHASE	SPACING	HEIGHT
1	1.3000	88.00	210.00	102.00
2	3.0000	66.00	140.00	138.30
3	3.0000	-148.00	70.00	102.00
4	1.0000	0.00	0.00	102.00

MUTUAL IMPEDANCE MATRIX					
Towers	Loop	Resistance	Reactance	Magitude	Phase
1	1	51.85	81.31	96.44	57.48
1	2	37.10	-11.15	38.74	-16.72
1	3	7.04	-34.83	35.54	-78.50
1	4	15.98	-12.81	20.48	-34.27
2	1	51.85	81.31	96.44	57.48
2	2	49.10	-12.37	50.63	-14.14
2	3	5.84	-26.47	27.11	-77.52
2	4	32.22	187.55	189.00	63.82
3	1	49.10	-12.37	50.63	-14.14
3	2	51.85	81.31	96.44	57.48
3	3	46.6209	4.1497	-800.86	-88.00
3	4	4.3172	3.1880	43.88	0.00
4	1	20.2310	9.5742	102.30	148.00
4	2	-24.92	6.8091	-11.26	64.00
4	3	46.6209	4.1497	-800.86	-88.00
4	4	0.9483	phase	-130.2773	
			phase	-169.8028	2.4861
			phase	-107.5254	1.7681
					1.0746

TOWER	LOOP	R	LOOP	PHASE	PHASE	LOOP	RATIO
1	1	4.3172	3.1880	43.88	0.00	0.6279	
1	2	20.2310	9.5742	102.30	148.00	2.4861	
1	3	-24.92	6.8091	-11.26	64.00	1.7681	
1	4	46.6209	4.1497	-800.86	-88.00	1.0746	



tended to construct (i.e. produce the same H & V patterns).

By swapping the field ratios in this case, the conical patterns will differ even though the horizontal pattern will be the same.

This could cause interference to co- and adjacent channel stations. This practice would be acceptable for day arrays, however.

By using the MODING computer program, I will present two actual cases where moding can be beneficial to the broadcaster.

Case A in Table 1 should be studied carefully in terms of conical fields, since we are dealing with a tall element.

Notice the variations in power distribution and drive point impedance.

In some cases low resistances are unavoidable.

You should note that in addition to the values shown in Table 1, there are seven other combinations in Case A.

Unfortunately, lack of space prevents us from examining them until next time.

While some might say having all your eggs in one basket might be beneficial in terms of bandwidth (i.e. having to broadband only one tower) the stability of this practice may be questionable.

We will examine this in terms of vector analysis next time.

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.

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Simplex (phantom) power and a peak LED are standard, too.

The M267 oscillator provides a clean 1 kHz tone, and is located on the front of the unit for simple access. The headphone output is also on the front and includes a level control. IC design, along with active gain controls, provides greater headroom and quieter operation.

For location work or even studio post-production, the M267 carries on Shure's reputation for reliability and ruggedness.

For more information on Shure's complete line of mixers, call or write Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, IL 60202, (312) 866-2553.

**SHURE**

BREAKING SOUND BARRIERS

DIGITAL DOMAIN

# The Pros and Cons of Digital

by Skip Pizzi

Washington DC . . . Let's start to look at some of the real advantages of digital audio over analog technology, and note the disadvantages, too.

Audio exists in three "dimensions" or "domains:" frequency, amplitude and time. We can examine digital versus analog in each.

In the frequency domain digital's advantages are a very predictable bandwidth, and ruler-flat response.

Moreover, these functions are consistent between different pieces of digital hardware at least insofar as the digital circuits go.

Any frequency anomaly between CD players playing back a test CD, for example, is a function of their analog sections or their interfaces to the rest of the analog system.

Think of the time and cost savings in recorder alignments in a digital world.

This is not to say that digital recorders don't require any routine maintenance, but all that tweaking to minimize distortion and flatten response will be a thing of the past.

The amplitude domain is where we've heard the most hype about digital so far, and probably rightly so.

This is where digital exhibits the most dramatically audible advantages over analog—at least on first hearing.

The most common form of digital audio processing so far, 16-bit Pulse Code Modulation (PCM), has a usable dynamic range of something around 92 dB, minimum.

Giving yourself a comfortable headroom allowance of 15 or 20 dB, this presents a 72 to 77 dB SNR (measured in the traditional sense); some systems even nudge SNR over 80 dB.

This compares quite favorably with the best noise-reduced analog recording systems, and certainly exceeds any standard analog system, being both quieter and freer from distortion. Both ends of the dynamic spectrum are extended.

Unlike analog recording, PCM systems have a higher distortion figure at lower levels than they do at higher levels; but in practically all cases it is below 0.1%, until overload is reached, at which point things can get ugly fast.

That overload function is also unlike analog recording, where saturation produces a more gradual and less ob-

noxious result.

So although digital extends the dynamic playing field, its boundaries are more tightly drawn.

This argues for greater operator vigilance, and high-resolution level metering.

It may finally mean the end for the venerable VU, whose welcome has long since been worn out anyway. (Just ask most non-US broadcasters what their standard level meter is. You won't find

“ Think of the . . . savings in recorder alignments in a digital world. ”

many responding "VU.")

In the time domain we have perhaps digital's greatest unsung strength, and its most ballyhoed alleged weakness.

The speed accuracy of digital recording systems is essentially crystal-locked, and therefore rock steady.

This means that wow and flutter are reduced to negligible amounts, and that playback time is quite accurate and consistent (in most cases—we'll discuss the exceptions next time).

The lack of wow and flutter is one of the most subconsciously pleasing aspects of listening to digitally recorded music.

Especially on instruments such as piano that have no natural vibrato, this time stability adds a level of realism to recordings that spoils the listener.

It's something you notice more by its absence than its presence—and then, you're ruined. Going back to what you once thought was an adequate analog wow and flutter spec is now no longer tolerable.

Moreover, the lack of phase jitter so common to analog recordings adds another level of realism to the stereo image and its stability that, while not overtly noticeable, quickly becomes hard to do without.

The playback time accuracy and consistency is a real plus for us broadcasters.

Can you picture a standard analog au-

dio program that's supposed to run 1:58:29 actually coming out right on the dot? Standard procedure for digital.

The big digital bugaboo that you've probably heard about regards its phase response.

The steep "anti-aliasing" filters that analog-to-digital converters require are the source of this problem, in which phase shifts of several hundred degrees at the high end are not uncommon.

Some listeners have blamed this phenomenon for the so-called "harshness" they hear on the high end of some digital recordings.

Others have made more exotic claims that this audio no-no is responsible for listener "stress," headaches and other mysterious ailments.

Let me point out a few things here.

First, the steep filters required in these devices were something that not many folks had had much experience making in the past, since there wasn't much call for them, and certainly not on a high-volume basis.

A few manufacturers actually admitted to this fact (after they had released improved second generation filters), and although some diehard analog Luddites are still out there, the problem has es-

entially been resolved.

In fact, some of the problems that a lot of folks blamed on this may not have been justified anyway.

Contrary to popular audiophile opinion, we really can't hear phase shifts above about 1 kHz.

Besides, the digital remastering of old analog recordings may simply have revealed problems with the original that were formerly masked (either by the software manufacturing process or the listener's playback hardware).

Or, in some cases, sweetening that had been added during the original release's lacquer disc-mastering process was not duplicated when a CD master was made from the same original master tapes.

When listeners compared the new to the old, and the old sounded "better," the digital technology was the instant culprit in their minds. Ah, but such is the stuff audio myths are made of . . .

Anyway, I can recount more than a few industrial strength "headaches" caused by analog recording's shortcomings.

Some digital critics act as if analog has no flaws of its own, or that no system is acceptable if it's not perfect, which is theoretically (not to mention economically)

(continued on page 21)

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Circle Reader Service 45 on Page 22

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Circle Reader Service 17 on Page 22

# Radio's New Secret Weapon

# StereoMaxx

**StereoMaxx™** is a hit with scores of Chief Engineers and Program Directors from coast to coast. Our spatial image enlarger is their new "SECRET WEAPON". And it's a secret they'd prefer to keep to themselves as long as possible.

A Southwest top 10 market CE explained to us:

**"After you asked me for a quote about StereoMaxx, I talked it over with management. We agreed on two things: First, StereoMaxx is making a difference at our station. It gives our sound a fullness and richness we didn't have before, and nobody else has now. And second, we don't want our competition to know what we're doing. So no names, OK?"**

We understand. StereoMaxx users love the box, but most don't want publicity. After all, it's no secret that audio processing can be a potent weapon in the "ratings wars." A West Coast Chief Engineer tells us how StereoMaxx is working out at his station:

**"It's terrific. The extra separation and depth we get from StereoMaxx makes us not only sound bigger, but better. It's amazing... The PD has been bugging me for months to give our station a sound that stands out from the other CHR's. With StereoMaxx, we're finally able to do it. I followed your instructions for connecting StereoMaxx with our Texar Audio Prisms. There were no problems putting StereoMaxx in, and it gives us no problems on the air."**

We're glad he said that. Enlarging the stereo image is one thing, but doing it without creating big hassles is quite another. A top 5 market CE put it this way:

**"I was a little skeptical because I'd played with several ambience gadgets in the past. But they were more trouble than they were worth. StereoMaxx is different. It really does make us 'more stereo'. And it really doesn't cause us any undue multipath hassles. Also, I don't like unknown 'black boxes', so I was impressed that you sent me complete specs, and a block diagram. The unit comes with full schematics... no mystery modules! Eric Small, you've done it again."**

To sum up, we like these comments from a West Coast Program Director:

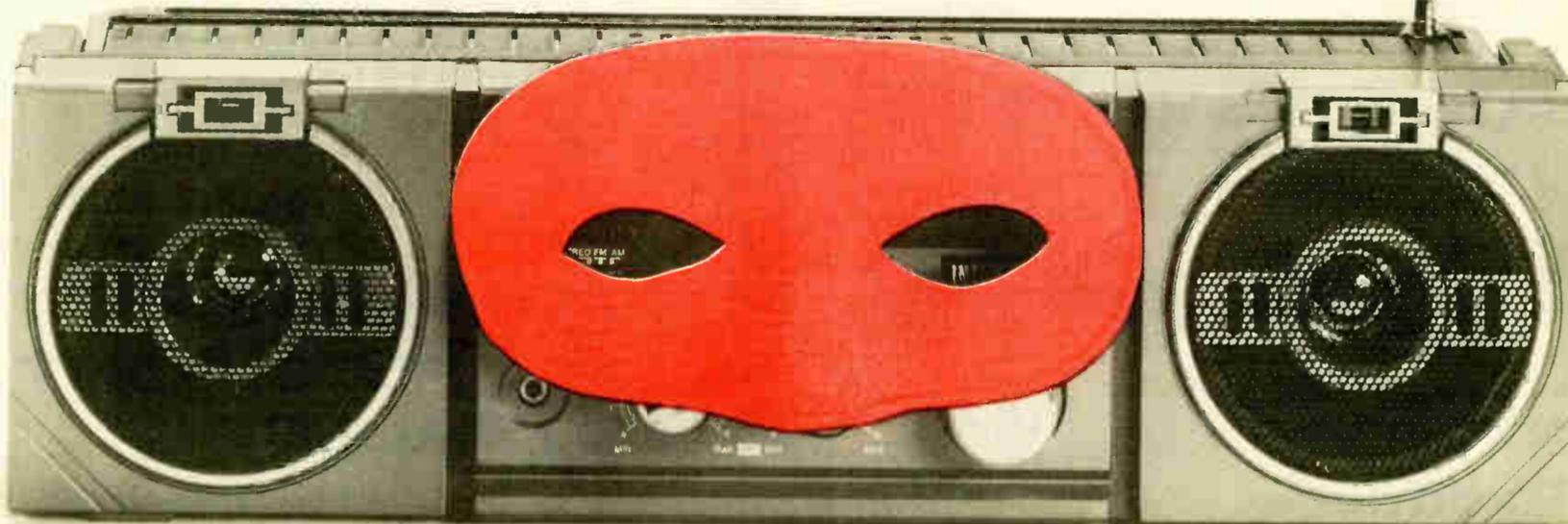
**"When I first heard about StereoMaxx, I thought it was a little expensive. But now you couldn't buy it back from us. Every song we play now has as much separation as the best produced stereo record or CD. Turning off StereoMaxx is like going back to mono."**

StereoMaxx sounds intriguing, right? Our FREE DEMO CASSETTE is an ear-opener. To get yours *pronto*, just call the StereoMaxx hotline at (800) 826-2603 toll-free. Our first production run sold out in weeks. So act fast, and there's a good chance you can beat the other guys to "radio's new secret weapon".



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# Creating a Little Station Magic

(continued from page 15)

put at least as much attention and effort into how you relate to others as you do into your systems.

Systems and computers, and all of the technical gear we use have led some of us away from being in touch with ourselves, our co-workers and our audience.

In some cases the systems we create end up controlling us. Other problems occur when we spend needless hours fine-tuning a system when the problem lies elsewhere.

The real danger of system use is our becoming too dependent on it. When this happens, we become less intuitive, less feeling and less human.

The bottom line is audiences don't listen to systems, they listen to the radio. They listen for entertainment, companionship and information.

If in the production of a radio station these elements of audience interest are lost, so is the audience.

Because we have accepted that perception is reality, we have concentrated on image projection-Calculus applied to promotion.

Problems start to occur when the substance does not live up to the audiences' expectations, based on their perception of the station's projected image.

When this happens, it's like the scene in the *Wizard of Oz* where Toto pulls back the curtain and exposes the wizard.

The Magic is revealed. The wizard loses his most prized possession ... power—based on credibility.

The same thing happens to the radio station which concentrates too much on image architecture and not enough on foundation.

The mortar which holds the foundation together is only as strong as the relationships among the people at the station. Pick any station that is doing unusually well and you will find this synergy at work.

Getting your station to that point may not be easy. Some stations will never be able to tap into this power.

There are a couple of these stations in every major market. Due to the inability of key people to get beyond their own limitations, the entire station will be limited.

If you want to take a shot at it, pick up a copy of Dale Carnegie's "How To Win Friends And Influence People." Get a couple of copies and make them available.

“  
Audiences don't listen to systems, they listen to the radio.”

If nothing else, you'll get a better understanding of why people are the way they are, which in itself can lead to Magic.

Apply Magic to the flow and content of any radio station and it will be successful. (For the sake of any disbelieving engineers who are reading this column, the formula for Magic is  $P/IE = \text{Cosine of}$

Theta, where  $\text{Magic} = \text{Cosine of Theta}$ .)

Incidentally, engineers get a lot of undue flack from other people at stations who try to pigeon-hole them as people who can relate to equipment but not people.

For some this may be true, but there are just as many PDs who hide behind their software these days.

The clear message to these people is, if you want to make Magic, get out from behind the computer (or spectrum analyzer, or whatever) and get in tune with your people.

Appreciate the opportunity you have been given to make Magic, and always ask the question, "How can I make this better?"

As you produce your radio station, try the impossible. Imagine you're a listener. Listen to the other stations in your market. Go to other markets and listen to the top stations, even if they're a different format.

Mistakes are often more obvious than good moves. I recently heard a station come out of a record, into a liner, into a recorded promo for an upcoming music sweep and into three minutes of spots.

When I talked to the PD about what I had heard I was told it was a mistake. The next day I heard the same "mistake" twice within three hours.

## Dimensions Of Digital Audio Sound

(continued from page 19)

impossible.

Meanwhile, back in professional broadcast reality, notice that we haven't seen too many real disadvantages as yet for digital audio.

In fact, with the exception of the dreaded dropout (which "error correction" and "error concealment" systems should take care of), there really aren't many theoretical difficulties.

The problems only crop up when we start to look at the practical side. Digital audio's major drawbacks at the mo-

ment are:

- Its complexity; it's cumbersome, and not as flexible or versatile as analog in terms of production, and it's new.
- Its incompatibility, both with the analog system, and among the various digital systems.
- Its cost.

These problems will all be solved with the passage of time.

Hardware will increase its capabilities, and users will adapt, until digital production exceeds the capacities and efficiencies of today's analog.

Prices will drop, and the different sys-

tems will be weeded out.

There will probably never be quite the universality of the analog recording system of today, but that's the price we pay for a free-market economy (I'll take state-of-the-art over art-of-the-state any day).

Unfortunately, there's no such thing as being a little bit incompatible in digital, like, say NAB to IEC playback EQ in analog.

It's more like trying to run MS-DOS software on a CPM computer. After all, it is a binary system: it works perfectly or not at all.

However, for broadcast facilities, there are some systems that may not require entire industry standardization (dare I mention the cart machine ... ?).

But I digress. What about today? The proper thing to do right now is to evaluate such factors as the above, in order to make informed decisions about how to proceed. Look before you leap.

So in the next installment let's look at the audio chain before we leap into converting it to digital. We'll also start talking about some realistic timeframes for your short-term digital conversion planning.

Skip Pizzi is the training coordinator for National Public Radio's Program Engineering Department. He can be reached at 202-822-2483.

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Circle Reader Service 23 on Page 22

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Circle Reader Service 47 on Page 22

# 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

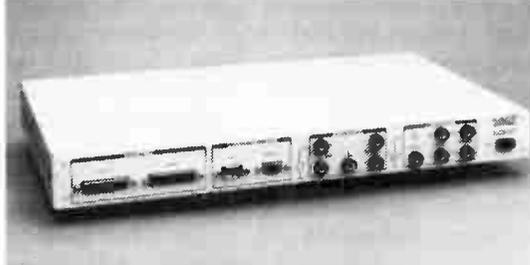


### Opinion Poll System

Archer Corporation's OPTS, Opinion Poll Telephone System uses your voice message to acknowledge the callers' opinion for or against any issue. It is compact, solid state and uses digital voice technology.

A minimum of two telephone lines must be installed and terminated by RJ11C modular telephone jacks, convenient to the work stations where OPTS meters will be visible. There are two models available.

For more information, call **Burton Trouteaud** at 414-463-4000, or circle Reader Service 82.



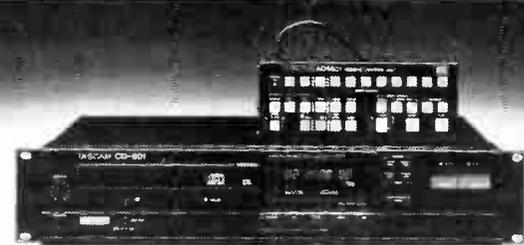
### System One additions

Audio Precision's new DCX-127 module adds DC voltage and resistance measurement, two DC outputs controllable over the  $\pm 10$  V range with  $20\mu\text{V}$  resolution and 21-bit digital input and output to the existing audio test capability of System One.

The new functions permit the system to simplify power supply and amplifier offset voltage checks, make loudspeaker voice coil resistance measurements and VCA measurements.

The DCX-127 is rack mountable and features three 8-bit output ports.

For more information, contact **Bob Metzler** at 503-627-0832, or circle Reader Service 85.



### Broadcast CD player

Tascam's CD-501 CD player is rack mounted and features balanced XLR +4 dBm outputs and fixed and variable monitor outputs for complete control room compatibility.

A remote fader start enables play to be initiated from the console. Two units can be operated from a single hard-wired remote control unit via a special link connector.

The CD-501 offers direct access to up to 99 tracks. The Track Skip function automatically locates the beginning of the next selection up or down the disc.

For more information, contact **David Ellis** at 213-384-7979, or circle Reader Service 86.

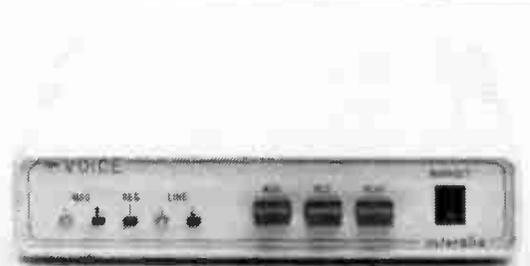


### Digital memory system

The Sirius-100 Digital Audio Memory System from FOR-A Corporation combines 16-bit digital recording and hard disk technology.

The Sirius-100 stores commercials, sound effects and related program material on a dedicated hard disk, providing random access.

For more information, call **David Acker** at 617-244-3223, or circle Reader Service 84.



### Digital telephone interface

Interalia recently introduced The Voice, which stores 64 seconds of totally digital audio.

Battery backup is standard and The Voice interfaces easily with all the major PBXs and direct lines through two RJ11 modular connectors.

You may interface one or two lines on the rear apron. Time available for each line is user selectable.

The unit is available for less than \$700.

For more information, contact your regional **Allied Broadcast Equipment representative** or circle Reader Service 83.

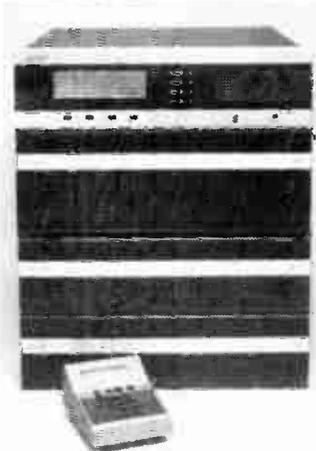
### Audio switcher

International Tapetronics/3M recently introduced its new single matrix Audio Switcher designed for radio broadcasters to replace patch-bays and distribution amps.

The switcher can route virtually any source, such as a satellite feed, to one or more studios within the broadcast facility.

It is a modular system, expandable from a 16x16 monophonic switcher (8x8 stereophonic) to a 256x256 monophonic (128x128 stereophonic) switcher.

For further information, contact **Bill Parfitt** at 309-828-1381, or circle Reader Service 81.



## Subscription/Reader Service Forms

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#12	032	052	072	092
#13	033	053	073	093
#14	034	054	074	094
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# BUYERS GUIDE

STL, Telco &amp; Remote Equipment

## Gentner Digital Hybrid a Hit

by Marty Sacks, CE  
WGAY-FM/WWRC-AM

Washington DC ... WWRC recently purchased two of the Gentner Digital Hybrids to replace the fixed adjustment hybrids that were originally supplied with our Telemix IX.

Most engineers have a pretty good idea about how well a new piece of equipment will perform within a few hours following its installation. It was no different when we installed our Gentner Telemix IX back in the summer of 1984.

### User Report

At that time WWRC was preparing to change to a nostalgia/MOR music format and we wanted a flexible on-air telephone system that was easily integrated into a combo operation.

#### Room for improvement

While the system worked well for us, there was an occasional caller who fell outside the fixed adjustment point of the internal hybrids supplied with the unit.

This resulted in the hollow-sounding announcer audio that most of us have heard at one time or another during on-air phone calls.

The limitations of these hybrids prompted us to call Gentner VP of Engineering Bill Gillman to suggest the design of an auto-nulling hybrid to take its place. Bill agreed and began researching

the product.

We talked several times over the next two years as the project was progressing. We learned later that a couple of different approaches were investigated.

It was not until about a year ago that the chips were available to manufacture the product in its final form using digital signal processing (DSP).

#### Beta test site

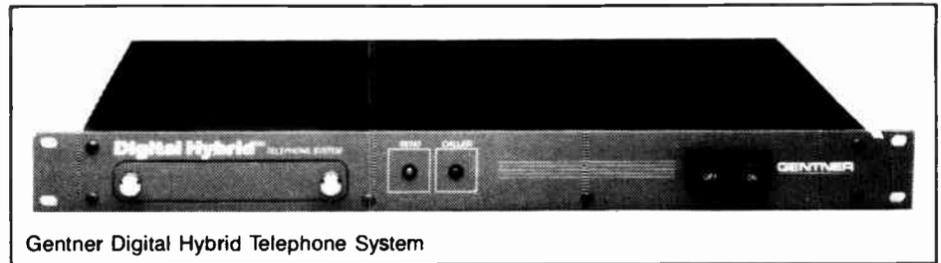
Gentner approached us prior to last year's NAB about being the first station in the country to test the new Digital Hybrid. Not long after making preliminary arrangements, we learned that the decision had been made to return WWRC to an all-talk format.

With that news it became apparent that an upgrade in hybrids was going to become a necessity rather than just the nice improvement we had originally intended.

We received the hybrids and spent a couple of weeks testing off the air. We were quite pleased with the ease of installation.

Telemix IX as a call-director to switch the desired lines to the hybrids.

Telemix IX users have the option of either grabbing the tip/ring on the barrier



Gentner Digital Hybrid Telephone System

Each hybrid comes with a modular telephone cable, a DB-37 remote connector, and a well-written users manual. The instructions are categorized by the particular phone system to be interfaced to keep things simple.

Since we have 15 lines that are capable of going on-air and the hybrid gets a single tip/ring input, we retained our

strip on the back or obtaining a modification kit that will bring everything out on the RS-232 connector.

We opted for the latter to make maintenance on the units easier.

Gentner's new Telemix X has been developed to do call-director chores for the hybrid if required in your plant.

(continued on page 26)

## New Options Free Up STL Clutter

by Marlene Petska Lane

Falls Church VA ... Establishing a studio-transmitter link on the 950 MHz band is no longer simply a matter of calling up a manufacturer, buying a system and plugging it in, especially in bandwidth-hungry urban areas. Space is rapidly being eaten up.

"There are stations in the LA area that have been waiting for years for a microwave channel," says Mike Callaghan, CE for KIIS-AM/FM there. "We have people

doing double hops and squeaking things in sideways and it's really taken a toll."

Of course radio engineers and manufacturers are not a meek lot. Alternatives

### Industry Roundup

such as narrow deviation channels and 23 GHz are already being explored, if not employed.

23 GHz holds a great deal of promise for broadcasters who need to make relatively short hops, and several manufacturers have been marketing "digital" 23 GHz systems.

#### Digital STL systems

"Digital" STL is something of a misnomer. Although digital modulation schemes are used, the microwave radio itself is an analog device.

"Digital" STL systems possess several attractive advantages over the usual 950 MHz systems. There is no measurable degradation of stereo separation, frequency response, noise or distortion.

Systems typically deliver a dynamic range of 90 dB or better. Because these systems require wide bandwidth carriers, 23 GHz and 18 GHz are the most often used frequencies.

Marti Electronics recently added a 23 GHz system to its line, joining the likes of M/A-Com, Nurad and Broadcast Microwave.

Called the Marti STL-23, it is FCC type accepted under Parts 21 and 94 (it may be used except as the final link in the chain) and is compatible with all digital PCM video format processors.

"I would say of all the things that we've done over the years, this has stirred up more reaction than any other single product we've ever announced," says

M.E. McClanahan, VP of Marti.

That is not to say that digital 23 GHz is the ideal medium for every station.

#### Not for everyone

As most are aware, it is subject to rain attenuation, fog and other atmospheric conditions. Its use is generally limited to areas within 5 to 10 miles. (In some areas, it may be used effectively with a 6' dish for distances of 10 to 15 miles.)

Some stations have been reluctant to adopt 23 GHz because of its price. The systems cost roughly 2½ times that of a 950 MHz system. Manufacturers indi-

(continued on page 29)

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### AM BROADCASTING - HIGH FIDELITY

Are these terms mutually exclusive?

YES  NO  DON'T KNOW

Surprisingly, many broadcasters may not know that the correct answer to this question is no. Large sums of money are spent each year to purchase new transmitters, new studio equipment, new audio processing equipment and to modify antenna systems for improved AM sound. Unfortunately, until now, there has been no such thing as a professional quality AM monitor receiver. As a result, the perceived fidelity of an AM signal has been severely restricted by receiver performance.

Potomac has developed the SMR-11 Synthesized Monitor Receiver which will let you hear and measure the quality of your transmitted AM signal ... perhaps for the first time. Features include: Crystal Stability; 60 dB Signal to Noise Ratio; Audio Frequency Response  $\pm 0.5$  dB, 20 Hz to 8 kHz; Total Harmonic Distortion less than 0.2% (95% Modulation) at audio frequencies above 40 Hz ... please write for complete descriptive brochure.



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## BUYERS GUIDE

## Moseley STL Stalwart at KIIS

by Mike Callaghan, CE  
KIIS-AM/FM

Los Angeles CA ... Any number of companies would like to sell you an STL system. They all have some unique features and they all promise similar excellent performance.

But the price and features certainly don't tell the whole story. Achieving that excellent performance under adversely crowded conditions is what separates a superb system from the ordinary.

And just because your market isn't

jammed up now doesn't mean you'll be free of RF problems forever. Even in small and medium markets, many more stations are coming on the air.

### User Report

A low-cost STL package now is a bad investment if it has to be discarded for a better one in just a couple of years. And if you want to go ahead and start with the best, the Moseley PCL-606

seems without peer.

In some narrow deviation tests conducted between Hollywood and Mt. Wilson last year, a Scala paraflector running a full 8 W from a test transmitter was aimed directly at our receiver.

The frequency was a mere 125 kHz below the main KIIS STL carrier. Even though the test unit was modulated at  $\pm 30$  kHz with a 1000 Hz tone, the only effect we found was some additional noise from our SCA monitor. The main programming was totally unaffected.

But a station 250 kHz down from the

test carrier, using equipment made by another company called up outraged saying we had taken them off the air. Yet they were fully twice as far away from our test transmitter as KIIS' 606 was!

The point is that even though a lot of companies make and sell STL equipment, Moseley has the experience, resources and apparently the inclination to produce a superior product.

The 606 is as close to military design as you'll find in broadcasting. The top cover lifts to reveal a series of discrete modules, clean and concise wiring, and attention to detail that's refreshing to find.

The receiver and transmitter have the same dimensions: 3½" high by 18" deep, so shallow racks should be avoided.

The composite transmitter rear panel has inputs for two multiplex and one composite source with a type "N" RF output. The receiver has a pair of composite outputs to drive two exciters and one multiplex output for a remote control.

In SCA applications, the background carrier may be generated at the studio and sent up to the main transmitter along with the stereo program material. This saves the cost of a separate phone line.

Front panel metering covers all important functions, and a rear panel metering output enables remoting any of them.

A group of front panel LEDs show operating conditions and radiate and standby modes. Operating controls are simple enough that two switches on each unit cover all the functions.

An extra metering position converts the front panel meter into a voltmeter which works with an internal probe to help in troubleshooting. Internal test points are clearly labelled and documented in the manual.

A system as complex as this one requires complete and easy-to-digest documentation. Moseley thoughtfully sends two full instruction manuals with each system. Over two inches thick, they weigh almost as much as the system itself!

At first glance the manual seems overwhelming, but it's clearly and logically put together.

A variety of topics are covered—some old, some new—including a review of circuit board soldering techniques, step-by-step installation and alignment techniques, subcarrier system design and hookup, and a thorough, concise description of each module in clear, easy-to-understand language.

The computer-based parts list describes every component and hardware item in detail.

The circuitry uses many features new to a lot of broadcasters, including:

- A PIN diode attenuator in the receiver optimizes system noise in crowded RF environments.
- Fixed, low distortion, ceramic IF filters.
- Two selectable IF bandwidths to allow for optimum distortion or protection from adjacent channel interference.

The 606 can be obtained in either a monaural or stereo composite configuration. It used to be that dual-monophonic systems offered better results than composite ones.

But given the performance of the 606  
*(continued on page 31)*

**WATTS UP?**

3.5KW      5KW      10KW

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What's more, for upgrades to power levels beyond 10KW, each of these FMQ series

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Circle Reader Service 46 on Page 22

**BUYERS GUIDE**

**VRC-1000 Saves Steps for KKFR**

by Gary Wachter, CE  
KFYI-AM/KKFR-FM

Phoenix AZ ... The Gentner RF Products Division's stand alone VRC-1000 microprocessor-based remote control unit is an extremely sophisticated and versatile system that conquers countless remote supervision and control situations.

It is controlled and responds by standard touch tones or optional 300 baud modem.

Sixteen channels can be software selected to sample 0 VDC to +10 VDC or -5 VDC to +5 VDC. The A/D converter's resolution is 1 part in 1024, four-digit, accurate to ±0.5%. Current metering in the 0 to 10 mA range is selectable with an internal jumper.

Software allows the user to program each channel with a calibration constant.

Analog to digital conversion can take place linearly, power to linear or indirectly (product of two previous channels). Any of the 16 command channels also can be assigned to each metering channel.

**User Report**

Two low limits and two high limits can be associated with each metering position.

If a given limit is exceeded a control channel may be activated automatically to correct the situation. Alarm triggering with programmable delay before activation is also possible when any point is exceeded.

Control is via 16 output channels, each with a Raise and Lower function (up to 32 possible outputs). The outputs are open collector rated for a maximum of 48 VDC at 250 mA.

Software flexibility allows the momentary On pulse duration to be programmed or the channel can be set to latch. For other than direct TTL interfacing, I strongly recommend that you purchase or construct a proper interface to the outside world.

I have been using power optical I/O isolator modules with great results.

Sixteen TTL channels monitor conditions of external contact closures. Manual and automatic command channels with alarms can also be set to trigger on low and/or high states of each channel.

Any metering channel may be defeated by the action of a status channel to disable the limit checking. For instance: a phasor status in the day mode is programmed to mute the reading of the night common point meter.

The importance of this feature is realized when there are alarm points set on the CP meter!

Other automatic functions include 20 time of day functions and logging (if equipped with a modem). The automatic logging can be programmed with start and stop times and the interval between the full page data dumps.

Alarms are recorded with the time of occurrence, the channel and the value that was exceeded. Alarm conditions can initiate dialing of up to five different phone numbers (DTMF or pulse) to

paggers, modems or people.

The VRC will relentlessly pursue a proper response from an authorized person in order to reset an alarm condition.

Access to the VRC can take place from the studio over a dedicated line, RF link or the dial telephone network. When dialing in, the unit greets you with, "Hello. This is \_\_\_\_\_. Please enter access code."

You fill in the blanks with up to 15

words of your own choosing from the built-in vocabulary. Five programmed touch tone numbers are pushed to gain user access.

If the correct sequence is not entered on the first attempt, a click and dial tone will be heard shortly. With a proper code entered, a report on the condition of the alarms, if any, is given.

The alarms may be cleared or skipped over to get into the command section

where you may monitor, control or switch to modem.

The voice will lag behind the action on rapid multiple commands. This is not a problem since the commands are executed as soon as received.

Programming may be done at the VRC or remotely over the phone line. After you have properly accessed the unit, another seven-digit code will get you into the setup mode. Should power be lost, all setup parameters are retained.

The modem presently runs at 300  
*(continued on page 27)*

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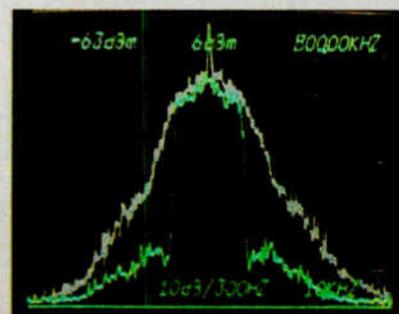
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Typical transmitted response of PMC 400A, NRSC output filter.

Typical transmitted response of PMC 300A.

(15 minute peak stored displays; V: 10 dB/div., H: 10 kHz/div., 300Hz resolution)

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## BUYERS GUIDE

# Monroe Beeps Keep WBRV in Line

by David Atwood, Pres  
Atwood Broadcasting Corp.

Boonville NY ... Not long ago I was talking with a fellow broadcaster who like myself had just purchased new remote control gear. According to him his system had everything, including a synthesized voice to tell him what it was doing.

Given the price I am really very happy with our new Monroe 6005 unit.

It does everything *except* talk. My unit beeps and I have to understand what its beeps mean.

### Multiple functions

At WBRV in upstate New York we have incorporated this dial-up remote control into our AM station for control and monitoring of the transmitter.

*"We are very satisfied with it, even though it doesn't speak to us in English."*

Like many former daytime stations we have many functions to perform. There is PSA power, full daytime power, PSSA that changes monthly, and yet another nighttime power, plus tower lights, on-air monitor and several other functions.

In the studio, the on-air operator controls and monitors the Monroe Electronics Model 6005 Remote Control unit located 25 miles away via DTMF digits on a standard dial-up telephone line.

The 6005 is used for monitoring and control purposes only because formal readings are still required to be taken at the transmitter site to comply with

FCC rules.

By connecting a standard telephone in parallel with the 6005 and programming the 6005 to answer on the tenth ring sig-

## User Report

nal, the on-site engineer can answer the on-duty operator to notify him or her of any changes made at the transmitter site.

Making connections to the relay (control) outputs was the first step in the installation of the 6005.

The main transmitter power on/off is connected to relays 1 and 8, while relay 2 switches the main transmitter output to the main antenna or to the dummy load.

Selecting the transmitter power level High, Post Sunset and Nighttime is accomplished by relays 3, 4 and 5 respectively.

These three relays are programmed in the latching mode. They are incorporated into a relay bank system that selects the proper power setting.

Relays 6 and 7 are used for increasing and decreasing power levels via an external motor drive.

By programming relays 6 and 7 in the momentary mode of operation, adjusting power level is done in steps (relays energize for 250 ms per step) or for longer durations determined by the length of time the operator supplies the 6005 with the command digit.

### The next step

Step two of the installation was making the connections to the digital inputs of the 6005 for status monitoring.

All digital inputs on WBRV's 6005 are programmed to initiate an auto-dial call back (alarm) upon detecting a change in input status.

Inputs 1 through 3 monitor the three power settings, while inputs 4 through 8 monitor window comparators. By using window comparators, high and low power limits for each power setting are monitored.

The High and Post sunset power comparators are connected to inputs 4, 5, 6 and 7 respectively. Input 8 of the 6005 is connected to the Nighttime window comparator high limit. The low limit is not connected to the 6005.

Step three of the installation applies to the audio monitor input of the 6005. This

input provides a dual purpose for WBRV of sampling on-air audio and monitoring the on/off cycle of the tower lights.

The on/off cycle is used to control power to an external monitor audio relay and to energize a buzzer, thus allowing the operator to monitor actual on-air audio and the on/off cycle of the tower lights.

The last step in the installation at WBRV was selecting system options.

Programming the 6005 site identification number, primary and secondary telephone numbers (for auto-dialing), ring to answer, access code and the real-time clock were accomplished by entering a five-digit programming code.

*(continued on page 29)*

# Gentner Hybrid Tested

*(continued from page 23)*

For facilities without dual mix-minus busses, conferencing between two hybrids, vital in a number of formats, is made possible by inclusion of an Aux Send input provided on the back panel and a minor amount of additional wiring.

### Customizing the IX

We preserved a favorite feature of our old Telemix IX—its ability to instantly mute callers by depressing their line button. We were assisted in this by the Gentner factory, which made modifications in the IX firmware.

We also took this opportunity to fully customize the new firmware in the IX for custom defaults. A standard version of the new hardware is available to all Telemix IX owners free of charge.

We also took the opportunity to install a back-up battery to keep the CPU from crashing during momentary power glitches.

Our customization was rounded out by a remote reset circuit that allows us to reset the CPU from the on-air control room in an emergency.

Although we interfaced to a Telemix

IX, Gentner provides for a number of different interface situations.

### Several interface features

Just about all of the audio and control functions appear on the remote connector, including LED voltages for indication of unit/caller status and remote control of caller "ducking."

And DIP switches located behind an access panel allow variations in control of vital functions of the box. The most important one will mute audio, automatically re-null the hybrid and re-output the audio after a new line is selected.

This is useful for interfacing with a multi-line phone. Two of the ten switches are provided for future software updates.

An XLR connector is provided on the back of the hybrid to output a mix of caller and send audio. This audio can be sent to a recorder for recording phone bits off-air without any interface to the console.

The hybrid contains a high quality mic preamp, switch-selectable on the back of the box, to allow a mic to be hooked up directly to the hybrid send input. This is a handy feature for stations without a mix-minus system in the console.

### Customized hardware

The unit performed very well. It took a little time to get used to the momentary pause (about 1/2 second) between the time a line was punched up and when the caller audio was available.

We found that the quality of the audio coming from and going to the caller was quite good. We were equally pleased with the consistent quality of the null.

We understand that the microprocessor and digital signal processor are both firmware-controlled to allow for future enhancements.

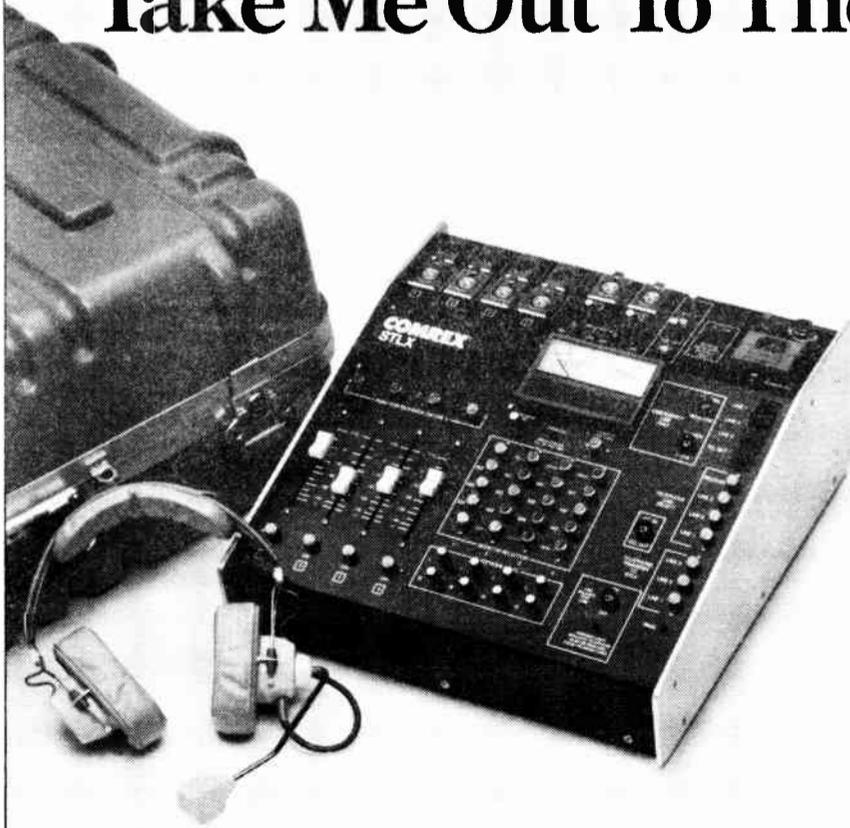
Additionally, Gentner has indicated that the DSP chip is idling about 50% of the time, so that some customization, like specialized filtering, is available by re-writing some of the digital hybrid firmware.

It is likely the box will evolve over the next few years due to the flexibility of the design and Gentner's commitment to the customer.

*Editor's note: Marty Sacks was studio supervisor at WPGC prior to becoming CE of WGAY/WWRC three years ago.*

*For more information on the Digital Hybrid or the new firmware available to Telemix IX owners, contact Elaine Jones at Gentner: 801-268-1117.*

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**BUYERS GUIDE**

**WZZO Digitizes M/A-Com 23 CC**

by Bruce Miller Earle, VP & DE  
The Holt Comm Corporation

Gulfport MS ... WZZO-FM, an ACR-formatted station licensed to Bethlehem, PA serves the Lehigh Valley area located just outside of Philadelphia. Over the last ten years the station has ranked among the nation's top 15 most listened to ACR stations.

With strong competition from such Philadelphia powerhouses as WMMR-FM and WYSP-FM, we feel that part of the success for such excellent numbers can be attributed to being on the cutting edge of technology with regards to signal and audio quality.

With this in mind, the decision was made in early 1987 to install a 100% digital studio transmitter link.

After comparing various systems, we chose the M/A-Com 23CC microwave radio set operating in the Ku band at 21.825 GHz for the RF portion of

this system.

Although more expensive than other sets, we believe the quality of construction and M/A-Com reliability will more than recover the cost difference in the years to come.

**User Report**

Next, we installed the dbx 700 Digital Audio Processor at the studio and transmitter end to mate with the M/A-Com radios.

The dbx 700 was originally designed to be used in conjunction with a U-Matic video cassette recorder. It provided an inexpensive way for recording studios to utilize digital recording without purchasing expensive pulse code modulation (PCM) recorders.

The noise floor with this unit in recording applications can approach -110 dB.

In our studio-transmitter link, the final thru-system noise figure was a remarkable -83 dB, with stereo separation better than 50 dB.

Within hours after installation, WZZO-FM began receiving calls from listeners asking what we had done to our signal, or if we were using only compact discs.

We knew from previous experience with the dbx unit and Ku band transmission that this would be a happy marriage, but we had no idea to what extent.

We are extremely proud of this new system and the vast audio edge it has given us over our competitors.

During our daily STL identification at midnight, we ID our microwave radio station WNER-657, tell our audience that we broadcast 100% in dbx companded predicated delta modulation and state that WZZO is "the digital stereo standard."

*Editor's note: Bruce Miller Earle has worked on various international broadcast projects, including designing and building state-owned AM, FM and TV networks for the Mexican government.*

For more information on M/A-Com's 23 GHz system, contact David Erikson at 617-272-3100. For information on the dbx 700, contact Jim Tipton at 617-964-3210.



M/ACom 4' Drum style 21 GHz microwave dish mounted in center of WZZO transmitting tower.

**VRC-1000 Controls Xmtr**

(continued from page 25)

baud, which is a little slow. A Qume QVT-101 terminal must be used to properly format and display the data. An optional printer is connected to the terminal for logging.

Terminal emulators for PCs can also be used but beware, not many are fully compatible.

After connection, the CRT will fill up with a complete picture of what is happening at the site in real time Alarm and setup pages can be called up.

Control of any channel is done through the keyboard using the same numbers and \* & # characters as in the phone pad.

A typical example of the power of the VRC is in setting up a remote. The VRC is accessed with a portable phone. Signal strength is called up and repeated while the RPU transmitting and receiving antennas are zeroed in.

The VRC has a built-in microphone for remote listening but nearby transmitters make it too noisy to be of

much use.

We removed the mic, lowered the preamp gain and ran in RPU audio instead.

Although it is on a phone line, the quality of the received signal can be evaluated accurately and corrective action taken if necessary.

Finally, the IFB transmitter was activated. This can all be accomplished in less than a minute and does not require the assistance of anyone at the studio.

The VRC-1000 has already prevented many unnecessary journeys to the transmitter sites, and we have a much better picture of the conditions at the sites than ever before.

*Editor's note: Gary Wachter has been actively involved in broadcast engineering for the past 16 years.*

For more information on the VRC-1000, contact Elaine Jones at Gentner: 801-268-1117. The author may be reached at 602-258-6161.

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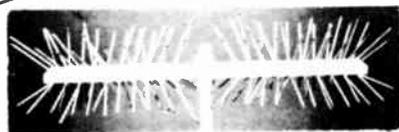
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## BUYERS GUIDE

# Wired STL Solves WITL Dilemma

by Geary S. Morrill, DE  
Mid West Family Stations

**Lansing MI** ... When WITL-FM received authority to construct our new transmission facility a couple years ago, the fact that we would be co-located on the same property but separated by some 1200' was both blessing and curse.

It kept the transmitter close to the studio facility for maintenance purposes, but the challenge of delivering program between the two sites while maintaining control of the audio processing at the studio end was a dilemma.

### User Report

If we used audio pairs, we could run AGC at the studio end, but would have to leave the limiter and generator at the transmitter. There would be some degradation of HF phase and amplitude response over this long of a run as well.

An STL hop for this distance was wasteful from both a spectrum and monetary standpoint.

Finally, the answer was found: The Wired STL™ from Modulation Sciences.

This composite line driver/receiver combination allows separation of the stereo generator and exciter of up to 2500' (10,000' on special order) yet preserves composite baseband integrity to 53 kHz.

Baseband is transmitted via inexpensive twinax cable terminated with common XLR connectors. One transmitter can drive two separate receivers, or a transmitter can stand alone as a composite DA feeding up to four lines.

Setup of the unit is straightforward, with a test output on the front of the composite transmitter which allows for easy hookup of a scope for phase adjustment of the generator.

The scope can be taken to the receive end test jack and the HF compensation control can be adjusted to match the waveform observed at the transmit end. When properly equalized, frequency response of the system should be within  $\pm 0.05$  dB from DC to 53 kHz.

On a typical 1000' run of 78 ohm Belden 9463, differential time delay relative to 38 kHz is at +10 ns at 1 kHz, +30 ns at 10 kHz and +10 ns at 53 kHz.

Stereo separation in excess of 60 dB at 1 kHz and 55 dB at 15 kHz can be supported (through calculation of the measured response assuming an ideal composite input waveform). That's plenty of headroom for today's stereo generators.

Broadband noise 20 Hz to 100 kHz is below 4 Vp-p, with IM distortion (even at 1:1, any two tones, 50 Hz to 53 kHz) at 70 dB below the same level.

One of the inherent strengths of the system is its superior 60 Hz noise rejection capability. This becomes important when the difference in ground potential between the two ends comes into play.

Common mode rejection is 95 dB nominally, and a worst case of 0.5 A of shield current on a 500' run still would leave output noise at a respectable 66 dB below 4 Vp-p.

Normal shield currents of a few mils would be virtually unmeasurable.

A problem did develop when we first installed the units. In speaking with Modulation Sciences, the unit was primarily developed to work in high-rises where lightning wasn't a major concern.

Unfortunately, when our tower was struck, the dissipation through the ground system developed a field of un-

known magnitude and frequency to be induced into the line.

Needless to say, the chips on both ends of the driver didn't care for this a bit. By adding surge protectors at each end the problem was eliminated. Later units have this protection added.

If you're faced with a composite distribution dilemma in the future, give the Wired STL a try.

*Editor's note: Geary Morrill's 15 years of experience in broadcast serve him well at Mid West Family Stations, where he is responsible for the technical operations of 18 stations.*

*For more information on the Wired STL, contact Eric Small at Modulation Sciences: 718-625-7333. The author may be reached at 517-393-1010.*

# TC-8 Lends Control

by Peter Burk, Pres  
Advanced Micro-Dynamics

**Pepperell MA** ... It's 11 am on Sunday morning and your new weekend announcer can't get the transmitter to stay on the air. You'd have an easier time of it if you were there, but you're at home reading the Sunday paper.

A quick call straight to the remote control system confirms your suspicion. The VSWR is high (must be ice) and the transmitter will only stay on at reduced power.

You lower the power for awhile, make sure the de-icers are working, then finish reading your paper.

A TC-8 Remote Control System with TSU Dial-Up option lets you do this anytime. You don't have to have your house wired for sound, either.

The only equipment you need is a touch tone phone or a rotary dial with a pocket dialer.

After you dial the number and enter a security code, you press the number on the touch pad for the desired channel and listen to the synthesized voice announce the current value.

If the value is too high or too low, you simply press "\*" for Lower or "#" for Raise.

Anything you can do from the studio control unit you can do by dial-up.

For all the convenience of dial-up, full time "traditional" remote control still has some advantages.

First of all, it is easier to read the numbers directly from the display than it is to listen to a voice announce them.

This has nothing to do with the intelligibility of the speech synthesis, it's just that it takes a few seconds to listen to something that we can see at a glance.

Second, your remote control should be instantly available to the control operator, at least during important dayparts. Most GMs don't like the idea of being off the air while someone dials the phone and prays for an answer.

### Technology Update

Actually, the ideal system includes both/full time remote control for normal operation and dial-up for special cases.

That's what the TC-8 provides. The basic system uses phone lines, STL, TSL or subcarriers to communicate with the transmitter. The TSU adds the dial-up capability for roving supervisory control.

There are several options to the TC-8/TSU system that provide flexibility and convenience. An antenna monitor adaptor, relay interface panel and a computer interface all increase the utility of the TC-8. Subcarrier generators are built-in.

"Floating" control points are not presently acceptable to the FCC, yet the TC-8/TSU combination is completely legal, since the control remains with the studio operator. He has the power to interrupt anyone calling in on the line.

This is an important point, since current FCC rules require that someone at a designated control point be available to shut the transmitter down if necessary.

Dial-up remote control should not be configured in such a way that you lose control any time someone dials the number. The TC-8 studio unit can always override the dial-up caller.

*Editor's note: For more information, contact the author at Advanced Micro-Dynamics: 617-433-8877.*

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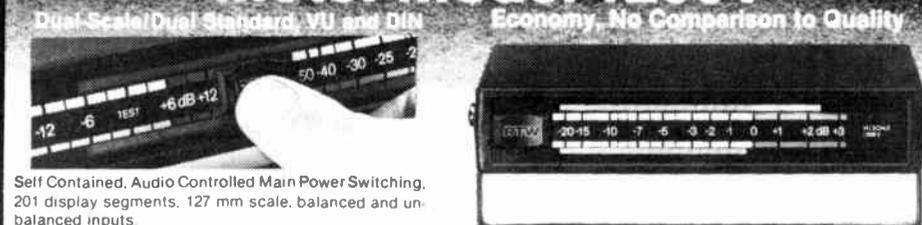
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## BUYERS GUIDE

# Quality STL Space Hard to Find

(continued from page 23)

cate, however, that because the hardware is now readily available, the price of the systems will drop.

Stations may also hesitate employing digital STLs because of possible future FCC action. The FCC may begin to tighten the reigns on radio stations using video channels to transmit digital audio.

"Using video tape formats is a widely inefficient use of spectrum and the Commission doesn't have much of a sense of humor about it," says Eric Small, VP of engineering for Modulation Sciences.

But for many, 23 GHz may be the only immediate and reasonable answer, other than narrow deviation channel solutions, to crowded channel conditions.

"I think the urban guys will have to go to 23 GHz and up," predicts Small.

## Mother of invention

Others are hopeful that a band below the weather-sensitive 23 GHz will be opened.

"I think it behooves the FCC to find another hole for us in the 2 GHz and below (band)," says Jesse Maxenchs, director of marketing for TFT.

At least one crowded urban area has been exploring 1.7 GHz as an alternative. Obviously radio broadcasters would be able to get maximum coverage from this frequency whereas they may not from 23 GHz or 18 GHz.

The 1700 MHz to 1710 MHz band is currently being used in Canada with relative success. Its plan calls for those stations broadcasting in stereo to fill the top of the band and work their way downward. Mono stations start at the bottom and work up the band.

In conjunction with these assignments two stations can use the same frequency by employing horizontal and vertical polarization.

If the 1.7 GHz band is opened in the US, the market will be ready. Moseley Associates already markets 1.7 GHz equipment for microwave STLs, and stations may be able to modify TV's 2 GHz equipment.

Broadcast use of 1.7 GHz in this country may be hampered, however, by problems peculiar to current technology in the US. Although not insurmountable, these problems have so far delayed any progress in opening the band.

Manufacturers and broadcasters believe that soon the FCC will be forced to find more space.

"There's going to be a lot of pressure brought to bear on the Commission," says Small. "The demand will be to either do something about the telephone companies' outrageous rates and mangy service, or give us more spectrum."

Given the relatively narrow bandwidth that radio can be put in, many are hoping that the Commission will nip corners out of existing TV intercity STL and ENG channels and make them available to radio.

## Fiber optics down the road

Even so, these solutions are seen only as interim steps toward the eventual use of fiber optic links. A radio rarity today,

**'Radio stations don't like to be common carriers.'**

fiber optic links are expensive and the technology itself is still in its infancy as far as broadcast is concerned.

Broadcasters appear content to bide their time and let the phone companies establish the needed fiber optic system, rather than try to absorb the phenomenal expense of installing links themselves.

And, the transition is likely to be slow because of a certain reluctance on the part of broadcasters.

"Radio stations don't like to be common carriers," says Callaghan. "We're pretty happy with the status quo, even

though we're running out of channels."

Despite the initial reluctance which must be overcome and the high cost, fiber optics can provide the radio broadcaster with an excellent link.

In areas with serious RFI problems, where microwave is too crowded or where the available paths simply are not line-of-sight no matter how you go about it, fiber optics could become a reasonable alternative.

With a fiber optic link RFI is virtually nonexistent, total noise immunity is achieved, there are no ground loops and there is no hum.

"With fiber optics, there is virtually un-

limited bandwidth," says McClanahan. "Once the fiber optic system is distributed to many points, then they (broadcasters) can do anything they want."

At this point in time, the experts in the fiber optics business are telephone experts, not broadcasters. Until they become familiar with terms like broadcast quality audio, low distortion and wide dynamic range, the promise of fiber optics will remain just that.

In the meantime, broadcasters can continue looking to solutions such as narrow deviation channels, 23 GHz and the FCC for STL solutions.

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Our new dial-up option gives you full access to all TC-8 features from any touch-tone telephone. Its on-board speech synthesizer announces all readings, and a user-selectable password protects against unauthorized access.

And this is one dial-up remote that's unquestionably legal. FCC regulations require a designated positive control point, and that's what the TC-8 studio unit gives you — even when the dial-up remote is in use.

So now there's no need to choose between full-time remote control and dial-up. You get both with the TC-8.

How much? That's the most amazing part. The TC-8 dial-up option is just **\$395!** The TC-8 studio/transmitter system is just **\$2495.**

For value, no other transmitter control system comes remotely close to Advanced Micro-Dynamics' TC-8. Add it up for yourself. TC-8 now gives you full-time studio remote control PLUS dial-up features for LESS than others charge for a dial-up remote control alone!

Your next move? Call your favorite distributor, or call Advanced Micro-Dynamics Toll-Free at **1 (800) 255-8090.** And if you're already among the hundreds of TC-8 users, call us for information on adding the dial-up option.



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## Monroe Monitors WBRV

(continued from page 26)

The real-time programming is done monthly to update authorized time changes. Access code changes are made as the need dictates.

While in the program mode, time commands were also entered for relays 3 through 5 and power-up default commands for return to power configurations.

Using time commands at WBRV eliminates the need for the on-duty operator to change power settings. Only acknowledging the callback (alarm) of the power setting change is required.

When the 6005 answers an incoming telephone call, it responds with a tone burst which signals its presence at the transmitter.

At this time an access code of four digits must be entered or the on-duty operator will not be given further access to the 6005.

The on-duty operator may then may send DTMF commands to operate out-

put relays, request input or output status and request call back status.

Having the 6005 for the past year at WBRV has proven that control of a transmitter may be done accurately and legally via dial-up remote gear.

When it comes to cooperation, I've worked with a lot of good people but the folks at Monroe are super. How many times have you worked with a company that out of the blue calls to ask how its unit is performing? Monroe did.

They have even asked to come and observe how we have installed the 6005. We are very satisfied with it, even though it doesn't speak to us in English.

*Editor's note: David Atwood became owner and GM of WBRV in 1977 in fulfillment of his childhood dream since age 12. His wife Nancy also owns a station, WLLG which recently went on air.*

*For more information call Gene Fuller at Monroe Electronics: 716-765-2254. The author may be reached at 315-376-8549.*

# BUYERS GUIDE

## Shrink Subcarrier Bandwidth

by Frank McClatchie, Pres  
FM Systems

Santa Ana CA ... A new type of subcarrier is now available that shrinks the required subcarrier bandwidth while multiplying the number of channels that can be carried. It also delivers a better audio SNR to boot.

The new class of subcarriers are spaced closer together. The spacing can be close to 90 kHz for 7.5 kHz bandwidth

### Technology Update

program audio or data services. The 180 kHz spaced channel assignments are for 15 kHz program audio services.

The center frequency in each bracket is the 15 kHz service, while the other two are 7.5 kHz channels. Either one or two 7.5 kHz channels can be assigned, but no 15 kHz channel in that bracket, or one 15 kHz and no 7.5 kHz channel.

Since the occupied bandwidth of this new class of subcarrier is very much less than the older type of wideband modulated subcarriers, the "power" invested into these subcarriers can also be substantially less.

The "power" referred to here is actually the proportion of the total main carrier deviation attributable to the operation of each subcarrier.

With this new class of narrowband subcarriers, a 10 kHz bandwidth STL

can carry up to 12 subcarriers (see Figure 1). A typical example of the usefulness of these narrowband subcarrier systems is where an existing FM station and TV station share an STL.

The TV station in the past used one subcarrier channel for TV audio, the next two for the stereo FM station and the fourth channel carried data for both the TV and FM station.

Now the TV station wants to go stereo. What to do? Dump the data? The wideband subcarriers are maxed out.

The solution is to install six new narrowband systems. TV gets its stereo channels, FM also has stereo channels, and now the TV station and the FM station can each have their very own data channel.

Now that there is subcarrier channel capacity to spare, why not install two more channels for AM stereo? That's only eight subcarriers. Could another four channels be sold to two other FM stations on the same hilltop?

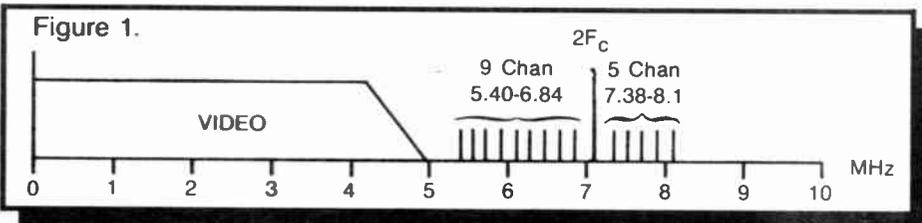
The point is that with so many new subcarrier channels available, new possibilities emerge.

Now for a little more of the technology. According to the formula:

$$S/N = C/N + 1.76 + 10 \log B_c/B_a + 20 \log D_c/F_{sc} + 20 \log D_{sc}/B_a + D_f - S_f$$

where:

- S/N=Audio SNR
- C/N=Carrier-To-Noise Ratio of Microwave Carrier
- 1.76=10 log 3/2 Factor



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Circle Reader Service 14 on Page 22

- Ba=Audio Bandwidth
- Bc=Microwave IF Bandwidth
- Dc=Deviation of Microwave Carrier By Subcarrier
- Dsc=Deviation of Subcarrier By Audio
- Df=De-Emphasis Factor (13 dB for 75 μS)
- Fsc=Frequency of Subcarrier
- Sf=Double Sideband Factor (3 dB)

It can be seen that decreasing the subcarrier deviation (Dsc) without changing other factors results in a reduction of audio S/N (S/Na) of 6 dB when deviation is reduced by one half.

Wideband subcarrier systems may deviate up to ±237 kHz (thus occupying a bandwidth of 2 (15 kHz+237 kHz)=504 kHz), while a narrowband subcarrier will deviate ±50 kHz (and thus occupy 2 (15 kHz+50 kHz)=130 kHz).

Therefore the narrowband subcarriers will be noisier than the wideband system by:

20 log 65/237 kHz = -11.24 dB  
Not only that, but the main carrier deviation (Dc) will be reduced by the bandwidth ratio of the narrowband to the wideband:

10 log 130/504 = -5.88  
So the total SNR loss is 11.24+5.88=17.12 dB. The regular wideband subcarriers were noisy enough, so how do the narrowband systems overcome the additional 17 dB penalty?

The narrowband subcarrier systems can actually be much quieter than the wideband systems because the new narrowband systems employ 2:1 dual-band companders.

Such modern companders effectively improve the audio S/N by 26 dB, thus offsetting the 17 dB noise penalty, plus another 9 dB improvement over the wideband systems.

Don't panic when you run out of spectrum space on your STL, just convert to narrowband subcarriers.

Editor's note: For more information, contact the author at 714-979-3355.

## CE Sold on Telecart

by Tom Koza, CE  
KPWR-FM

Los Angeles CA ... Many radio stations are finding numerous applications for telephone "information lines" which listeners can call to receive information on concert schedules, school closings or the local ski report.

At KPWR we use two information lines: one is the night answer message and the other is for request line information.

When we first installed the lines, I used conventional cassette-type answering machines. This was disastrous! The machines couldn't handle the 1000+ calls per day that come over the lines.

One machine suffered a "meltdown" after 10 days of use! Obviously this is an application more suited for broadcast gear, and an old cart machine was the perfect choice.

Even a 15-year-old mono unit will hold up better than most answering machines. The only problem we faced was how to make it automatically answer the line and play the message to the caller.

A call to our equipment supplier provided the solution: A device called Telecart by Henry Engineering.

Telecart is a cart machine-to-phone line

interface/controller that permits any cart machine to automatically answer a phone line, play the message and hang up when the message is finished.

### User Report

The Telecart unit is about the size of a cigar box and is powered from 115 VAC so it doesn't draw any power from the phone line or the cart machine. It has a digital call counter that counts the number of calls received, up to 999.

All connections to the Telecart are made via the 12 terminal barrier strip on the front of the unit. Installation takes about 30 minutes.

To install, you connect the remote start, play indicator and audio output circuits of the cart machine to the appropriate terminals. The phone line is connected using a modular cord supplied with the unit.

One thing that impressed me was that all circuits in and out of the Telecart are isolated. The cart-start circuit is relay isolated, the play-sense input is optoisolated and the audio circuit is transformer isolated.

(continued on next page)

### EBS EQUIPMENT

Model CEB Encoder-Decoder	Price
Model CE Encoder Only	\$475
Model CE with Stereo Option	\$330
Model CD Decoder Only (REQUIRED FOR LPTV)	\$360
Receiver can be supplied to drive Decoder	\$280
	\$100

- Encoder FCC Type Accepted • Decoder FCC Certified •
- Exceeds FCC Specifications •

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Circle Reader Service 38 on Page 22

# Moseley Excels Under Crowded Conditions

(continued from page 24)

composite system, there's no reason to lose the advantage of having the stereo generator at the studio.

Instead of buying separate left and right channel systems, buy a main and a standby. Use the money you save on antennas to buy an automatic transfer panel to switch transmitters if one fails.

KIIS has used a 606 since the system was first introduced in 1984. Distortion through the entire chain is under 0.7% THD, and stereo SNR is 66 dB.

Our automatic transfer panel has never switched; the 606s run cool without using fans, and are probably the most reliable pieces of equipment in the facility.

Regard for the field engineer is easily found in the manual, in the design and

in the excellent technical support Moseley has backing the system.

There are a lot of companies who'd like to sell you a new STL system, and your next one and the one after that. Working with the Moseley PCL-606 has convinced me that the best and easiest way is to do it right the first time.

Plug it in, set it up and then concern yourself with things that really merit your attention.

*Editor's note: Mike Callaghan is SBE certified and teaches broadcast engineering/telecommunications at California Community College. He also gets up at 6 AM to do aerobics.*

*For more information on the PCL-606, contact Bill Fink at Moseley: 805-968-9621. The author may be reached at 213-466-8381.*

# Henry Provides Solution

(continued from previous page)

Everything is safe. There is no chance of wrong polarity, accidentally grounded phone lines or ring voltage backing up into your cart machine!

It also means that you can use just about any cart machine—new, old or very old—regardless of manufacturer.

Telecart operates automatically. When the line rings, it starts the cart machine just after the first ring. The line is "picked up" and the message plays to the caller.

The Telecart uses the remote play-light

circuit from the machine to confirm that the cart actually did start; if it didn't the line will not be answered.

At the conclusion of the message, the cart re-cues and the line is released, ready to accept another call. If the caller hangs up in the middle of the message, Telecart will keep the line "busy" until the cart has re-cued back to the beginning of the message.

There is no way a new call will be answered until the cart is re-cued. Each time a call is answered, the digital call counter advances one count. There is a

## BUYERS BRIEFS

TFT, Inc.'s 8600 series of discrete (mono) 950 MHz Aural STL systems have several unique features directed to specific applications among AM and FM broadcasters.

Two 8600 systems, each with a full 15 kHz frequency response, may be used for FM or AM stereo. The built-in phase adjusting provision assures proper phase matching.

In congested metropolitan areas the 8600 link, with  $\pm 25$  kHz deviation and 125 kHz channel spacing, permits the use of two links for discrete left and right audio in a minimum amount of occupied spectrum.

A built-in 39 kHz SCA generator and demodulator may be used for remote control or engineering order-wire needs.

For more information, contact Jesse Maxenchs at TFT: 408-727-7272, or circle Reader Service 72.

Wegener Communications' Panda II analog subcarrier system provides an alternative to the digital encoding-decoding scheme to get high quality audio to the transmitter site.

Available SNR is better than 90 dB with program quality audio specs, ac-

ording to the company.

Because the equipment is modular, many configurations are possible, such as Panda II circuitry for FM stations where wide bandwidth and low noise are mandatory, and Panda I circuitry for stereo or mono AM, and/or narrowband subcarriers for background music and/or telemetry control.

For information call your regional Allied Broadcast Equipment representative, or circle Reader Service 77.

Marti Electronics' STL-23 Digital Aural Broadcast STL is FCC type accepted under Parts 21 and 94, and is compatible with digital PCM video format processors.

It has a dynamic range of better than 90 dB and stereo separation of more than 80 dB, according to the company.

The STL-23 transmitter, receiver and subcarrier boards are located inside the weatherproof antenna assembly for cost saving and ease of installation.

There are a wide selection of audio/FSK and RS-422 subcarrier options.

For more information, contact M.E. McClanahan at Marti: 817-645-9163, or circle Reader Service 71.

button on the unit to reset the counter to "000."

We have been using two Telecarts for about three months. The units have worked well without a hitch. It's amazing how many people call the info lines ... a hundred calls in an hour is not uncommon!

Information lines are an excellent way

for any station to provide a needed public service to listeners. The Telecart is an inexpensive way to get the job done.

*Editor's note: Tom Koza has been in radio for more than 13 years.*

*For more information, contact Hank Landsberg at Henry Engineering: 818-355-3656. The author may be reached at 213-467-1224.*

# It's 3:55 a.m. Do you know what your transmitter is doing?

Now your transmitter can alert you to problems by phone—anywhere, anytime with the VRC-1000 Remote Control. A preprogrammed, synthesized voice quotes parameters; you make adjustments right on your Touch-Tone® phone. Or, you can dial from any-

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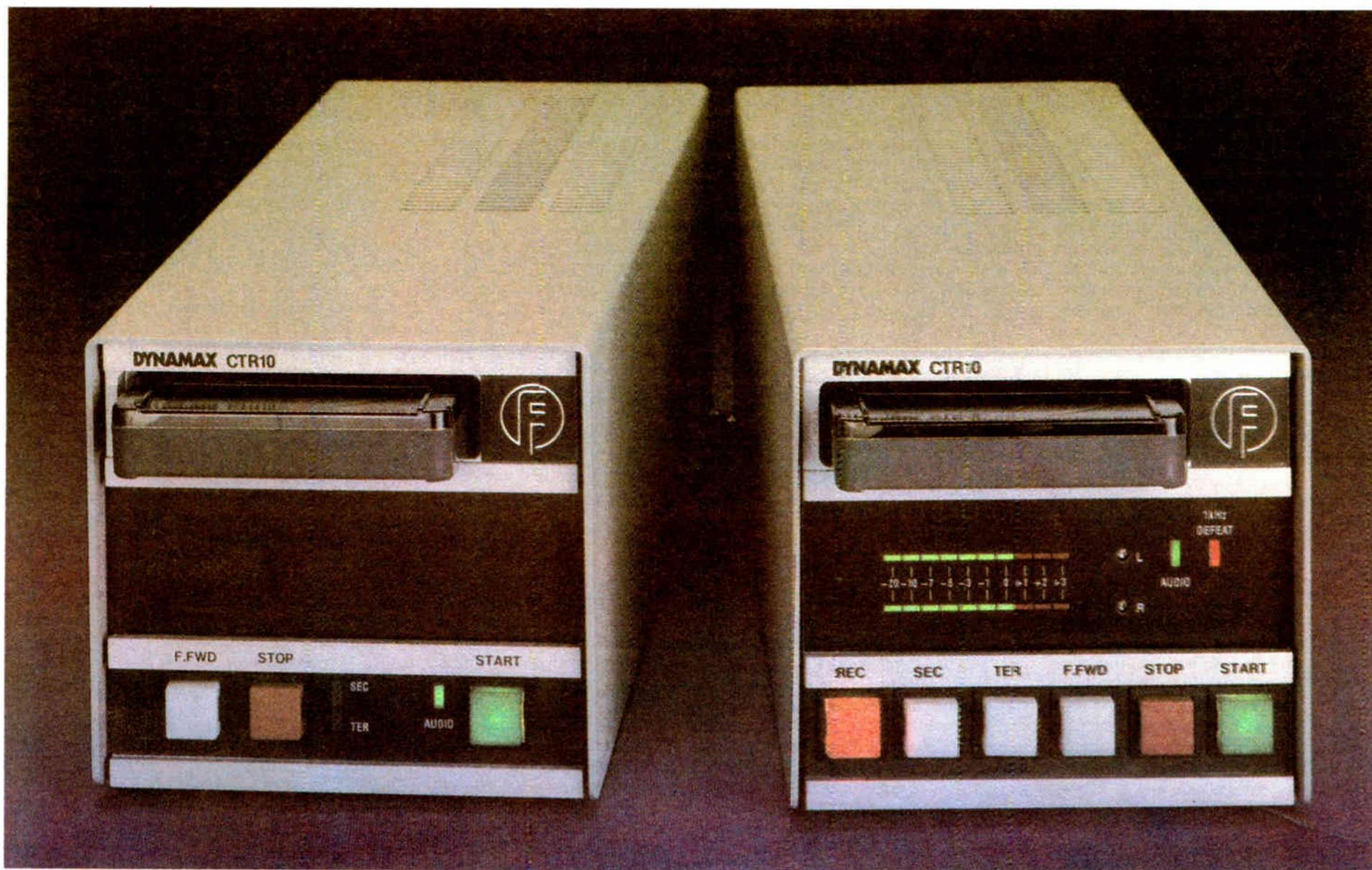
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