Published twice a month

Radio World

Buyers Guide AM Transmitters and Exciters See pages 27-35

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US Weighs 57 kHz Standard

by David Hughes

Washington DC ... The US may attempt to downplay a proposed international 57 kHz FM subcarrier (SCA) standard for data transmissions, expected to be adopted in May.

The standard, originally proposed by the European Broadcasting Union (EBU), is scheduled to be examined and adopted by the International Radio Consultative Committee (CCIR) during its plenary session in May in Yugoslavia.

The standard, called the Radio Data System (RDS), differs from a variety of US subcarrier operation practices, and is said to be incompatible. US stations utilize other subcarrier frequencies, such as 67 and 92 kHz.

NAB Engineer Ralph Justus, chairman of CCIR Working Group 10-B, which deals with FM (VHF) radio, said the US actually failed to notice a clause contained in last fall's RDS 57 kHz standard recommendation that referred to "other applications."

He said the RDS subcarrier standard referred to automatic receiver tuning and program identification. However, it also mentioned "other applications," which could include data transmission systems.

While no US official position had, as of press time, been developed for the CCIR plenary session, several are being examined, according to Neil McNaughton, chairman of CCIR Study Group 10 (which focuses on radio broadcasting in general), parent of Justus' 10-B group. McNaughton is with the FCC Mass Media Bureau.

Justus said that 10-B's members met on 5 March to choose a list of RDS recommendations, which will work their way through the US CCIR hierarchy and receive State Department input prior to the May session.

Downgrading

At the meeting, the 10-B working group examined the possibility of downgrading the standard recommendation to a "report," McNaughton said. "However, I can't say if that will be the final US position. There are three or four possibilities," he added.

Requesting anonymity, a participant in the 10-B meeting, who has helped develop subcarrier technology in the US, said "it would look bad" if the US, at this late date, "dug in its heels" and opposed the standard. The EBU has been working on the RDS standard for eight years.

He said the US is examining whether to "downgrade the recommendation" or to "dilute the impact" of the standard by making it "one of many" recommendations, as opposed to the sole recommendation.

The situation developed because the US was not keeping close watch on the issue when the 57 kHz "signaling protocol" SCA data standard was being developed, the participant added.

"Not appropriate"

Sources felt that approval of the RDS standard would have little effect on US broadcasters. An SCA data transmission standard would "not be appropriate" in the US, Justus said, where a variety of different data systems are already being applied.

In Europe, many of the FM stations (often operated by state-run broadcasting systems) still do not utilize stereo, he said. Those stations would run their 57 kHz RDS system and perhaps the Blaupunkt-developed ARI system, which provides traffic alerts and other voice announcements. The ARI system, which also uses 57 kHz, operates in quadrature

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NAB Seeks FCC RFR Preemption

by Edward Wytkind

Washington DC ... The NAB has petitioned the FCC to issue a policy statement preempting the adoption of nonfederal radio frequency radiation (RFR) emission standards that restrict broadcasters from operating Commission authorized facilities.

The action comes in the wake of numerous cases around the US involving state and local RFR standard setting. To date, authorities in Oregon, Washington, New Jersey and Massachusetts have adopted (or are considering adoption of) RFR standards, which in some instances are more stringent than the FCC-adopted American National Standards Institute (ANSI) limit.

Justifying the rationale for adopting RFR standards, state and local government officials say that without the adoption of strictly enforced federal public and worker safety standards, the right to police RFR producing industries to ensure public safety should be retained at the local level.

However, under the Communications Act of 1934, state and local zoning ordinances preventing or inhibiting the installation of communications facilities are in violation of the First Amendment, according to the NAB.

Health effects not conclusive

Citing a lack of "new scientific evidence" showing conclusive harm from public exposure to RFR levels below the ANSI standard, the NAB's petition urges the FCC to preempt state and local RFR standards that are more stringent than the ANSI guidelines. To do otherwise, it said, would be to "unduly restrict communications services."

The NAB has been lobbying the Commission to exert its so-called "statutory right" to preempt local and state RFR standards since last summer, when the FCC adopted the ANSI standard.

In that rulemaking, however, the Commission stated that the preemption issue was beyond the scope of proceedings. At press time, FCC officials would not comment on the NAB petition.

Of the various health effects cited in past RFR studies, one study attempted to link short- or long-term exposure to RFR with enlarged adrenal glands and hormonal imbalances in laboratory animals. In addition, heat sensations in the knees have been reported by communication tower climbers.

Despite the NAB's emphasis on federal preemption rights, the National League of Cities said it is prepared to "challenge and oppose" any FCC attempt to deny cities their statutory right to adopt public safety ordinances.

According to the NLC's General Counsel Cynthia Pol, such attempts by the Commission will be "easily challengable in court."

However, NAB legal counsel Barry

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Regulatory News

Gramm-Rudman to Affect FCC

by Edward Wytkind

Washington DC ... The Gramm-Rudman-Hollings bill will force the FCC to reduce its fiscal year (FY) 1986 budget by $4 million, or 4.3%, as a result of the government budget cuts mandated by the Congressional bill passed late last year, Commission officials announced in March.

"The (budget) cuts will inevitably have some effects on certain aspects of the FCC's operation," possibly including the processing of applications, according to FCC Mass Media Bureau Deputy Chief of Policy Bill Johnson.

Prior to the passage of Gramm-Rudman-Hollings, the Commission's 1986 budget appropriation was $94.4 million. FCC Chairman Mark Fowler recently requested $96.36 million for 1987.

Despite the budget cuts already being initiated by US government agencies, the final decision rests with the US Supreme Court, which is scheduled to rule on the constitutionality of mandating automatic budget cuts.

The 4.3% budget cut will force FCC officials to institute an absolute hiring freeze which will prevent departments from replacing employees who have resigned or been fired, according to Marilyn McDermett, FCC managing director of Operations.

Johnson explained that departments that lose the most employees this year will probably experience the greatest effects from the budget cuts.

However, until the US Supreme Court rules whether Gramm-Rudman-Hollings violates the Constitution, Johnson said, it is difficult to speculate what effects the bill will have at the Commission. Congressional sources said the court should render a decision by July.

After last year's passage of the bill, a special US Court three-judge panel ruled that certain aspects of the bill, including the across-the-board budget cutting mechanism, could violate the Constitution and deserves review from the higher court.

Although budget cutting measures initiated by the Commission could be affected by the higher court's ruling, the FCC said it will also "defer promotions" and will eliminate expenditures such as travel related costs.

Johnson added that if the Supreme Court rules the bill unconstitutional, the FCC is not sure what might happen to 1986 budgets already intact.

In addition to possible operational effects at the FCC, the NAB said it also may feel effects from Gramm-Rudman-Hollings.

Due to substantial reductions in government agencies' travel budgets, there may be a reduction in the number of government employees who can participate in NAB convention session panels, NAB officials said.

> *"The 4.3% budget cut will force FCC officials to institute an absolute hiring freeze."*

At press time, Congress had passed the budget reconciliation bill (HR-3128), which, among other things, will stipulate ground rules under which a company or organization would be permitted to pay travel expenses and other costs incurred by a government employee participating in a private industry event, according to NAB officials.

While Congressional sources could not confirm this, the reconciliation bill extended travel reimbursement through the end of 1987, the NAB added.

For more information, contact Marilyn McDermett at the FCC: 202-634-1524.

Featured this issue

FCC Clips

Computer Program

FCC Mass Media Bureau Chief James McKinney, at a February NRBA-sponsored "town meeting" for broadcasters, said the Commission is working to revamp its computer programs to allow more coverage "holes" to be filled on the FM band.

He said that the current AM band application practice—in which broadcasters who discover an area on a frequency not serviced by another station may apply to use it—could be applied to a greater degree to the FM band.

"On the AM band, if we find a hole, we fill it," McKinney said. "We can't do that as well with FM—yet."

He did not mention when details of the plan would be revealed.

New Groundwave Curves

The FCC's Office of Engineering and Technology has issued a report that includes a computer program that computes the proposed groundwave propagation curves for the expansion of the AM band from 1605 to 1705 kHz, expected by 1990.

The report, "Modern Methods for Calculating Groundwave Field Strength over a Smooth Spherical Earth," is available for purchase from International Transcription Services, 2100 M Street NW, Washington DC 20037, 202-857-3800.

For more information about the report, contact Robert Eckert at the FCC: 202-653-8163.

CB Interference

The Commission has announced that it plans to increase its efforts to combat the sale and use of linear amplifiers.

Most cases of interference to home electronic entertainment equipment, the FCC said, are caused by Citizens Band (CB) transmitters used with illegal linear amplifiers.

All FCC Field Operations Bureaus will take an "active interest in locating and closing down" operations using linear amplifiers and other illegal transmitters. The Commission said it will also look for "unscrupulous dealers and service technicians" who modify or repair equipment.

For more information, contact Sue Earlewine at the FCC: 202-634-1940.

Radio Stats

According to its latest statistics, released 25 February, the Commission tallied 9,824 radio stations in the US.

FM operations outnumber AMs 5,106 to 4,718. Of the FM total, 1,231 were noncommercial operations.

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

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Regulatory News

Moves to Foreign Clears Limited

by David Hughes

Washington DC ... The FCC has established a two-year hiatus during which AM daytimers not located on foreign clear channels would be prohibited from expanding their operations by moving to a foreign clear.

The new plan was contained in a February order issued by the Commission to clarify its policy regarding increased nighttime operations on Canadian, Mexican and Bahamian clear channels.

Last year, the FCC approved increased nighttime operations for daytimers located on foreign clears. An international agreement authorizing added US nighttime operations on Canadian clears (540, 690, 740, 860, 990, 1010, and 1580 kHz) was signed last year. These stations have already received their night power authorizations.

However, an agreement with Mexico still awaits final signing. It will cover operations on 540, 730, 800, 900, 1050, 1220 and 1570 kHz. FCC officials say an agreement could be penned by spring or summer.

No progress has been reported in negotiations on Bahamian clear channel (1540 kHz) operations.

Frequency moves contemplated

The FCC's latest action was prompted by inquiries from some stations not operating on foreign clear channels on the possibility of moving to a vacant foreign clear channel in their area to improve nighttime coverage.

Communications Investment Corporation (CIC) said it could move its Salt Lake City station KALL from 910 kHz to 900 kHz, a Mexican clear channel, in order to improve its coverage area. The station now operates with a 1 kW directional pattern at night.

CIC said the move, which would technically permit the station to run an improved 1 kW pattern at night, "would not preclude the other possible uses of 900 kHz contemplated by the Commission."

> *The Commission said it does not expect too many stations to take advantage of the new plan.*

However, in its latest order, the FCC established an initial two-year period during which only proposals for new stations or power increases by existing daytimers already operating on foreign clear channels would be allowed.

The Commission said the plan would allow daytimers to improve their facilities. At the end of the two-year period, applications for channel changes by any station meeting applicable interference criteria could be accepted.

However, if after the two-year period a station moves to a foreign clear channel, it must still provide full protection to existing foreign clear and domestic fulltime stations. In line with the Commission's original power restrictions on foreign clears, night power levels cannot exceed 500 W, even if the station's current power level is greater than 500 W.

In many cases, daytimers on Canadian clears received nighttime power levels from the FCC well below the 500 W limit, some in the single-digit range. However, the FCC said those stations can increase their powers by implementing directional antenna systems. After five years, the 500 W limit will be raised to 1 kW.

The Commission also maintained that if a station were to move to a foreign clear, it would have to specify a minimum nighttime power of 250 W.

Compromise reached

"We do not believe special provision should be made to allow existing daytime-only stations on a foreign clear channel to change to another such channel," the Commission said. However, it added that a "permanent prohibition" on daytimer moves would be "overly broad."

"A two-year prohibition on channel usages will permit us to focus on the categories of applications for which there is the greatest need," the FCC added.

Even though fulltimers and daytimers will be allowed to move to vacant clear channels after the two-year period, the Commission said it does not expect too many stations to take advantage of the new plan. Since existing stations on foreign clears will probably take full advantage of their expanded powers, there will be little room for new stations.

"Most of these opportunities would arise in the more remote areas of the country," the FCC said.

FCC docket number is MM 84-281. For more information, contact Joel Rosenberg at 202-634-6530 or Jonathan David at 202-632-7792.

Regulatory News

FCC Tough on FM Applicants

by David Hughes

Washington DC . . . The FCC has adopted a hard-line, "letter perfect" policy regarding errors, even minor mistakes, on FM applications, according to some consulting engineers.

If an FM application is filed with even a relatively minor flaw, the application will be returned as unacceptable for filing, thereby creating delays, even "dead applications," they say.

In some cases, the returned applications could even leave a consulting engineer or attorney open to legal consequences from his client, some said.

"Almost any mistake (on an application) will get it thrown out," said Robert duTreil, of the Washington DC engineering consulting firm of duTreil-Rackley. He said an FCC FM applications "window" last year resulted in a 30% rejection rate.

"Reasonable aspects"

However, the FCC says its new policy, which was implemented last summer to weed out incompetent applications, is not without its "reasonable" aspects. The policy has resulted in a 50% reduction in the application rejection rate, it said.

"The return rate is dropping, and it is dropping considerably," said FCC FM Branch Assistant Chief John McVeigh. While the Commission has cracked down on application errors, he said, it is still being "reasonable" with minor errors, such as typographical mistakes.

In mid-1985, the Commission issued a notice reminding applicants for commercial FMs to include proper specifications or risk having the document "returned without further consideration."

Association of Federal Communications Consulting Engineers (AFCCE) VP Charles Gallagher, who runs his own consulting firm in Lanham, Maryland, said that he has experienced few problems but has heard some "horror stories."

The FCC crackdown on faulty applications took place about a year ago, he said, with a series of April and May notices warning against "sloppy" applications.

Gallagher said that some applications have been returned when a 15-minute topographical site map has been supplied instead of a required 7 1/2-minute map, even if the latter is not available. The application is returned and must be refiled.

However, McVeigh said that while the FCC will not accept an application that is not "complete and accurate," it has been more "liberal" than it had been regarding topo maps.

ERP problems

Another sticky area, Gallagher said, involves determining FM effective radiated powers (ERPs). A curve must be utilized to determine the ERP reduction required in conjunction with the height above average terrain (HAAT) of the antenna.

Because of poor reproduction of the FCC's ERP curve, "three different people can look at the curve and come up with three different power levels," Gallagher said. If the power level is even slightly off, the Commission will return the application.

"I would rather get a slightly lower power level than get a returned application," he said.

In the past, the Commission would call the consulting engineer and get a "minor discrepancy" corrected, he added.

McVeigh said that while the Commission is becoming more strict, it is still "allowing some margin for error" in ERP and HAAT calculations. He cited "rounding errors" and conversion errors from English to metric figures as an example, adding, "We are being reasonable."

In the final stage of an application, when it is close to being granted, the FCC will allow applicants to make amendments in a number of cases, he said. This would include instances such as the Federal Aviation Administration not clearing a tower height, or other "environmental" problems, McVeigh maintained.

DuTreil agreed that the Commission has been a bit more lenient regarding site maps and antenna height recently. However, he cited an application that was rejected because the antenna height was listed incorrectly in what he maintains was an obvious typo.

Legal problems

"Consulting engineers put their reputations on the line when they file an application," said duTreil, adding that they can be sued by a client if a minor typographical error gets an application thrown out. "It's a real dilemma."

He said that the engineering community is trying to get the Commission to "soften up." If that fails, he said he would not be surprised to see the issue wind up in court.

DuTreil added that Washington, DC-based engineers, by virtue of their proximity to the FCC, have an easier time keeping up with changes in the Commission's application processing crackdown.

"Engineers located outside of Washington are facing greater problems; they don't get all the (FCC) releases," he added.

"Backfired"

James Weitzman, a communications attorney with the Washington, DC firm of Shrinsky, Weitzman and Eisen, said the Commission's policy to streamline the application process may actually be backfiring.

In past cases of deficient applications, the Commission would issue a short, one-page document listing the application errors, he said, with the corrections to be made within 30 days.

Now, the application is instead rejected. In many cases applicants are not informed of the problem until it is too late to refile, Weitzman said. In these cases, he added, applicants are filing formal petitions for reconsideration, which require far more FCC time and effort to respond to than the one-page correction document.

He said law firms such as his now must spend more time "looking real hard" at the engineering side of applications. "We just can't deal with fifth-rate engineers anymore."

For more information on the Commission's FM application policy, contact John McVeigh: 202-632-6908.

Preemption

(continued from page 1)

Umansky argued that the FCC has "full authority to ensure that interstate communications not be impeded."

"Reasonable consideration"

Umansky added that in last year's proceedings, which eventually produced the FCC's current RFR rules, the Commission provided reasonable consideration of state and local government concerns on public safety.

In addition, the NAB said that since state and local authorities are precluded from governing interstate communications, including licensing and the allotment of radio and television stations, they should be preempted from "impeding" federally authorized broadcast facilities.

"It is our view that nonfederal attempts to 'unlicense' federally licensed facilities, with only limited exceptions, are preempted as well," the NAB maintained.

"We (NAB) even support a public comment period so broadcasters around the US can voice the problems they've experienced in building or modifying FCC authorized facilities," Umansky added.

For more information, contact the NAB at 202-429-5300.

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).

When, oh, when?

Dear RW:

Oh, when will the fighting stop? "Kahn's better—no, C-QUAM's better."

If AM radio doesn't stop arguing and start investing, there may very soon be no one interested.

I am not an engineer, but I am actively involved in radio as GM of a 17,500 W noncommercial FM station. I instruct high school students in the rules and regulations under which radio stations operate, in addition to broadcast history and technique. I am fed up with what is happening with AM stereo.

Yes, the FCC has hurt the industry with their marketplace approach, but has anyone remembered what system they originally picked? That one went nowhere.

I'd like to take a moment to look at some things I believe AM radio must consider. First, you've got to have a good sounding facility, and it must sound good on the new receivers. That means backing off the highs a bit and realizing there is no need for over-compression.

I own three AM stereo units (Sony's SRF-A100, Sony's XR-33A and a Sparkomatic C-QUAM-only auto unit), and the biggest turnoff is to hear a station over-compressing its signal.

Second, AM stations wanting to upgrade their sound have got to spend the money for good equipment, good carts and possibly a new music library.

Third, station owners must forget about the fringe-area audience. Today's listener is not going to listen to a noisy, weak signal. It's not worth sounding a little louder in the fringe area if you are giving your listeners in your primary coverage area fatigue.

Finally, let's see a good old-fashioned rebate! Once a station has improved the audio and the programming, set up a demonstration for area car dealers, audio sales people and your sponsors. Let this important group know what you're doing and what you really sound like. Then work out agreements with car dealers who will promote AM stereo.

Set up a display at a hot audio sales outlet, with your station as the draw to the AM stereo section.

Finally, don't forget the rebate. Here's how it works. If a person buys a car with an AM stereo radio (must be the system you're using) or an AM stereo receiver at a store you're working with, he/she sends a form to your station and receives a rebate (could be an amount based on your frequency, such as $15.30).

The person would also receive a special program guide, an explanation of what AM stereo is all about, and an explanation of how much better the listener's new radio is compared to his/her old radio.

Let's stop fighting about which system is best. Let's get to work promoting better quality AM radio.

Walt Barcus, GM/Broadcast Instr.
WKHS-FM
Kent Co. Pub. Schools, Massey, MD

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Breaking the RFR Logjam

The NAB's petition to the FCC to formulate a policy statement that will preempt all nonfederal radio frequency radiation (RFR) standards would force the Commission into a collision between its rights granted by the Communications Act of 1934 and states' constitutional rights.

A second collision—between the FCC's own American National Standards Institute (ANSI) RFR standard and state/local perception that the standard will not be strictly policed—highlights the federal government's sidelong approach to RFR standard enforcement. OSHA, which regulates worker safety, is not acting on the RFR issue, while the EPA is scheduled to recommend four RFR levels in June that range from 1/10 of the ANSI levels to no standard at all.

These actions are detrimental to broadcasters. To date, six states have adopted or are considering adopting RFR standards. The Portland, Oregon City Council is close to adopting a standard that contains RFR levels 1/5 those in the ANSI standard.

The FCC should not have to enforce these RFR standards. The Commission is not in the business of public or worker safety. It should concentrate on allocation and interference issues, instead of attempting to address this regulatory area.

The FCC should be urging a more comprehensive administrative approach at the federal level—specifically, within the executive branch of the federal government. FCC Chairman Fowler should approach the Office of Management and Budget to bring pressure on other administrative bodies to begin forming and enforcing a uniform federal standard.

The NAB's petition approaches the problem from the opposite angle. If, as expected, comments on the petition indicate that broadcasters are concerned about the imposition of local/state RFR standards, they will push for preemption.

However, the National League of Cities feels the Commission doesn't have preemption powers. If the NAB's petition ultimately leads to a court challenge, it is impossible to predict what the result might be, or how long the fight might take.

If broadcasters are then still plagued with local/state standards, Congress would have to preempt nonfederal RFR standards by establishing a unified national standard. Since this could take years, a coordinated federal approach between FCC/EPA/OSHA *now* is a better solution.

—RW

A Win-Win AM Stereo Solution

by Gerald M. LeBow

Stamford CT . . . I think now is the time for broadcasters to go for the knockout punch in AM stereo. We need to get the whole thing on the road before there is no AM radio service left to worry about.

With all the problems AM radio has today, such as directional antennas, high noise levels, low fidelity receivers, aging antenna systems and transmitters, etc., AM radio just can't use another black eye in the technical area.

Clearly, there is only one system that can effectively bring AM radio into the 20th century, and that is the Kahn/Hazeltine system.

Since all knowledgeable engineers and virtually all of the major broadcast groups have already decided that the Kahn/Hazeltine system is technically superior, let's take the final step and move forward with it.

In 1985, Motorola Corporation profits were down from $2.95 a share in 1984 to $0.61 in 1985. One would think that a company with such poor performance would concentrate on the business it knows best—two-way communications. The stockholders of Motorola should be delighted if someone came along to buy out the AM stereo division, and help them recoup their losses.

Guest Editorial

But who is going to buy Motorola out? Assuming that 12-15 million car radios and a comparable number of home/portable radios are manufactured per year, you have about 30 million radios per year. If each radio has a $0.25 royalty for AM stereo, then you have about $7 million in royalties revenue per year.

Assuming the bulk of the patents are good for at least another 10 years (remember that Kahn has most of the patents on both Motorola and the Kahn/Hazeltine systems), you have a potential revenue base of $70 million.

It is not unreasonable to think that a venture capital firm or some broadcaster-supported group could come up with sufficient funds to buy out Motorola AM stereo and get paid back with interest from royalties, if we could get Kahn to agree.

Let's further assume that we could get Leonard Kahn to share some of his patent royalties with the broadcast industry. We could set up a broadcaster trust fund, to be controlled by someone like NAB, with proceeds used to fund research to improve AM radio.

Better antenna systems, reduced incidental phase modulation, and the use of synchronous transmitters and the like could be developed to help AM broadcasting survive these troubled times.

Any funds over and above those required for the research would go back into the AM broadcast industry for promotion of AM stereo.

It all sounds simple . . . maybe it can really work! Mr. McKinney, FCC Mass

(continued on page 8)

Gerald M. LeBow is executive VP at Sage Broadcasting Corporation (WNAQ-AM stereo). Write to him at 1 Dock Street, Stamford, Connecticut 06902.

More Readers' Forum

(continued from page 5)

Full of errors

Dear RW:

"I never build projects out of electronic publications," I told my boss.

"They're full of errors and the designs aren't even proven. I think they just use them to fill up space and use up overstocked components."

"But look at this telephone flasher in Radio World. It's just what we need for these new electronic phones. And look, you can get the parts for just $15 at Radio Shack," he replied. I scanned the plan. "I don't believe in tying flimsy integrated circuits to phone lines," I protested.

Out here in the real world, contract engineers usually aren't paid to piddle around with make-work projects.

I went to six Radio Shacks in four counties. I still lacked a triac, 2 W resistor and 2 zener diodes. These came from an electronic wholesaler. I had to substitute 56 V zeners for 60. I could always string an extra series of forward diodes to trim it up.

It has now cost more than double the $15 just to scare up the parts.

If you hook up the circuit as drawn and described in the 15 December issue and ring test it, you will blow out the opto isolators—the ones you drove 100 miles to get.

The RS 276-134/ECG 3047/MOC 3010 has its diode drawn backwards, which means you must also reverse the blocking and zener diodes. That's what you get for etching a board.

Now I'm sure a phone line will read 48-55 V into a good voltmeter. Lighting up an LED is a different matter. In the real world, the 20 cps ring only kicks up the DC 5 or 10 V.

We got one line to strobe the light kind of weakly; the other line wouldn't even break the 56 V zener threshold. You just can't tie a constant voltage sensing device to a dial line that varies hourly, daily, monthly and yearly.

I shorted out the zener diodes (the ones we had to special order), and the strobe works fine without them.

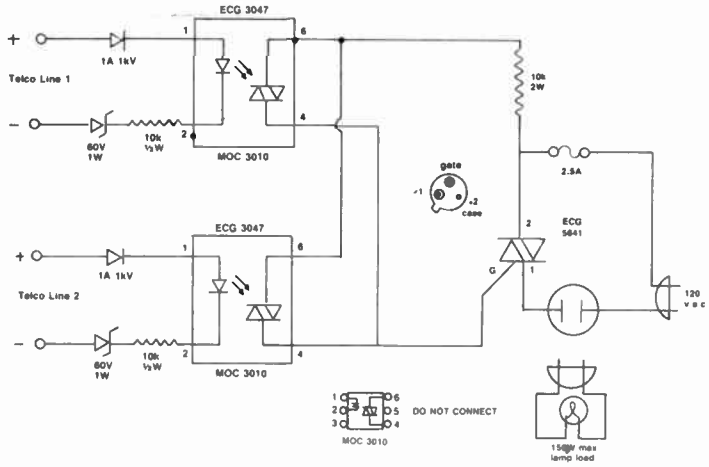
Evidently the loop resistance is high enough to hold the LEDs off.

S.Marshall, CE
WDME-AM/FM
Dover-Foxcroft, ME

P.S. See enclosed schematic which includes zeners, drawn as corrected.

RW *replies: Bob Hoy, CE at WHAT/WWDB, Philadelphia and frequent* RW *contributor, said, "Mr. Marshall makes a valid point. I have also noted that many times there are mistakes made in the printing of articles.*

Figure 1. Telephone line ring-flasher light flashes at 20 p.p.s. when line rings



It was my error. *When I re-drew the diagram from my hastily written notes, I either misnumbered the IC or drew the components backward!*

The simple solution is to just exchange the 1 and the 2 on the diagram of the optical coupler.

I have received several calls about the circuit and they all have claimed success. Apparently they saw my error and made the correction.

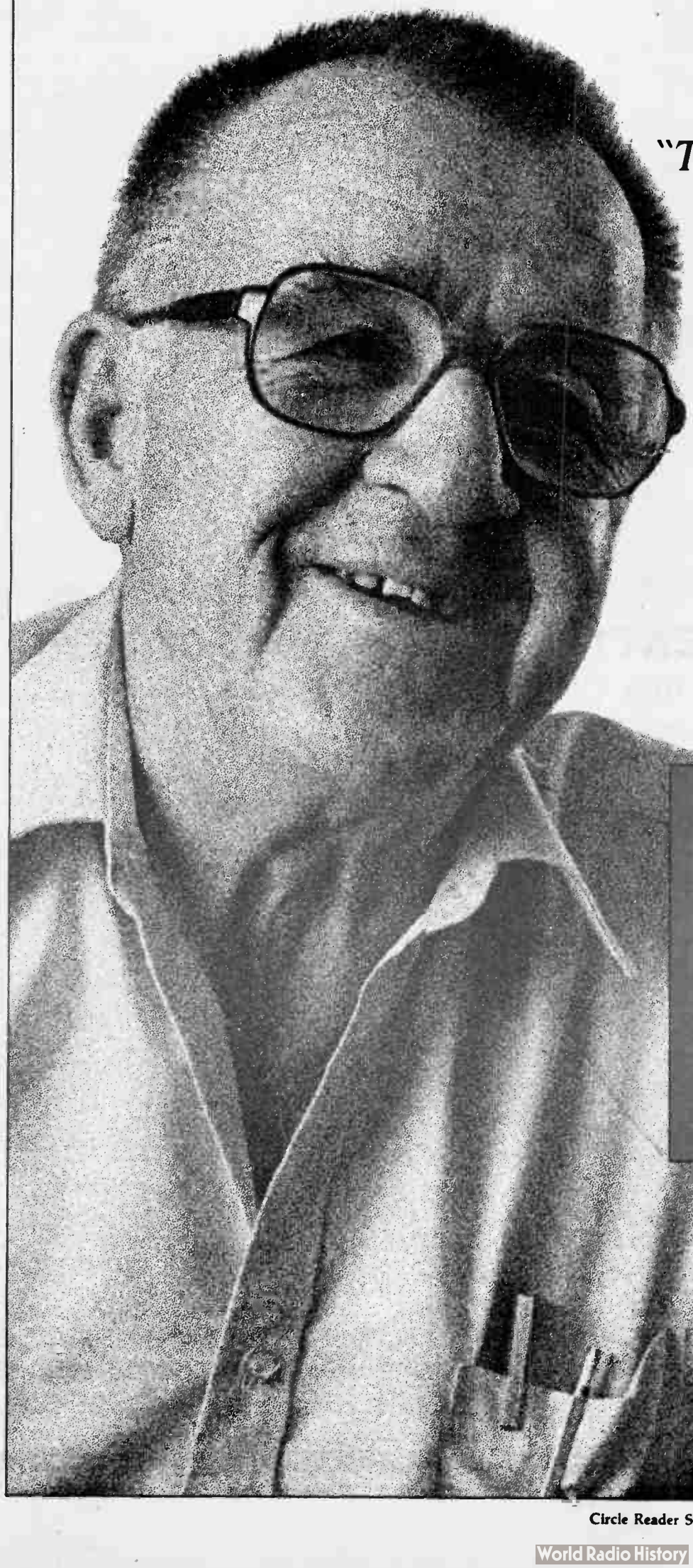
In theory, the LED should blow when hooked up backward. In the "real world," the 10K seems to protect the diode from excessive back current. I have tried this with several LEDs, including an optical coupler (I don't have to drive 100 miles for them) and have not been able to destroy one in this circuit yet.

Why it is not working properly is beyond me. I know that New England Telephone has some strange equipment, but was unaware that it would be that much different.

My first guess would be a wiring problem either of the unit or of the phone line. If a standard phone works, including rings on a line, then the unit should also. There could be a problem with polarity; if it is hooked up to the line backward, it won't work. Maybe Mark Durenberger, RW *columnist, would have more information on the subject of different phone companies.*

My congratulations to Mr. Marshall for sticking to it and making it work. Also, my apologies for the error."

GO WITH THE WINNERS. DYNAMAX CTR100 SERIES



"The Dynamax CTR100 Series cart machine is the best new piece of gear to come along in years. It has outstanding features, all at no extra cost, that others don't even offer."

Tom Bracanovich
Vice President - Engineering
Malrite Communications Group

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AM Improvement Plans Solidify

by David Hughes

Washington DC ... NAB and National Radio Systems Committee (NRSC) efforts on the AM improvement front continue to progress, with the latest plans including development of a new groundwave accentuated antenna.

The NAB has announced that it is drafting a lease for 20 acres of land located 30 miles west of Washington, DC in Loudoun County, Virginia, to be used in tests of new antenna designs.

Groundbreaking for construction of the antennas is set for May, according to NAB Engineer Mike Rau. The tests, announced in late 1985, are scheduled to be conducted this summer.

One antenna design features a combination of vertical, horizontal and diagonal antenna elements, while the other utilizes short vertical radiators and a round electric screen.

On another AM improvement front, the NAB, in conjunction with the activities of the National Radio Systems Committee (NRSC), a joint NAB-Electronic Industries Association (EIA) venture, plans to sponsor a study of AM listening habits.

The study, funded with the EIA, a receiver manufacturer trade association, will examine whether people listen more often to strong signals in urban areas or relatively weak signals in rural areas, Rau said.

If most listening is done in urban areas with relatively strong signal levels, receiver manufacturers could increase bandwidth to improve fidelity. Rau said most receiver manufacturers design narrowband receivers that minimize interference when tuned to weak signals.

He added that a pilot study is scheduled to be held in Chicago before the test will be held later this year.

The NAB is also funding a study on AM "splatter" interference, which is produced on adjacent channels by transmitter overmodulation. The study will address the causes of overmodulation, monitoring reliability and prevention.

A draft for the study, which will be conducted by the engineering consulting firm of Hammett and Edison, is due in June, Rau said.

Discussions of forming an AM preemphasis/deemphasis standard continue. The NRSC met in late 1985 to develop methods and procedures to test and evaluate preemphasis proposals. The subcommittee has held several meetings this year, with another slated at the April NAB Convention, Rau said.

The NRSC has set a June deadline for proposal of a recommended standard. The group is looking at defining suggested limits, or boundary conditions, for the preemphasis proposal.

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

Solution

(continued from page 5)

Media Bureau Chief, has proposed that one or the other of the AM stereo proponents buy out the other and eliminate the systems confusion. He feels that the Federal Trade Commission will not have a problem with this action, and the FCC would certainly support it.

If you assume that a venture capital group would be happy to get a 20-30% return on its investment in a relatively short period of time, sufficient monies could be put up to buy out Motorola. Broadcasters who are already operating with Motorola would be retrofitted at no charge from the royalties collected from the receiver manufacturers.

It's a win/win situation. Broadcasters win because they get a single system and the receiver manufacturers win because they can comfortably manufacture single system receivers.

Most of all, the general public wins because they quickly get a high quality AM stereo service with fidelity and performance comparable to FM stereo.

Drop me a note and let me know what you think of this idea. If enough agree, I believe we can find a way to raise the money needed to take out Motorola and get Leonard Kahn to contribute some to his royalties to this fund.

Once that is done, AM stereo can move forward to help AM broadcasters regain parity with their FM cousins!

KERG Faces May RFR Deadline

by Edward Wytkind

Garberville CA ... A California FM station is faced with an early May deadline for resolving a conflict with state officials who claim the station's radio frequency radiation (RFR) levels pose a threat to forest rangers working atop a watchtower located 66' from the station's tower.

State officials and the FCC have told KERG-FM that the matter must be resolved before California's next fire season, which commences approximately 1 May. By that time KERG must either reduce RFR levels at the watchtower or be faced with continued operation at low power (and without a formal Class C license).

The conflict is only one among a rash of RFR clashes around the US pitting broadcasters against state or local government authorities. In several cases, citizens' groups have managed to initiate local or state standard-setting activity.

ANSI violation discovered

The KERG incident surfaced last August after officials from the Telecommunications Division of the California Department of General Services (CDGS) discovered that the RFR levels at the firetower exceeded the federally recognized American National Standards Institute (ANSI) limit.

After receiving complaints from the California Department of Forestry, which mans the firetower, the FCC complied with the state's demands and reduced the station's power level from 51 kW to 2 kW and granted the station only a program test authority (PTA).

KERG and state officials said they expected the matter to be resolved in time to meet the fire season deadline.

CDGS Supervising Engineer Larry Mertens said the "logical" engineering approach would be to increase "vertical separation" by raising the broadcast tower.

KERG engineering consultant Neil Smith, of the Washington DC firm Smith and Powstenko, said he was waiting for Electronics Research Inc. (ERI), which built the station's antenna, to complete antenna pattern measurements.

"ERI's study should minimize the problem," Smith said.

The bottom line

Mertens said that while the state would review any remedies presented by KERG consultants, he said he believed the station would probably have to raise the tower or move it away from the fire platform because the towers are "simply too close to one another."

"If they propose just an array change, I suspect it may not remedy the problem," Mertens added. "The bottom line is that (RFR) levels must fall below the ANSI standard."

For more information, call William Hassinger of the FCC at 202-632-6460.

Editor's note: As this issue was going to press, Radio World learned that KERG sent a letter to the FCC relinquishing its right to broadcast in Garberville, CA, according to William Hassinger of the FCC's Mass Media Bureau. See details in the next RW.

(continued on page 10)

IDB, South Star Ink Comsat Deals

Washington DC ... International data, audio and video satellite uplink and downlink transmission services, using Comsat's Atlantic and Pacific international satellite systems, have been announced by Culver City, California-based IDB Communications and South Star Communications of Davie, Florida.

Late last year, IDB signed a universal access agreement with Comsat, which allows IDB to use its 27 uplinks nationwide for addressing Comsat's Etam, West Virginia Atlantic Gateway teleport, IDB Marketing Director Peter Hartz said.

Under the agreement with IDB, Comsat will transmit and receive data and programming with international customers who can address Comsat's Atlantic INTELSAT (International Telecommunications Satellite Organization) satellite system.

Second hub announced

Meanwhile, South Star, which has operated its own south Florida international teleport for approximately one year, is constructing a new teleport in Colorado Springs, CO, which should be completed in the fall, according to South Star President Barry Pasternak.

The Colorado hub will be part of an 1,100-acre "high tech" industrial park located adjacent to the US Air Force Consolidated Space Operations Center, South Star said.

South Star has already signed an agreement to use Comsat's Atlantic and Pacific INTELSAT satellites, which, once the Colorado hub is in operation, will allow international customers from Europe, Latin America and any other countries equipped to address Comsat's Atlantic and Pacific systems to send and receive programming and data via C- or Ku-band.

Without disclosing whereabouts, Pasternak said that South Star will an-

US Eyes CCIR's 57 kHz

(continued from page 1)

with RDS and is therefore compatible, Justus said.

US broadcasters would only have to abide by the standard if the FCC mandated it, according to Justus. With the FCC's current deregulatory mood, a mandate would be unlikely, he said, adding "the FCC has already deregulated the (FM) baseband."

McNaughton added that he sees no reason why the FCC would change its current policy allowing "each broadcaster the freedom to choose his own" usage of his subcarrier.

However, Justus pointed out that receivers designed to the RDS standard specifications may not be protected from interference if other subcarrier frequencies are used.

The CCIR's plenary session will essentially put a "ribbon and bow" on the RDS standard, but that, even with the standard, the CCIR's "work will still go on," McNaughton said.

The Yugoslavia session will wrap up the CCIR's latest four-year work cycle. The subcarrier standard is just one of many areas to be examined.

For more information, contact Ralph Justus at the NAB: 202-429-5346, or Neil McNaughton at the FCC: 202-632-6955.

Patent Infringement Alleged

by Edward Wytkind

Atlanta GA ... Scientific Atlanta has alleged that Fairchild Data Corporation's DART (digital audio radio terminal) system, distributed by Allied Broadcast Equipment, infringes on Scientific Atlanta's patented DAT (digital audio terminal) satellite transmission system.

According to Scientific Atlanta VP and General Counsel David Eggers, the company's patent counsel "believes" there has been a patent "infringement."

"If there is an infringement, than anyone who makes or sells the product would be in infringement," Eggers said.

Fairchild would not comment on the matter, but Allied officials spoke on the company's behalf.

Jeff Nordstrom, Allied Satellite Division Sales Manager, said Fairchild and Allied recognize Scientific Atlanta's patent on the DAT system, but added that it does not mean Fairchild's DART system violates any patents.

Allied said it received a letter regarding Scientific Atlanta's patent on the DAT digital transmission system, but that the letter failed to cite the particular component or circuitry patents being infringed upon by the Fairchild-built DART system.

"Our position is that there is no violation on the grounds that Scientific Atlanta has failed to point out the specific part of the system being violated," Nordstrom said.

Scientific Atlanta officials would not divulge details on this aspect of the case.

Fairchild "finds no infringement" or "basis" for changing its manufacturing plans for the DART satellite transmission system, Allied President Roy Ridge said.

Citing a lack of technical documentation behind Scientific Atlanta's allegations, Ridge said that Fairchild plans to continue production of the system and Allied will continue to sell the DART system until Scientific Atlanta gives technical backup to its claims.

Allied said the case is not expected to go to litigation. While Allied and Fairchild have stated that they will continue with production and sale of the DART sytem, Scientific Atlanta said it was too early to comment on whether the company plans to initiate any legal action.

Two Comsat Deals Inked

(continued from page 9)

nounce two more teleports later this year.

Upon completion of the Colorado hub, Pasternak said South Star will be able to offer broadcasters a "one-stop shop" ranging from ENG to SNG (satellite news gathering) services.

He added that the greatest application by broadcasters of South Star's services will be for the exchange of overseas news and other programming. Pasternak also said that overseas customers will be able to take US college courses via satellite, which he said could result in the formation of a worldwide educational system.

Bypass technology

IDB's Hartz said the Comsat/IDB venture provides bypass technology to broadcasters and data users, and allows them to avoid having to use AT&T services.

He explained that before deregulation and the divestiture of AT&T, and prior to the availability of such bypass services, broadcasters were left with little choice but to use "more costly, less efficient" AT&T services for international data and audio transmission.

IDB's customers will include most countries in Western and Eastern Europe, and any nation that can address Comsat's Atlantic INTELSAT satellite system.

As an example, Hartz cited a Greek customer who transmits data via satellite from Greece to New Jersey and publishes a newspaper in the US. Among various US radio stations who are customers, he said a Kansas City, MO station receives and transmits audio to and from Moscow.

For more information, contact IDB at 213-870-9000 or South Star at 305-472-8111.

Computer Aids FM Patterning

by Jack Cheese

Jalisco NM . . . QuesoComm is an engineering design firm specializing in the construction of directional FM and TV transmitting antenna systems. Although directional FM is relatively new in the US, it has been in use worldwide for many years.

Over the last two decades, QuesoComm has developed sophisticated methods for testing and patterning directional FM arrays. Despite our best efforts, using a computer-aided test range, we often found that FM patterns would change once the antenna was installed at the customer's site. This required costly and time consuming re-patterning on-site.

Since our profits could be quickly diminished by field pattern work, we were committed to devise a foolproof method of predicting FM directional characteristics that would not change after an antenna was installed by the customer.

Simulate site

Much research was done before we finally arrived at an answer, which was simple and not surprising: we merely had to *simulate* the client's site on our test range.

Our first client was for a new class A FM in California. Due to a close-spaced adjacent channel station, a tight pattern was necessary.

Our engineering team was flown to the proposed site, where the area was surveyed and exacting drawings were made.

The tower was to be in a downtown area of the city of license, hence details of nearby buildings, utility lines, streets, etc., were noted.

The antenna was to be a four-bay, circularly polarized unit with patterning to prevent interference to the adjacent channel station about 20 miles away. While the antenna was being constructed in our manufacturing facility, a construction crew was recreating the client's city (for about a 100-yd radius) on our test range, which is about 20 miles east of rural Jalisco, NM.

The antenna was assembled and "rough tuned" in our lab, then mounted on the test tower. A grid of 400 RF sample points at 100' intervals would relay intensity measurements back to an in-house computer, which would create a three-dimensional CRT display of radiation efficiency.

Test data

All was ready. The 10 W exciter was turned on, and the test data began to come in. The pattern was close, but additional adjustment was necessary. The computer software was able to predict what antenna members and parasitic elements needed modification. The changes were made in a few hours by our resident "tower jockey," and the array was retested.

Perfection! . . . Until a "surprise" was noted.

Testing until now was done with a 400 Hz tone modulating the carrier. The oscillator ground was accidentally disconnected, modulating the exciter with hum, noise and random RF pickup.

We noticed that the pattern had *changed*, obviously due to an excessive Q or bandwidth restriction. Due to this added variable, it was deemed necessary to not only duplicate the client's tower site, but their predicted modulation as well.

FCC petitioned

Since our FCC transmitting permit allowed only brief carrier-on periods with test signals, we petitioned the FCC to change our status to allow more realistic test conditions.

QuesoComm's attorneys contacted the Washington, DC office of the Commission, and after only a few days of legal footwork, the FCC responded by changing our license to a Class A/F (100 W maximum, for Field test purposes only) and issued call letters KCHZ-FM.

A source of typical "program-type" modulation was procured, connected to the exciter, and final tests and patterning were once again underway.

After six hours of computer aided adjustment, the desired results were achieved using the *same* modulation format

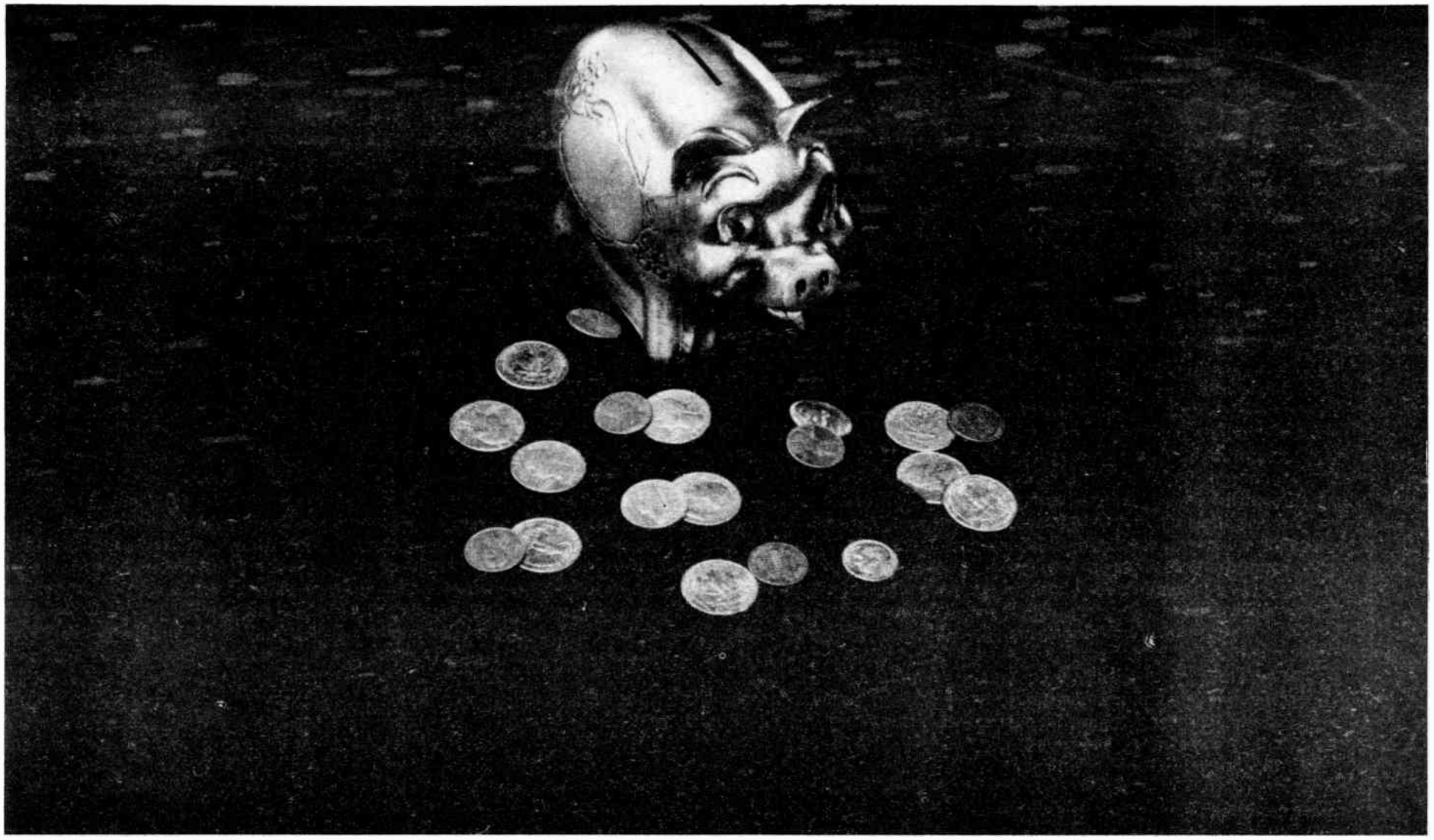
(continued on page 21)

Jack Cheese is president of QuesoComm, Inc. and an infrequent contributor to RW. *He cannot be reached.*

Engineer adjusts pattern during tests.

Tower mounted on recreation of typical building in client's city.

Fine tuning the modulation source.



The best sounding console on the market costs less per day than a spot announcement!

Get an up-scale look and high-end sound for about $2.76 a day! With a Harris Medalist audio console, ease of ownership is only the beginning . . .

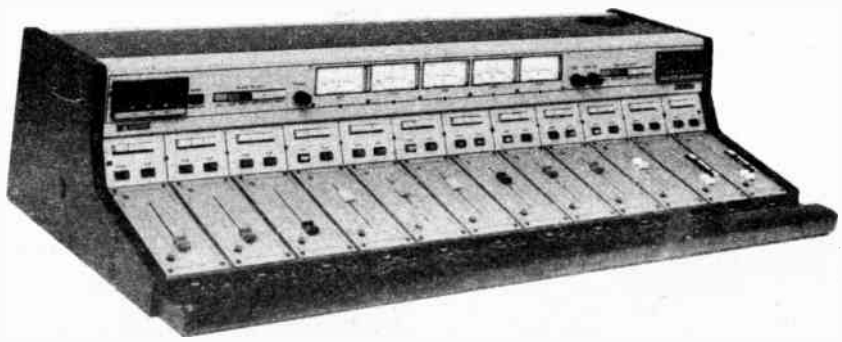
Complete RFI immunity
The studio sits right in the major lobe of the 50 kW directional antenna pattern at KXEN Radio in St. Louis. A mere 300 feet from the nearest tower. Chief Engineer Pete Niekamp: "Our co-located studio is right in our own station pattern. Harris promised radio interference-free operation with a Medalist-10. They delivered."

Superb Sound
"In more than 15 years in radio, the Medalist is the most versatile, smoothest and easiest to operate of any console I've seen," says Ken Martin, Program Director at KZEL Radio, Eugene, Oregon. "A new operator can learn the Medalist quickly. We are in a very competitive market, where all stations have gone as loud as they can. We're winning because we're loud *and* clean. Forty percent of our music is on CD's, and the Medalist provides an excellent sound with this exceptionally clean source material."

Staff morale builder
At Liggett Broadcast Group's WHNN Radio, Saginaw, Michigan, the Harris Medalist-12's impressive appearance and performance belie its modest price. "Our operating staff perceive they are working with a much costlier board," says VP/GM Dan Stewart. "The Medalist is a real morale builder."

Better books
Both KLVI and KYKR Radio, Beaumont, Texas, enjoyed ratings gains in the latest survey. "This is due in part to the Medalist consoles," says VP/GM Candye Anderson. "The AM people were envious when the FM side got the first Medalist. Now we have two. Both stations sound great, and the operations people are quite enthusiastic."

No match for the money
Among 8-, 10- and 12-channel consoles, there's simply no better value than the Harris Medalist audio console. Contact Harris Corporation, Broadcast Group, P. O. Box 4290, Quincy, IL 62305. (217) 222-8200.



HARRIS

For your information, our name is Harris.

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Slide Rule Once CE Requisite

by Floyd E. Hall

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

Only a few short years ago, we didn't have calculators or computers, but instead had to do all mathematical computation with a pencil and a piece of paper, and with log and trig tables?

Old Timer

I wonder how many young engineers have any concept of how the mathematics of electronic engineering were developed. In 1614, John Napier of Merchiston, Scotland, in his "Cannon of Logarithms," set forth his purpose in these words:

> Seeing there is nothing (right well beloved students of mathematics) that is so troublesome to mathematical practice, nor doth more molest and hinder calculators than the multiplication, division, square and cubical extractions of great numbers, which besides the tedious expense of time are for the most part subject to many slippery errors, I began therefore to consider in my mind by what certain and ready art I might remove those hindrances.

So, he developed his system of logarithms. After some independent investigation, I have come to the conclusion that most electronic "engineers" don't know the meaning of the word.

For your information, a logarithm is an expression of the power to which the number 10 must be raised to equal the number. So the logarithm of the number 100 equals 2.

Some of you will laugh at that, but let me tell you, there was a time, even in my life, when that was very important.

The first calculator

The first calculator was developed—or should I say "invented"—in 1620 by Edmund Gunter of London. He made a straight logarithmic scale, based on Napier's logarithms, and effected calculation with it with the aid of a compass.

Now—skipping over a lot of history—in 1891, William Cox developed for Keuffel and Esser Co. a revolutionary slide rule, with scales on the front and the back. K & E became the first manufacturer of slide rules in the US.

When I began in this business, a slide rule was our only calculator. When I sat down to design a directional antenna, I also had at hand tables of trig functions to four or five places, besides the logs on my slide rule.

What we do now in a few seconds with a programmable calculator or a personal computer might then have taken us hours, or sometimes days.

I bought every slide rule K & E came out with, and I always carried a 5" log-log rule in my shirt pocket.

I remember I went to a station up the coast one time, and the young chief engineer told me that some guy had stopped by a few days before who said he was a consulting engineer .

The young boy said, "I don't think he was a consulting engineer, since he didn't have a slide rule in his pocket, and he didn't smoke a pipe!" (I was known far and wide for my pipe smoking in those days. Few stations in the West didn't have one of my pipes on top of the transmitter or phaser!).

One of the greatest inventions for us in the radio business was, first, the Morrison Radio Engineers Rule, K & E No. 4138, and then the Cooke Radio Slide Rule, K & E No. 4139. The latter was invented by Nelson M. Cooke, chief radio electrician, USN , and member of the Institute of Radio Engineers (I don't remember the date, but it must have been about 1939-41).

I wonder how many computer programmers can use a Log Log Decitrig Slide Rule?

Transformer puzzler

Now, I want to tell you about something which I first experienced about 25 years ago and have recently run into again (and which still puzzles me).

First, let me tell you that way back in the '30s, in the bottom of the Depression, I started a transformer manufacturing business (a very small one, but it kept my family and me off relief).

I acquired an enviable reputation for building quality custom transformers. I built them for broadcasters, oil-well research and exploration companies, and for hams, and also did rebuilding.

When the Class B audio amplifier was invented, I built high power modulation transformers for some of the first high level modulated broadcast transmitters.

I am only telling you all this to profess some expertise in the design, construction and maintenance of transformers, both power and audio, and in the design and construction of various types of inductors. (How many of you know what a saturable reactor is?)

About 25 years ago, the owner of a 5 kW AM operation about 70 miles northwest of me requested my help in finding the trouble in his big, old 5 kW transmitter. I promised him I would come out, but asked to speak to his CE in order to get some idea of what he might need.

The CE, a mere boy, said than for some time distortion had been high, and he could not achieve more than about 50% or 60% modulation. I took some tools, and my trusty, old General Radio 1650 Impedance Bridge, a couple of mica condensers, and took off for the desert.

Inductive reasoning

When I got there, the transmitter wouldn't modulate at all. All it would do was make a weak, raucous noise.

Since the transmitter was under remote control, I of course checked the audio to it, and even hooked up a distortion analyzer to the output of the driver stage. The audio was clean at that point, and of sufficient level. This then left the modulator stage.

The modulator currents swung with drive, but the PA showed absolutely no positive modulation. In those days, many of these old 5 kW transmitters had a metal cabinet out back which contained the plate transformer, the modulation transformer, and the modulation choke and condenser. These things were 2-3' high, and weighed anywhere from 200 to 400 pounds!

At this point, everything I had found so far pointed to either the modulation transformer, the modulation choke or the audio bypass condenser. I took out my old, trusty General Radio impedance bridge and proceeded to measure the impedance of the windings on the modulation transformer.

Nothing! I couldn't get any kind of an AC reading. I worked and fiddled with the bridge, becoming more confused by

(continued on page 14)

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

64 Years Ago in Radio World

The radio telephone is one of the latest contributions of science to humanity. It is, briefly, a means whereby the voice of a speaker or the song of a singer can be heard in natural tones at distances of hundreds of even thousands of miles.

Special receiving apparatus must, of course, be used to hear the messages sent out from the transmitting stations. These instruments are, however, surprisingly simple and, except for the longest distances, can be operated by anyone without technical experience. All that is necessary is to run a well-insulated wire, preferably over 50 feet long, from any two convenient points, such as the house and the garage, and connect the receiver to it.

The radio waves, sent out by the transmitting station in all directions at the rate of 186,000 miles a second, strike this wire and induce in it currents corresponding to those generated by the sound waves in the transmitting station. These currents are caught by the receiver and transformed back into the sound again, and thus the listener receives the message just as it was delivered.

Some of the economic aspects of this new enterprise are very interesting. It has, in the first place, created what is practically a new industry, heretofore very limited. It is now running into many millions of dollars annually.

It is also benefitting the nation by providing farmers with a means of getting, instantly, news, market reports, weather forecasts and other useful data, and also by making his farm a much more attractive place for his family than it has been heretofore. That this will have some influence in improving agricultural conditions can hardly be doubted.

For the average dweller in a town or city, it has great educational possibilities, as it brings to him music and ideas of a kind that he would never otherwise get. Nor must its special ability to bring the services of the church into the home be overlooked; there is a power for good in this that can hardly be overestimated.

What the future will bring forth is difficult to determine with certainty, but that this system will have far-reaching social and economic results is beyond question.

by William H. Easton, PhD, in *Forbes Magazine*.

Reprinted from Radio World, 1922

Slide Rule Once CE Requisite

(continued from page 13)

the minute.

I checked the modulation choke and got a reading of about 50 henrys. The modulation condenser checked right, close to its designated capacity, and the dissipation factor was low.

Back on the modulation transformer, I couldn't get any kind of a reading or bridge balance. I felt disgusted with myself, the bridge and this whole damn business! "There must be something wrong with me," I thought.

Finally, I told these people I believed the trouble was in the modulation transformer, but that I was unable to prove it to my satisfaction. Since a replacement for this thing, even in those days, would cost between $3,500 to $4,000, I was not about to climb out on that limb!

At this point, the young CE, who had suspected the transformer some days before, spoke up and said they could get it rewound in Los Angeles for about $1,100.

I couldn't quite reconcile the evidence, or say for certain there was anything wrong with the windings. The DC resistance levels of both the primary and secondary were just about right, and I didn't believe the measurements indicated any shorted turns. However, they decided to have it rewound.

Before I left, I hooked up the modulators Heising with the choke and condenser, and got them on the air with about 50% modulation and a clean sound.

A week or 10 days later, the CE called me and said they had gotten the transformer rewound. The shop that did it could see nothing wrong with the windings. The CE said he had installed it and it still didn't work!

A flash

This business was beginning to bug me—as the kids said in those days—and then I got a flash. I had a client down south with the same 5 kW transmitter, and when I called him he said, "Sure, do what you want. Just get me back on the air by 6 AM."

I told the CE with the crazy transformer to put the thing in the pickup truck and get it down there by midnight; we would see if the thing would work in this transmitter. I knew *it* was working all right.

Around 11 PM I asked the jock on the board how many spots he had in the next hour, and he said, "None. You can shut it down any time you want."

So-o-o, I took the GR 1650 Impedance Bridge and measured the modulation transformer before the kids got there. The bridge worked perfectly, the impedance checked out correctly and now I knew! There wasn't anything wrong with me, I said, bragging a little bit. It's hard to believe, but the big old chunk of iron just wouldn't magnetize.

> *"I told the CE with the crazy transformer to put the thing in the pickup truck and get it down there by midnight."*

I knew it sounded crazy, but I was sure I was right.

When the kids got there with their big hunk of iron, I tried to measure it just as I had the good one, and got the same confusing results I had gotten at their station. I then hooked it up in the good transmitter, and it acted exactly as it did in theirs!

There could be only one thing wrong with it. Believe or not, that 300 pounds of core just had no permeability; it just wouldn't charge. This old transformer was just a coil of wire, with absolutely no inductance. Of course, my client got a new one, and was again back in business.

What brought all this on was the fact that, since that time, I have found two more of these, and one just recently in a transmitter not more than about 10 years old. This is strange.

Apparently the high-permeability silicon steel alloys used in the construction of these transformers, in some cases at least, have a definite life. I have never heard of this happening in a power transformer—that is, a 60 Hz step up or down.

I will welcome any comments or description of a similar experience from any of you. In the meantime, I plan to contact one of the old steel manufacturers I used to buy core material from, and see what they can tell me. CUL!

Gauge Tests Cart Tape Tension

by Winfield S. Standiford

Washington DC . . . Tape cartridge failure on the air has plagued broadcasters since the first machine was put into service. Until now it has been very difficult to precisely monitor the mechanical performance of a tape cartridge while it was operating to determine if it had been improperly manufactured and loaded, or if it were reaching the end of its useful life.

The solution

Tentel Corporation, working with an idea from the WKYS Engineering Department (see Figure 1), has built a low-cost, portable tape tension gauge that will measure, to a high degree of accuracy, tape tension within any NAB standard tape cartridge. The new gauge is a modification of the reel-to-reel tape tension gauge Tentel has built for years.

Use of the prototype of this device has enabled us to get our on-air cart failure rate from an average of one every two days down to one every two months. It has consequently lowered our operating costs in that we now remove a cart from service based on hard test data that tells us it is a candidate for failure, rather than on guesswork.

Money-saver

It has also saved us money in that we spend less time doing unnecessary cart machine maintenance. In the past, a large number of cart failures on a single cart machine triggered a search for a problem in a player because there was no way to easily check out a failed cartridge.

The cause of any failures that happen can now be quickly pinpointed.

The gauge is simple to use. You first need a cart machine. It can be any cart machine.

Neither the audio sections, nor the heads or the external tape guides are needed. All you need is a transport with the ability to pull tape at a constant speed.

We use an obsolete, out-of-service machine with the top removed.

Then you simply insert the cart, start the tape in motion and carefully insert the tape probes into the cart and over the tape.

To help ease the probes over the tape without damage, Tentel has offset the center of the end of the probe. This works quite well. To date, we have tested in excess of 3,000 tape cartridges by several leading manufacturers.

What is a bad tape?

The characteristics of the many tape cartridges we measured with the Tentelometer indicated somewhat different performance among carts of several manufacturers.

The NAB "Standard for Cartridge Tape Recording and Preproducing" states in paragraph 2.1.1.5:

> The tape tension measured with tape moving in the direction of normal travel, with heads and external guides eliminated, and any braking system defeated shall not exceed three ounces.

With this in mind, we elected to replace all tapes in our library that reached or exceeded the 3 oz. mark.

At the suggestion of one cartridge manufacturer, we imposed another limit:

> Tape cartridge tension shall not vary more than ½ ounce while tape is being pulled.

These were the standards we applied when we tested our complete music and commercial library. After testing a large number of cartridges, we learned to further interpret some of those readings.

Tapes that have been dropped or mistreated will exhibit wide variations in tension as the tape normalizes. This happens after a few seconds of play.

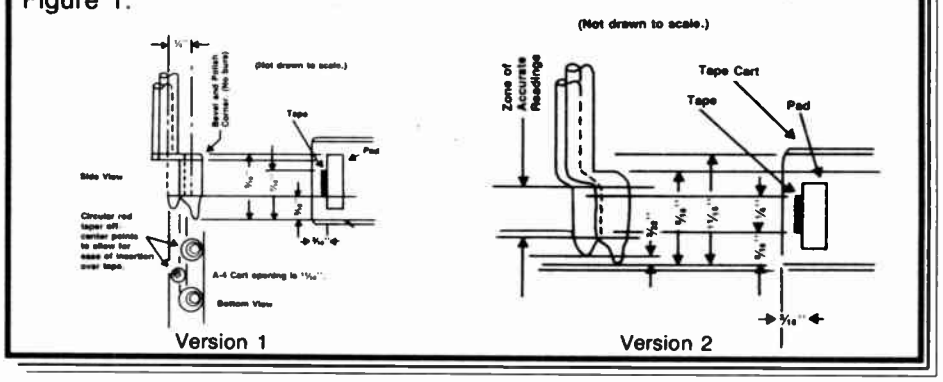
Some recordings that were pulled out of air-play rotation and had been out of service for several months exhibited high tension for the duration of their first play. After that they moved to within normal limits.

Apparently something happens between the layers of tape that causes them to not slide against each other. We do not know the exact cause.

New tapes that had been sitting on a distributor's shelf for long periods, or

(continued on page 16)

Figure 1.



Scott Standiford is manager of Engineering for WKYS-FM. He can be reached at 202-885-4330.

Gauge Tests Cart Tape Tension

(continued from page 15)
that had been subjected to wide variations in temperature during shipment, tended to act the same way when measured on the first pass through the machine.

Brand, style differences

In our tests of measuring a large number of one style of tape cartridge, tensions averaged between 1½ to 2½ oz. When an occasional unit of this style measured out at 0 oz., we rejected it.

Another style of cartridge measured zero in almost all samples tested. This is apparently normal for this particular cartridge, and could be considered acceptable.

If you run into this situation and you are playing stereo material, it might be worth investigating the performance of zero back tension cartridges in your tape player in reference to phase stability.

Regardless of the brand or style of cartridge used, we rejected any tapes with tension greater than 3 oz. or that varied more than ½ oz. in normalized operation.

These limits we imposed on our tape library are valid for the tape carts we use and the machines in which they run. With different machines and tapes by other manufacturers, these limits might not apply.

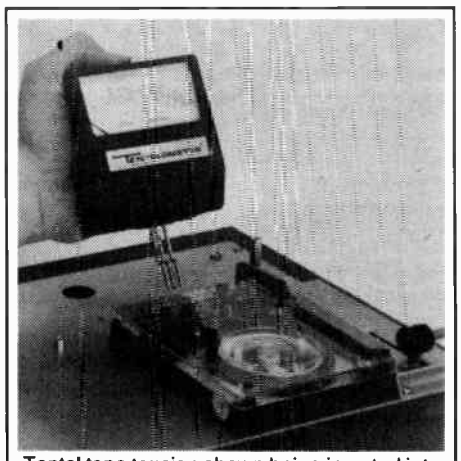
It's best to consult the data supplied by the manufacturer of your tape cartridges to determine where you wish to establish your limits. It might also be helpful to consider what the manufacturer of your cart machine feels is optimum back tension for best performance in the player you own.

Failure correlates

We found a correlation between failure of cartridges and their lot numbers. The failure rate is somewhat lot dependent. It also varies with tape length.

In addition, we found that if a tape fails in a player, that player has an increased chance of tape slippage until its capstan and idler are cleaned. A cart failure leaves deposits on these parts that reduce a player's ability to pull tape.

We routinely clean our player heads, capstans and idler every eight hours. We also clean the capstan and idler after each failure.



Tentel tape tension shown being inserted into a Broadcast Audio Cartridge for quality testing the cartridge.

The Tentel Gauge is proving itself a very useful tool in pinpointing the cause of our cart failures. It has enabled us to radically lower our on-air cart failure rate and keep it at acceptable levels.

The gauge has the added benefit of being able to accurately measure tape tensions at various points in the tape path of a reel-to-reel recorder. The movement is quite sensitive to small variations in tension, and gives the user much information needed to identify and resolve mechanical problems in tape recorders.

Editor's note: For further information on the Tentel T2-H7-AC broadcast cart tension gauge, contact Wayne Graham at Tentel: 800-538-6894 (except California) or 408-379-1881.

Seasons Affect Signal Strength

by Ronald F. Balonis

Wilkes-Barre PA ... In these days of competitive radio, there are few engineers who have not had to give an answer for or who have not had to find causes for some sort of signal complaint.

Signal complaints come from just about everyone; listeners, sponsors, salespeople and managers. It seems as if everyone now has a critical ear, and all want an answer for what they hear or don't hear.

Sometimes the complaints are posed as friendly questions, but sometimes they come as veiled accusations, and are coincidental with the latest ratings book.

Regardless of origin, these complaints are a sign of the times in that even engineers cannot escape the effects of today's competitive radio marketplace.

Whatever the source, the complaints do serve as useful feedback in keeping an engineer in this era of deregulation alert. Some signal complaints are readily explained away by the mediocre AM radio that the lack of standards has given us, and some actually point to a system problem.

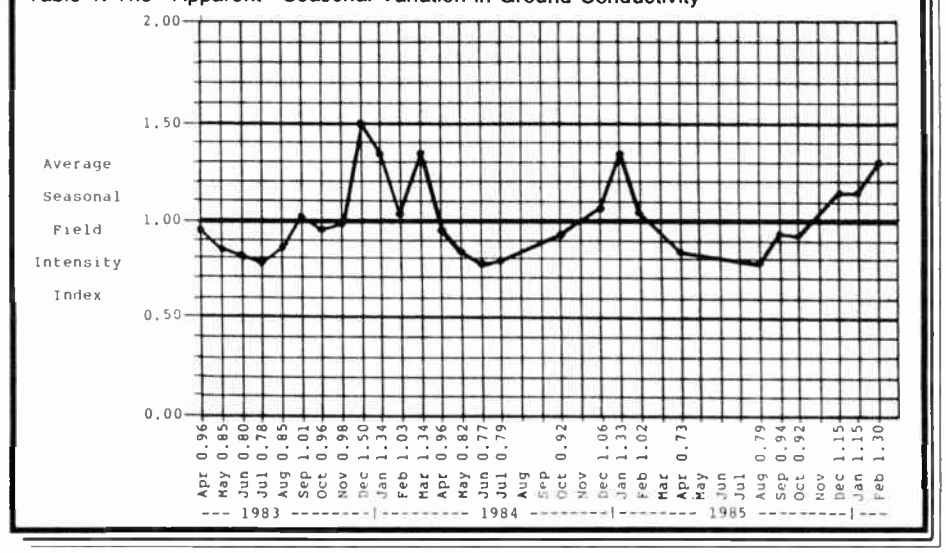
However, there are some that can't and don't. These are the most puzzling and troublesome, and they become even moreso when you, as the engineer, can actually hear and verify them, yet can find no cause, either electrical or mechanical.

I've had my share of this sort of signal complaint. Over the years, I've found many of them to be seasonal and directly related to the environment. Initially though I didn't know the cause.

It is my determination that the "apparent" seasonal variation in ground conductivity causes AM signal strength fluctuations. The analysis below is specifically based on the propagation of AM signals in northeastern Pennsylvania, but I'm sure it is applicable, within limits, elsewhere.

Ron Balonis is CE at WILK, Wilkes-Barre, PA and a frequent contributor to RW's "Broadcast Computing" section. He can be reached at 717-824-4666.

Table 1. The "Apparent" Seasonal Variation in Ground Conductivity



In the days of weekly monitoring point readings for stations with directional antennas, there appeared in the readings of some of the monitoring points a seasonal, cyclical variation.

The seasonal effect, depending on the monitoring point, caused the signal strength readings to be lower in the summer and higher in the winter. It is one of the villains to be wary of in the care and feeding of a directional antenna.

As with all things, and especially so with a directional antenna, it is always

(continued on page 18)

Seasons Affect Signal Strength

(continued from page 17)
best to correctly pair causes and effects; attempting to adjust for environmentaleffects can lead to a maladjusted directional antenna.

My experience with the seasonal effect on a directional antenna's monitoring points led to the assumption, unproven at first, that it was the prime cause of seasonal signal complaints.

To document and compile proof of the seasonal effects on AM signal propagation, several years ago I started making readings, at four different locations, on eight of the AM radio stations in northeastern Pennsylvania.

I used a random, once monthly, reading schedule—that accounts for the couple of months' readings missing on the graph. The frequencies of the stations ranged across the AM band from 590 kHz to 1540 kHz and their power levels ranged from 1-5 kW.

All of the measurement locations exhibit the seasonal effect, but, to simplify things, only the readings from one of the locations are used in this analysis. This location was the most balanced of the four in that the signals from all eight stations have to traverse a similar type of terrain: a populated valley for 3-4 miles, and then rolling mountains for another 5-10 miles.

It was also the only location where the signal levels are in the same decade on the field intensity meter: 1 to 10 mV/m.

The graph in Figure 1 displays the results of three years of readings; it shows the influence of the seasonal effect on propagation better than words can.

For plotting on the graph, the readings were transformed to average monthly indexes by first computing a monthly average index, from which the three years of readings (27 readings) for each station were averaged.

Each station's monthly field intensity reading was then divided by its three-year average to arrive at a monthly seasonal index.

The monthly seasonal indexes were then averaged to give the average seasonal field intensity index, which is plotted by month to make the graph.

The graph shows, as an indexed value, the average groundwave signal variation for AM radio in northeastern Pennsylvania for the last three years. The seasonal signal variation ranges, as an index, from a low of 0.78 (78%) in midsummer to a high of 1.50 (150%) in midwinter. This range proves that many signal complaints were not only valid, but also that the seasonal change in field intensity levels due to an apparent variation in groundwave conductivity are real and, more important, significant.

The actual causes of the "apparent" seasonal change in conductivity are many, and result from a sometimes additive and sometimes subtractive summation of them.

However, none of the causes is actually controllable; the seasonal propagation effect is, in effect, just another fact of life for AM radio.

As far as groundwave propagation is concerned, the antenna and the ground can be considered as an extension of the transmission line. But this transmission line, having the ground as one conductor and air and everything on and in it as the dielectric, behaves like a seasonably variable lossy line because the ground and the dielectric change with the seasons.

When the temperature increases, ground moisture declines, vegetation covers the ground, and its losses increase, decreasing the signals. When the temperature decreases, the ground becomes wetter or freezes, the vegatation dies, and its losses decrease, increasing the signals.

As the groundwave travels, it spreads out and follows an effective attenuation rate somewhat greater than that predicted by the theoretical inverse distance law. The attenuation also increases with increasing frequency and decreasing conductivity.

It appears, from my readings, that the general effect of the "apparent" seasonal variation in conductivity is that it increases with distance from the antenna. This, of course, translates into a coverage area which changes its size seasonally, and brings on the signal complaints.

Though this analysis cannot be extrapolated with a high degree of confidence to all radio markets, I'd expect to see a similar seasonal effect in those radio markets with like climate and terrain.

Whatever its effects, this seasonal variation is a rather benevolent thing that affects all AM stations in an area in about the same way and at the same time. Nothing can be done about it, but the knowledge of its effect and causes can serve to decrease an engineer's stress.

Identifying Business, Market

by John M. Cummuta

Chicago IL ... Is IBM in the computer business? No! Is Federal Express in the parcel-post business? No! Is United Airlines in the airlines business? No! Are you in the radio business? No!

Have I lost my mind? No! I'm illustrating the most fundamental principle of marketing, as we continue with our series on basic marketing concepts for your business, and those of your clients.

Marketing is a process, and every process has a beginning. For marketing,

Engineering-Manager

that genesis is in the identification of the business for which the marketing plan is developed.

"Identification of business" probably sounds like a silly term, seeing as you're obviously already in the business, so the identification of that undertaking should be evident.

But look back to my queries and answers in the first paragraph.

Is IBM in the computer business? Well,

> *"The identification of the business must be from the customer's vantage."*

they manufacture and distribute computers, but from a marketing standpoint that's not the business they're really in. Why?

Marketing efforts are always driven from the customer's perspective. They're constructed to identify and meet real or perceived needs in the target marketplace. So the identification of the business must be from the customer's vantage, and in terms of his or her needs.

Identifying your business

Is IBM in the computer business? No! IBM is in the "solving-the-data-and-text-processing-and-storage-needs-of-businesses" business.

The customers—those businesses out there with piles of information to keep track of—couldn't care less about transistors, ICs, keyboard design, display technology or software advances.

They're not interested in *computer* features or developments. They only know that they have problems or needs, in terms of information processing and storage.

So, IBM, being the savvy marketing company that it is, projects itself as the eternal solver of those exact problems.

You'll never hear IBM talking about how many "K" of memory its products have, or how fast their processors are. While its machines are among the slowest on the market, it owns the lion's share of the business. Why?

Because IBM says, "Mr./Ms. businessperson, you need to get a better handle

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

FM Xmsn/Reception Outlined

by Ed Montgomery

Lesson 4

Annandale VA ... FM broadcast systems employ high power transmitters to broadcast signals over wide areas.

Commercial FM was originally classified into three categories by the FCC. The power assigned was related to the antenna's height above average terrain (HAAT).

Class A stations are authorized a power of 3,000 W with a HAAT of 300'.

Class B stations operate with 50,000 W with a HAAT of 500', and Class C stations operate with 100,000 W with a HAAT of 2,000'. These channels, assigned to localities around the country, were for many years left unused or not operated at their maximum power and antenna height levels.

Docket 80-90

Docket 80-90, issued by the FCC, recently established a limit on how long an FM station could be operated at substandard levels. The Commission gives broadcasters a deadline for bringing facilities up to required standards, after which they would be restricted to their existing power and height forever.

Docket 80-90 also allows the establishment of additional FM broadcast channels at locations around the country presently not served with an adequate local signal.

The wavelength of the FM broadcast signal is in the vicinity of 9'. The broadcast antenna is considerably shorter than this, and is often shaped in a circular or "V" form. This type of design produces a more circular radiation pattern. The radiation pattern of one FM antenna element is shown in Figure 1.

As illustrated, one FM antenna element radiates energy skyward and at high angles that are high in relation to the ground. The energy sent into the sky is lost, while the energy sent toward the ground can reflect off it and cancel out the signal in the receiver.

High gain antennas

Broadcasters often choose to avoid such losses by using a high gain antenna. The high gain antenna consists of several antennas stacked one wavelength above the other on a tower (Figures 2 and 3). The effect of doing this is to limit the amount of radio energy sent into the sky and at high angles down toward the ground.

The high gain antenna compresses the radiated energy and forces it into a more elliptical shape. This, in turn, sends the signals farther away from the transmitting antenna.

The amount of gain is usually related to the number of antennas used. Each manufacturer has a specific gain value for its particular high gain antenna design. Too many elements can compress the radiated signal to the point that it travels across the top of a valley or depression

(continued on next page)

Ed Montgomery is a professor of Broadcast Engineering Technology at Northern Virginia Community College. He is available at 703-323-3248.

Identifying Your Business, Market

(continued from page 19)

on your financial data so that you can effectively manage your business. You need to have word processing and database capabilities to better communicate with your customers. We will help you successfully accomplish that, and we'll be with you every step of the way. We'll use our technology to solve *your* problems."

IBM never comes across as the "computer" company, but rather as the "business-problem-solving" company. The identification of their business is done from the customer's perspective.

The railroads in America nearly became extinct because they thought they were in the "railroad" business. What the marketplace needed and wanted was someone in the "moving-freight-and-people-from-here-to-there" business.

While the railroad people nostalgically spoke of "ribbons of steel" and "the iron horse," along came independent truckers, the airlines, UPS and other businesses that properly perceived the identification of the transportation industry.

Collectively, they tore most of the traffic away from the railroads, not because the railroads couldn't have met the needs of the marketplace, but because the railroads never tried to see themselves from that perspective. They never properly identified their own business.

Identifying the target market

Hand-in-hand with proper identification of the business you're in is the proper and specific identification of the community segment you've identified as your target.

The two concepts are intertwined, because you can't effectively pinpoint the nature of your business—that is, in terms of the target market needs you intend to meet—until you know what that target market segment is.

For instance, you can't just say you're in the "clothing-for-young-women" business, because there is a world of difference between the fashions for young black women and young Hispanic women. If you haven't made those distinctions in your own mind, how can you expect the public to have a clear image of you? It's that image that causes them to respond to you.

You have to play the two identification processes off each other. That is, you first give your business a general label; you then describe the target market for that business.

Examining that target market and its characteristics helps you begin to refine your business identity.

The more specifically you describe your business, in terms of the target market needs it will meet, the more clearly you can focus on the precise target market characteristics. The process is cyclical.

The advantages of this effort become plain. The more clearly the public can perceive what segment of that market you target, the more likely they are to do business with you. But the public will never clearly perceive your focus if you don't have one.

Let's say you've properly identified your business, and it's aimed at Hispanic women, 18-34 years old. You'll now be able to design every element of your business to project that image—*clearly*.

The sign in front of your store, the layout in the display window, the design of the store's interior, the clothing worn by your salespeople, the ages and ethnicity of your salespeople, the design of your letterhead, the design of your newspaper or direct-mail ads, the sound of your radio commercials and the way your people answer the phone, should all reflect the same image to the same target market.

Indeed, what section of what newspaper, what daypart of what radio station, what zip codes for what mailings you decide on are all dependent on proper identification of the exact target market and what needs of theirs you intend to meet.

The benefits

The benefits of understanding this process, and the marketing function as a whole, will serve you on two levels. You will better understand how to relate to your marketplace: your clients and community.

Second, your salespeople will be better armed to help their clients clearly see how to effectively reach their individual target markets. Helping them improve their businesses will make them longtime friends.

If we apply these principles to your station, we begin to see that you're not in the "radio" business.

It's not a matter of transmitters, and processing, and personalities and showbiz.

It's a matter of serving your audience target market by being in the "providing-portable-entertainment-and-information" business.

You will be better serving your advertiser target market by being in the "communicating-their-properly-targeted-advertising-message-to-your-listeners" business.

Like IBM, try to operate from a perspective of the needs of the target market you've identified as yours. In turn, help your clients to focus their advertising efforts to meet the needs of their target markets.

Then, next time someone asks you if you're in the "radio" business, you'll shout,"No!"

FM Transmission, Reception Outlined

(continued from previous page)
in the earth, and is never able to penetrate these areas. The goal is to use an antenna gain that will permit adequate coverage of the terrain the station covers.

Since the high gain antenna increases signal strength in the overall coverage area, and since the assigned power of a station cannot be increased, transmitter power must be adjusted to avoid increasing the coverage area of the station's class.

For example, a 50,000 W FM station with an antenna gain rating of five would have to adjust the transmitter power output to 10,000 W.

Antenna height also can affect the station power level. If one increases the antenna height above the maximum authorized, a power reduction is required.

Often broadcasters will do this to provide an adequate signal to their entire coverage area. Many believe that transmitting antenna height is more important than operating with maximum transmitter power at a lower HAAT.

Multipath cancellations

The FM broadcast signal is short, and thus allows numerous objects to interfere with it. Multipath cancellations can cause signal loss when signals are reflected off nearby metal objects, aircraft or moving vehicles (Figure 4). The result of these reflections is an instantaneous loss of signal in the receiver.

Receivers in a fixed location reduce and often eliminate this problem with a high gain receiving antenna. The problem is not as easy to resolve in mobile receivers, and often the multipath cancellation cannot be eliminated.

Two-way VHF systems reduce this problem by installing lower power repeater transmitters throughout their coverage area. A similar system employing computer switching is used in cellular radio.

For this reason, medium wave broadcast signals perform at a more reliable level than VHF signals.

Due to the fact that high angles of radiation exist near the site of the FM transmitting antenna, it is often wise to locate the transmitter off to one side of the city of license. Directional antennas can then be employed to direct most of the radiation to the licensed area.

This type of a transmitter location will offer low radiation angles to the primary service area and reduce much of the multipath reflection problems caused by radio signals reflecting off of the ground and cancelling the received signal in the receiver, most notably mobile receivers.

Figure 1. The radiation pattern off of a single horizontally polarized antenna

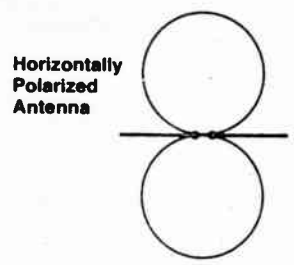


Figure 2. With a stacked horizontally polarized antenna, the radiated signal is compressed by stacking antenna elements one wavelength apart.

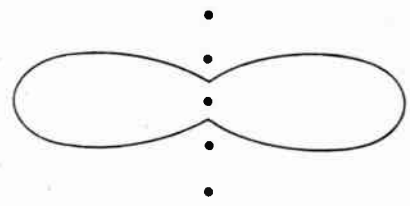


Figure 3. An FM broadcast antenna employing six elements, spaced one wavelength apart, permitting a high gain transmission.

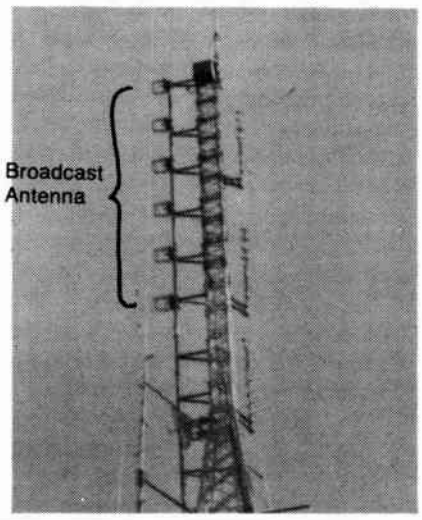
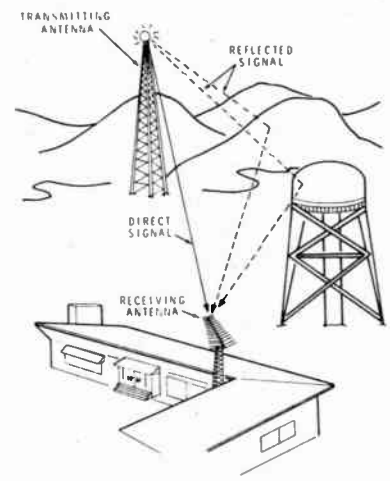


Figure 4. How multipath reflection takes place and how signals arrive at different times can cause loss or cancellation at the receiver.



Computer Aids Testing Of FM Signal Patterning

(continued from page 11)
as our California client would use. To be absolutely sure, the antenna was tested for several *months* with various types of modulation.

As expected, the radiation efficiency and directionality were closest to ideal when the exciter was fed with modulation for which the antenna was actually designed: CHR with 'Gold' three to four times per hour, and minimal use of recurrent material.

Further computer enhancement of our data suggested four stop-sets per hour, buffer lines at :15 and :45, weather at :02 and :32, ID jingles at :00 and :30, followed by up-tempo current hit tunes. And no news.

All of this data was given to the client when the antenna was delivered.

The array performed flawlessly when installed at the customer's site. Our client reports excellent coverage in all areas, especially in Men 18-34, and no interference to the adjacent channel station some 20 miles away.

There was, however, some indication of unusually high SWR during Sunday morning religious programs (not recommended, voids warranty).

New Products

Magnum Dynalab FM Tuner

Magnum Dynalab's new FT-101 FM tuner employs a three-stage RF section and an IF section using group-delay ceramic filtering.

The FT-101 switchable IF bandpass system applies a high amount of adjacent and alternate channel attenuation in the narrow mode, thus eliminating most near-channel interference.

Tuning is analog, allowing slight, off-station adjustment to reduce intermodulation distortion. Analog tuning also allows the user to tune exactly to the station's frequency, maximizing stereo separation performance when compared with the frequency synthesis method of tuning.

User controlled functions include mute, AFC, mono/stereo, and wide/narrow IF bandpass.

The electronic tuning uses low-noise controls. A portion of the local oscillator signal is fed to a digital driver circuit which commands the video display.

The Dynalab FT-101 is North American-designed and built. Suggested list price is $549.

Magnum and Magnum/Dynalab products are distributed in the US by Castle Marketing, PO Box 219, Alexandria Bay, NY 13607, 315-482-2589. For further information, contact Marv Southcott, Magnum Dynalab Ltd., Ontario, Canada, at 416-791-5888.

Tellabs Program Xmsn

Tellabs' 248 Program Transmission Group is a system of modules and enclosures for the transmission and distribution of wideband audio signals over nonloaded telephone cable.

Each module is a Type 10, measuring 1.5" by 5.5" by 6".

All components are front-panel accessible. Components used are selected to operate in a −40 F° to +140 F° environment.

The group includes a program amplifier; a program distribution amplifier; two program distribution amplifiers; two wideband repeat coils and a variety of mountings.

For further information, call James Cooper at Tellabs: 312-969-3530.

Time-averaged RFR Readings

Holaday Industries' new HI-5000-SX system uses the HI-3002 Broadband Field Strength Meter and the HI-3320 datalogger to display the six-minute time-averaged exposure level. This six-minute time limit is specified by the American National Standards Institute RFR standard, to which the FCC requires broadcasters to adhere.

The system allows one to simultaneously monitor both the instantaneous exposure level and the time-averaged level. The datalogger stores test data for subsequent printout or for display on the datalogger's LCD.

Price of the HI-5000-SX system is $4990. An optional 80-column thermal printer is available for $295. Delivery is 10 days after receipt of order. The system may also be rented; the fee is $650 per month, which includes the printer.

For more information, contact Burton Gran at Holaday Industries, 14825 Martin Drive, Eden Prarie MN 55344, or call 612-934-4920.

Circle Reader Service 20 on Page 35

Understanding Digital Basics

by Peter Burk

Part I

Harvard MA ... Everything—from cart machines to transmitters and audio processors—is loaded with digital electronics.

With the acceptance of compact discs and the inevitable emergence of digital recording in radio stations, a working knowledge of digital electronics is no longer a luxury.

Whether your interest is in designing custom circuits, maintaining station equipment or just being able to interpret specs on new gear, an understanding of digital basics is essential.

> *A working knowledge of digital electronics is no longer a luxury.*

This series on digital electronics will cover some of the topics of broadest interest, starting with a brisk review of the basics.

Combinatorial logic

Logical expressions, where the output can be expressed as a Boolean function of one or more inputs, can be realized using combinatorial logic. In its simplest form, individual gates are used to more or less dirctly implement the logic function.

Though complicated combinations of gates and inverters have largely been replaced by large scale integration (LSI), programmed logic arrays or microprocessors, it is usually necessary to "glue" these elements together with SSI (small scale integration) chips.

Combinatorial logic is also useful because many of the techniques available to manufacturers are not practical for one-of-a-kind projects that crop up at radio stations. For this reason, a good feel for combinatorial logic is essential.

All of the familiar logic elements—counters, flip-flops, latches, adders, etc.—can be built up from simple gates. Figure 1a illustrates the three basic gates we'll use. The truth tables show the output for each gate as a function of the inputs.

Note that the Boolean symbol for an AND gate is the familiar product symbol, while an OR gate is represented by a plus sign. For example, A+B is read as "A or B" while A×B (or AB) is read as "A and B."

To negate or invert an expression, a bar is placed over the expression. $\overline{A}$ is read as "A not" or "not A." Schematically, this is represented by a "bubble" placed next to the symbol on an input or output line.

Figure 1b extends this concept to include two very useful gates made up of an inverted AND (called NAND for "not and") and an inverted OR called NOR.

These gates are commonly available in just about any logic family with several identical gates in one package. Extra NAND or NOR gates may be used to invert the output, creating an AND or OR (NOT NOT AND=AND). For this reason, NAND and NOR gates are more common than ANDs or ORs in typical combinatorial logic circuits.

DeMorgan's theorem

We're not going to bore you with a bunch of Boolean algebra. However, one theorem is particularly useful and worth remembering. DeMorgan's theorem states that you can create the same truth table by inverting all of the inputs and outputs, and changing from AND to OR or vice versa. Algebraically, this is stated as:

$$\overline{A}+\overline{B}=\overline{AB}.$$

If this sounds confusing, study Figure 2a. By applying this theorem we can make any kind of gate out of multiple NAND or NOR gates. Figure 2b illustrates this idea.

It should be obvious that many useful functions can be created using just these simple gates.

A buzzer in the control room might be connected to sound whenever one of several alarms occurs, but only if the microphone is off. The circuit in Figure 3a will accomplish this, but requires two different types of gates, hence additional

(continued on page 24)

Peter Burk, with Advanced Microdynamics, is a frequent contributor to RW. He can be reached at 617-456-3570.

Figure 1a. AND, OR, and INVERTER symbols and truth tables.

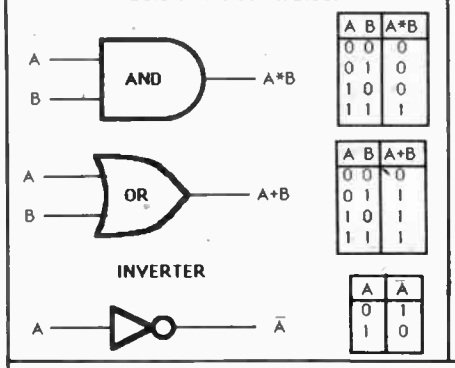


Figure 1b. Adding an inverter makes two more gates.

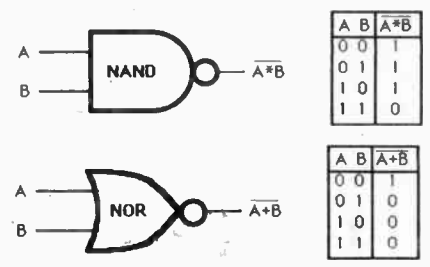


Figure 2a. DeMorgan's Theorem

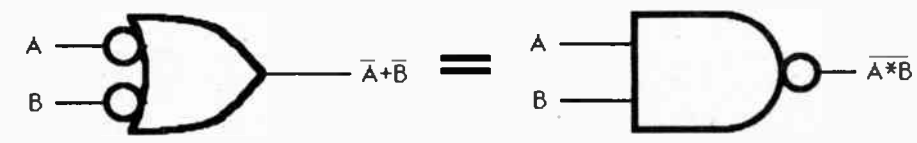


Figure 2b. OR gate made with NAND gates.

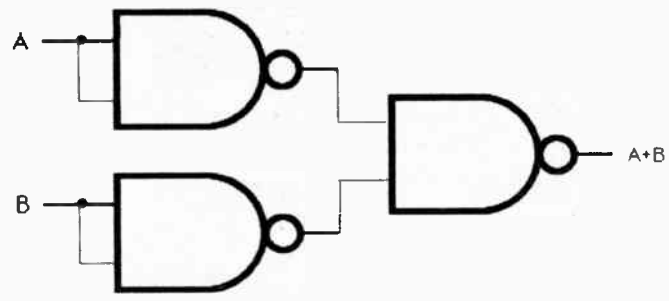


Figure 3a. Example used in text.

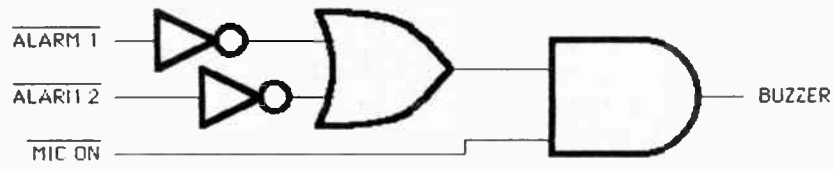


Figure 3b. The circuit is reduced to one chip by applying DeMorgan's Theorem.

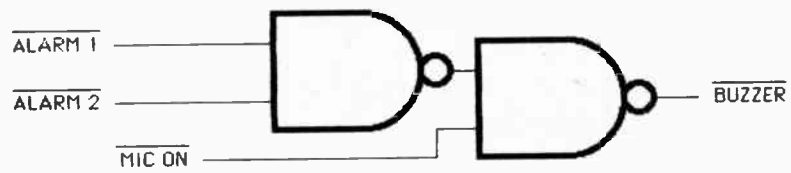


Figure 4. The Exclusive OR gate.

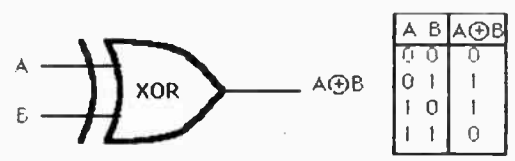


Figure 5. Exclusive OR gate used to select polarity.

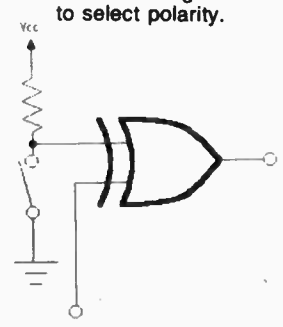


Figure 6. An eight line to 1 line multiplexer.

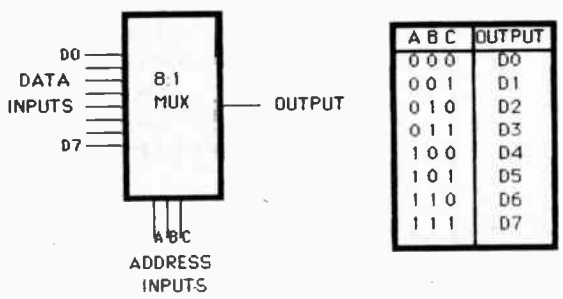


Figure 7a. An irregular truth table implemented with an 8:1 mux. Note that the inputs directly correspond to the desired output in the table.

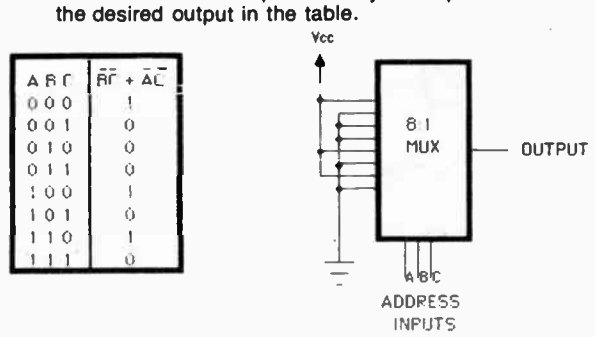
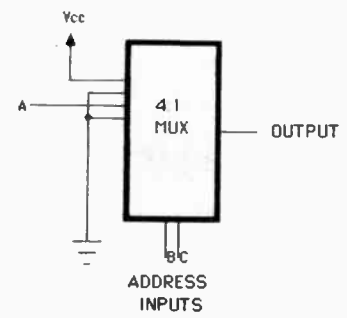


Figure 7b. The same circuit using half of a dual 4:1 mux.



Understanding Digital Basics

(continued from page 23)

chips.

Also, the available alarm signals may be inverted, as would be the case with open collector outputs or ground-operate relay contacts, requiring still more gates.

In figure 3b, we've used DeMorgan's theorem to reduce the problem down to two NAND gates, or one half of a quad NAND package.

Note that the output is also inverted, which is generally more useful. Most logic families will sink much more current than they will source, so driving real-world loads is simpler when the output goes to ground when active.

A useful combination of gates is the EXCLUSIVE OR. As you can see from the truth table, the output is on whenever A or B is on, but not both.

An exclusive OR can be constructed using the gates already presented, but it is so useful that it is commonly available as an SSI chip. Figure 4 shows the symbol and Boolean expression for an exclusive OR gate.

The exclusive OR has some applications that may not be obvious. Let's say we have four alarm inputs that may be of either polarity. A DIP switch can be connected to an exclusive OR gate, as shown in Figure 5, to allow simple switching of polarity.

One of the frustrations experienced using the gates presented so far is that your application might not fall neatly into a simple combination of these truth tables.

Entire textbooks have been written on minimizing Boolean expressions and, in fact, computer models exist that will find optimal solutions for logic problems. Vietch diagrams and Karnough maps can be used for simple problems, but they get unwieldy beyond four inputs.

Fortunately, there's an easy way to solve the problem. Medium scale integration (MSI) integrated circuits combine many gates into useful functions so that you don't have to be concerned about the details on a gate-by-gate basis.

Flip-flops and counters are common examples of MSI, and we'll get to them later. First, let's look at a simple way to implement *any* truth table without hassles.

Multiplexers

An MSI chip, known as a multiplexer, was designed to selectively steer one of several inputs to a common output. By studying Figure 6, you'll see that the appropriate data input is selected by setting the address lines to the desired value.

We can get creative and use a mux to implement our truth table, simply by connecting the inputs to the address lines and either high or low to the data inputs, exactly as in the truth table. In Figure 7a we implement an irregular truth table using an eight-line-to-one-line mux.

We can do still better by using a mux with N-1 address lines, as shown in Figure 7b. Here the same function is implemented with a four-to-one mux.

To implement this approach, divide the truth table in half. Each input is determined by comparing the top half of the truth table with the corresponding line of the bottom half.

If the output is identical for both lines, connect the data input to high or low, as appropriate.

If they are not identical, connect the input to the high order signal or its complement. If the upper line is true and the lower line is false, you will need an inverted copy of the high order signal.

This may seem confusing at first but, once you get the hang of it, you'll be able to implement functions easily that would be real nightmares with SSI.

In part 2 we'll compare the different logic families, present some guidelines for working with each type, and then further explore some common logic elements.

Forming a Simple Quad Latch

by Bill Sacks

Arlington VA ... Homer Heterodyne and Crystal Oscillator were taking a cruise around the phase locked loop. It was a wonderful spring day and the reflected impedance shimmering from the etheric field gave them the feeling of being solidly grounded. Crystal was feeling some phase jitter as a result of being pulled over for a parity check by a fail-safe controller.

After a few moments of sideband chatter and a few jokes about the fail-safe controller being a parasitic element requiring a noise blanker, Crystal relaxed and slipped into her resonant mode. Homer remarked that all of those guys are only a "one shot" with a retrigger anyway.

"He probably hasn't had an ohmic contact in months," remarked Crystal.

"Yeah, he's got the brain of an octal plug," remarked Homer.

"Sometimes those dumb terminals get into the fail-safe business just to hear the shot noise and play with their snubber circuits," observed Crystal. "They basically operate simplex."

"Why don't we try a mode jump," suggested Homer. "What do you suggest?

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

Straight Talk

They had existed as a shielded pair for so long, and shared so much mutual inductance, that either could easily go into sideband splatter and self-sustained oscillations with never a thought of a secondary breakdown, let alone having to suppress a carrier.

"We could reduce the overhead on the motorboat if we could form a quad latch," said Crystal.

"Perhaps we could hook up with Polly Phase and Tommy Toggle," Homer suggested.

Crystal was not thrilled with this idea because Homer had always felt somewhat resonant to Polly's long-woven flat braids. Crystal knew that there was still a quenched spark between them. She also knew deep inside that, even though Tommy was a simple flip-flop, she could not resist his fast-attack/slow-release single point grounding.

"I don't even know if they're active today, or if they're on standby," said Crystal.

"We could always give them a call," Homer said as he dialed the phone. "Great news," he said, "they're right in the forward path, and we can take the bus."

"Do you have their address code?" queried Crystal.

"No, but they're in the directory," Homer assured her.

"It's so hard to find them in that neighborhood with all the residual flux around," commented Crystal.

"That's okay," replied Homer. "They're going to leave a collector open."

The foursome met at Polly's address to check out her new relaxation oscillator. After a brief refresh cycle, all four donned non-hydroscopic insulation and headed for the nearest hot cathode terminal.

Soon they were comfortably within the resonant cavity of the traveling wave tube. They finally reached the anode, and thanked the conductor for a good ride.

"I just hate flying," remarked Polly, even though she knew that the statistical chances of getting caught in the grid were just about null.

They rented a boat from a kindly old gentleman whose cat's whiskers made him look older than he was. The boat I'm permeable to just about anything today."

After a thoughtful propagation delay, Homer suggested that they drive over the Wheatstone Bridge and do some motorboating. Crystal reminded him that she was photosensitive, and they would have to pick up some mineral oil.

came equipped with a full-wave bridge, and was of three-deck design, although it only had one motor.

The waveforms across the lake were as pixel perfect as one could wish for, and the partition noise seemed to lull everyone into a quiescent state. No one seemed to care which direction the magnetic direction indicator pointed to. The atmosphere just seemed to bring out everyone's full-scale sensitivity.

Tommy and Polly liked to have a good time. Tommy had brought lots of juice and a little potting compound. Crystal remarked that the four of them hadn't gone open loop in a long time. But that was all right, she said, because she had been in a normalized admittance mode for quite some time anyway.

After a while everyone began to experience some nonlinear distortion.

"Watch your slew rate, we've already had one parity check today. And you have to present a nominal bandwidth should we get stopped," warned Crystal. "In fact, you shouldn't have any of that passband ripple if you're going to be the driver."

Tommy mentioned that he had been subjected to a hydrometer reading just a few weeks ago.

All had a good time motorboating that day, except for a little hysteresis distortion on Tommy's part.

Be a Mic-Mixer Hero

by M. Darrell Williams

Bismarck ND ... It's Wednesday afternoon and already both of the station's portable mic-mixers have been logged out for Saturday. The Sports Department has one unit for an all-day marathon at Northside High School an the News Department has the other unit for taping a round-table discussion on a local sewer bond issue election.

Then, out of the blue, here comes the Sales Department needing another mic-mixer for commercial remotes—you guessed it, on Saturday (and we all know the persistence of the station sales reps!).

Option 1 is to get on the phone and order the needed mic-amp. This option puts you in serious jeopardy unless you order next-day delivery. Such an order will also, of course, seriously deplete the profitability of the remotes.

Option 2 is to try juggling the two existing units between seven locations and three departments. Electing this option, however, will upset everyone's (individual and collective) applecarts and is certain to ruin *your*Saturday.

Option 3 is to be a hero to everyone by building a dual-mic amp. The cost is about three hours of your time and about $22 of the station's money. What's even better is that it's really a rather simple project using the Signetics NE5534 IC.

I prefer using the NE5534 because of its outstanding performance, 600 ohm output and need for minimum external parts to get the job done.

Referring to Figure 1 and using standard microphone pin configuration (3-high, 2-low, 1-gnd), you will note mic pin-3 is connected to IC pin-3 through an 82-ohm resistor. Mic pin-2 is connected directly to IC pin-2 with a 1K bleed resistor to ground. Mic pin-3 is grounded.

Resistance between IC pins 5 and 8 determines the internal gain of the 5534 amp. I prefer to use a 50K cermet pot (Digikey Part Number 1FA54, at $0.96 each) to accomodate a wider variety of cheap to more-expensive microphones. However, a 47K resistor in place of the pot has proven to be adequate in most applications.

If you're not into building your own power supplies (I'm not), use an inexpensive 9 VDC 200 mA plug-in wall transformer from the local Radio Shack store, a 9 VDC battery, or Digikey's T207-ND that sells for only $3.20.

If your unit is going to be battery powered, you can probably discard the current limiting resistors and the filtering capacitors. Because wall transformers are rather noisy, and if that is going to be your power supply, you'll need the limiting/filtering part of the circuit.

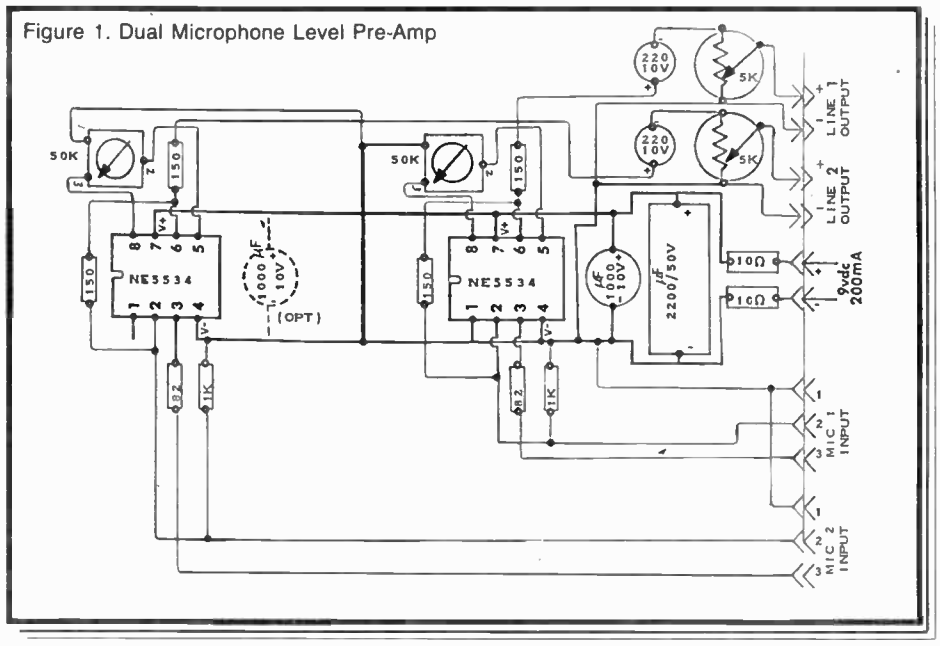
Looking at the output side, you will note the diagram calls for 5K audio pot. That's fine, but I usually end up using Radio Shack's little 10K audio pot with its built-in SPDT switch (Part Number 271-215 at $1.69 each) so I can turn the power off when the unit is not in use. Hint: If you anticipate RF to be a problem, simply solder a 0.047 μF capacitor across pins 2 and 1 of the output pot.

Here's another hint that will expedite your project. Considering that you probably will not have time to lay out and produce a printed circuit board, simply use a universal IC board available at your local "Shack" store. All the circuitry will fit nicely on a 2.5" X 3.5" board.

I like using insulated breadboard jumper wires because it saves a ton of time measuring and stripping little pieces of wire. Digikey has a kit with 350 jumper wires in 14 PC-mount lengths that sells for about $15.

Packaging the mic-amp circuit can also be a simple project using Radio Shack's "Economy Boxes." Once you get past the dumb blue color, you'll find the plastic is sturdy and is easily drilled for mounting components. How's that for simple?

Figure 1. Dual Microphone Level Pre-Amp



M. Darrell Williams is owner and CE of Dakota American Communications. His company produces a compact portable mic-line mixer unit that uses a circuit very similar to the one described in this article. If you'd rather buy than build, call him at 701-222-4374.

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Buyers Guide

AM Transmitters & Exciters

KDKA Pioneers AM Stereo

by Jack Layton, Eng Mgr.
KDKA-AM

Pittsburgh PA ... On November 2, 1920, KDKA signed on as the world's first commercial broadcast station. On July 23, 1982, just minutes after the FCC approved AM stereo operation, KDKA was the first station in the country to broadcast in AM stereo.

User Report

However, due to crude and temporary studio and stereo transmitter facilities, the first AM stereo broadcast was short-lived (lasting only 30 minutes) and the station went back to mono.

In early 1985, KDKA embarked on a studio rebuilding project. A major goal was to have at least one stereo music/news/talk studio-control room on-line before the end of the year. In August the first one went on air, and later that year, Studio-K made its debut.

A second—but certainly not inferior goal—was to build the Cadillac of facilities.

There had to be the best that money could buy in consoles, cart machines, and telephone systems. We chose a Ward-Beck console, the ITC 99 series cart machine and a custom-built Gentner Engineering telephone system. All this gear was housed in Buschbaum-designed and built cabinetry that was functional, beautiful and rugged.

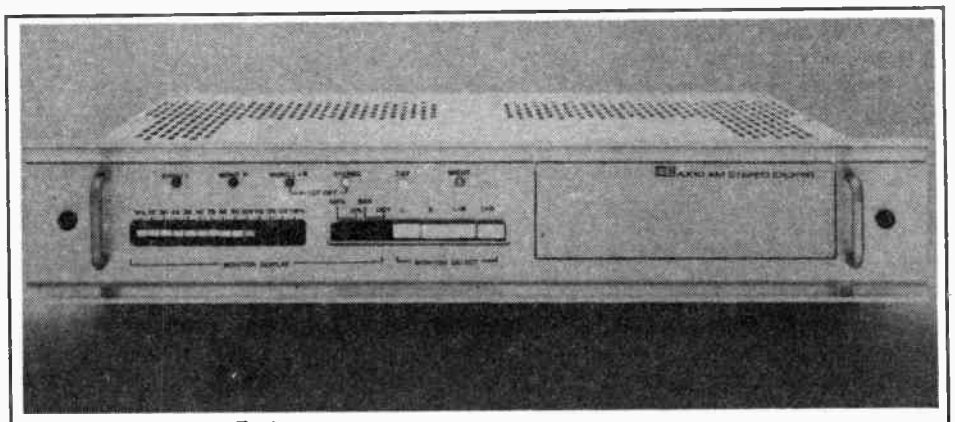
On November 2, 1985 KDKA celebrated its 65th birthday. All 65th birthdays are cause for extraordinary celebration—a transition from the ordinary everyday hum-drum to something new and different. Part of the "new and different" at KDKA would be AM stereo.

Choosing a system

There wasn't much question in our minds as to the AM stereo system that KDKA would install.

Factors influencing our decision included evaluation by Group W Headquarters Engineering, on-air experience with AM stereo at Group W's WBZ, and the fact that we wanted to use a system for which stereo receivers were readily available (yes, listeners are an integral part of broadcasting). There really was not much of a choice to make. At that time Sony, Pioneer, Sansui, Radio Shack, Delco and others had C-QUAM™ receivers on the market. Thus, we went with C-QUAM.

Common sense and good business practice says that there is little or nothing to be gained by going to all the trouble and expense of installing tape machines,



BE AX10 AM Stereo Exciter

turntables, consoles, delay units and STL equipment to carry a high quality left and right audio channel all the way to the transmitter and then transmit it via a system that few consumers are able to receive.

The old conundrum "If a tree falls in the forest and no one is there to hear it, did it really make a noise?" applies. That is, if you are transmitting AM stereo and there is no one out there to listen, then well, maybe mono is good enough!

At 12:05 AM on October 24, KDKA signed off the air. At 5 AM KDKA signed back on with transmitter 1 in C-QUAM stereo. Nothing was mentioned on the air about stereo. During the day

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Kahn Revives WNAQ

by Jerry LeBow, Exec VP
Sage Broadcasting

Waterbury CT ... When we purchased WNAQ-AM, a 5 kW 3 tower directional facility in Waterbury, Connecticut, it had been off the air for about 6 months. The previous owners had run into financial difficulties and were no longer able to operate the radio station.

User Report

We at Sage Broadcasting saw the opportunity to bring the station back on-the-air, and wanted to make it an exceptional AM facility in the market. Since the studio facilities were already set for stereo audio, we decided that one of our first improvements would be the introduction of AM stereo to Waterbury.

There were no AM stereo stations on the air in Waterbury, but Hartford's famous WTIC-AM had been broadcasting Kahn AM stereo for several years. When we looked around the state of Connecticut we discovered that virtually everyone transmitting AM stereo had chosen the Kahn/Hazeltine system. After careful research and investigation we also decided on the Kahn system.

Our first project was to check out the antenna system. To our delight, we discovered that the antenna array was quite good in terms of bandwidth and symmetry. Our engineers did some additional work to broad band the system.

We then did a proof of performance to bring this dark station back on the air. Since we had installed the Kahn AM stereo exciter by that time, we were able to do the full proof through the antenna in our Kahn stereo mode as well.

The installation of the Kahn system was simplicity itself. One of Mr. Kahn's associates from Kahn Research came up to Waterbury. He, along with our station engineer and myself, was able to complete the installation in one day. Since we had not yet officially signed back on, it was easy to run test tones through the system and put them out on-the-air. If anything, it peaked curiosity as to what was going to happen to the 1380 frequency in Waterbury which had been dormant over the past 6 months.

We experimented with a number of audio processing units and decided on the stereo Optimod. We were able to achieve a loud but transparent signal.

And when we listened on our wide-band Sansui tuner, which is the staion's air monitor, our sound was indistinguishable from FM stereo!

Measured separation in mid-band was greater than 40 dB. Across the band it was almost 30 dB. Since we had Kahn's new STR-84 exciter with all the bells and whistles, we weren't surprised but were certainly delighted at the low distortion, wide separation and high S/N.

On Labor Day 1985 WNAQ officially signed on as Waterbury's first AM stereo facility. In the proceeding months we did significant promotions, such as

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Buyers Guide

SunWatch Eases PSSA Pains

by Joe De Angelo, Product Mktg Mgr
Harris Corporation
Broadcast Group

Quincy IL ... When the FCC first announced Post Sunset Authorization (PSSA) over a year ago, it was received with mixed emotions by AM daytimers.

Their reservations were based on two factors: first, the low power levels authorized; secondly, a practical method by which to execute the "tiered" power levels called for under PSSA operation.

The full operating potential of PSSA has yet to be realized due to the unexpected delay in signing the Mexico-US treaty. According to the latest update from the Commission's AM branch, this will be soon, but no firm date could be given.

Some AM broadcasters who have experimented with PSSA operation have been pleasantly surprised by the amount of coverage achieved. In many instances good local area coverage can be realized.

A governing factor that often rules the extent of such coverage is adjacent and co-channel interference. Man-made electrical interference is another factor.

When the Commission announced it was adopting a "tiered" power schedule for PSSA operation, Harris recognized that there was no practical way broadcasters could execute the tiered schedule.

Some PSSA schedules have operators changing power levels every 30 minutes, often during busy afternoon and early evening commercial schedules. Another factor adding to the difficulty is that PSSA schedules and operating powers change every month.

The FCC, serious about adhering to these tiered power level schedules, recently fined a station $10,000 for excessive PSSA power.

The Harris SunWatch™ is an option available for all Harris SX SoundsStar™ AM transmitters. The SunWatch allows a station to program and automatically execute the entire year's PSA, daytime and PSSA operating power levels and switching schedule.

First, a programming worksheet is provided (much like with programmable calculators) where a station consolidates the PSA, daytime and PSSA schedules for a given month (see Table 1).

Note that the power levels used in Table 1 are the ones measured at the station's ACU or phase common point. With low PSSA levels, stations will need to add, in many cases, low current scale RF ammeters or millivolts.

The mode selection column corresponds to the high, medium and low power selection switcher on the SX transmitter's front panel. Under SunWatch operation, high, medium and low become arbitrary selections of any power within the range of the transmitter.

For example, on a Harris SX-1A transmitter, high power can be any level between 1,000 and practically 0.

Mode selection (high, medium or low) is a "remembered" state that can be programmed into SunWatch for a given event window. What makes this convenient is that the high, medium and low status lights are remoted, permitting interface-to-phase control circuitry or other antenna switching equipment.

Referring to Table 1, we can assign "medium" to all non-directional modes. Likewise, we can assign the "high" mode to SunWatch periods requiring directional operation. The phase will then switch automatically at the appropriate time.

Once we have completed SunWatch programming worksheets for 12 months, we're ready to enter the program. This is done via the SX transmitter's front panel touch keypad.

Programming is fairly straightforward. A program preview/edit capability is also provided, allowing the operator to look at or correct any given segment.

Up to 10 programmed "windows" per month are provided, yielding 120 events over the year. The internal SunWatch clock keeps date and time and is backed up with a battery just in case the AC power is interrupted.

Knowing there is a convenient and practical way to implement PSA, daytime and PSSA operating schedules, let's look at the economic incentive for doing so. Daytime AM stations have the opportunity to add $18,000, $54,000 or more in annual spot advertising through the effective use of PSSA.

Once the US and Mexico agreement is signed, daytime-only stations will be allowed to broadcast two hours after sunset all year long. This represents 730 additional broadcast hours a year.

Our poll of daytime-only station indicates they feel confident that their sales staff could effectively sell a minimum of five minutes of spots per hour out of the 730 hours. This represents 3,650 minutes of new annual spot billings.

Adding PSSA operation is a great way to gain additional spot revenue for a station. A Harris SX SoundStar transmitter and SunWatch is an innovative and effective way of implementing PSSA operation.

Editor's note: For further information, contact the author at Harris: 217-222-8200.

Table 1. Month of January

Window	Event time	Mode	Output Power	Comments
1	0530	Medium	500 W	Sign-On, Non-D
2	0645	High	1 kW	Directional
3	1715	Medium	325 W	PSSA, Non-D
4	1745	Medium	250 W	PSSA, Non-D
5	1815	Medium	127 W	PSSA, Non-D
6	1845	Medium	65 W	PSSA, Non-D
7	1915			Sign-Off

WNAQ-AM

(continued from page 27)

giving away AM stereo radios and car units.

We equipped the WNAQ news wagon with a Sony AM stereo receiver and took it around the area so everybody could find out what quality AM stereo sounded like. To many of our customers' amazement, WNAQ sounded just like FM stereo. Surprise, surprise!

As an owner and engineer I have no doubts we made the right purchasing decision. Our competitive sound is loud, but clear, and even our mono listeners tell us that we are one of the best sounding stations.

In stereo, we have realized the full potential of AM radio, and we are eagerly awaiting the receiver manufacturers to catch up with the broadcasters in providing high quality, high performance receivers for the Kahn system.

As a side note, WNAQ reduces its power to 250 W at night, and the co-channel interference, even in our primary service area is significant. The Kahn system performed flawlessly and was not subject to distortions and wandering stereo images.

If you would like to talk to some happy broadcasters who have done their homework in AM stereo, we invite you to call us at WNAQ or at Sage Broadcasting headquarters in Stamford.

Editor's note: For further information on the Kahn system, call Kahn Communications: 516-222-2221. Call the author at 203-357-1464.

Buyers Guide

Nautel's New 50 kW Efficient

by A. L. Anderson, Pres
KBMR-AM

Bismarck ND . . . We are proud owners of the first Nautel AMPFET 50 kW transmitter in the US. We chose it after learning of the many unusual features Nautel offered in this solid state transmitter.

User Report

We found a transmitter capable of 60 kW of power, consisting of 12 units of 5 kW each. These are combined into two combiners. Each of the 5 kW units actually consists of four 1.25 kW units; you therefore find that you have so much protection you can virtually lose a portion of a unit or a whole unit and still be on the air.

It would be difficult to find a situation where you would be out of service. For example, two exciters with three power levels in each unit along with the protection offered by the 12 individual units, provide you with transmitter power regardless of a massive breakdown.

The Ampfet 50 was designed to provide the ultimate in backup facilities. Even the power supplies are in two units, making it possible, in a matter of a few minutes, to use one power supply for 50% of the normal power.

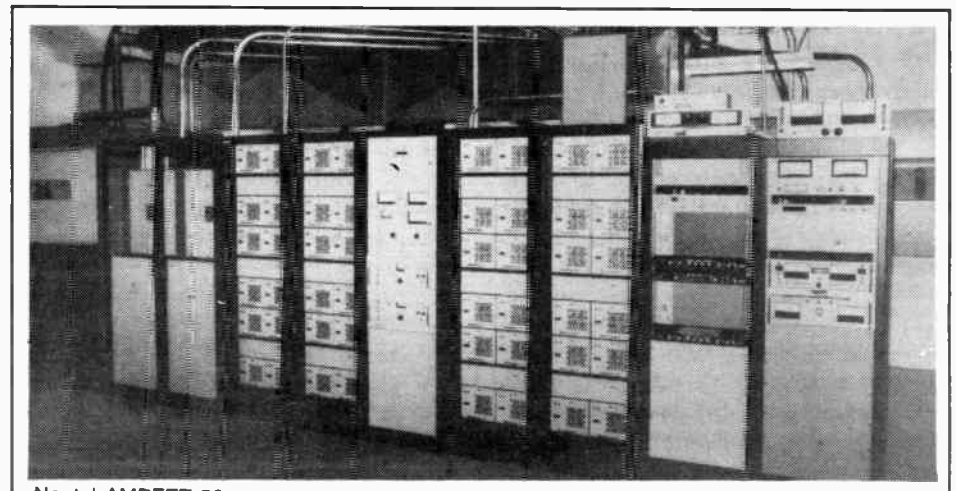
Service/maintenance

From a service standpoint, each of the 12 units can be removed for repair while on the air by simply flipping a couple of switches and removing a single screw. We could switch to 500 W to adjust the antenna units. It's also possible to raise power to 10 kW for phase adjusting, and then up to 50 kW for total operating power and field measurements.

We have had a few other 50 kW high-level modulation type transmitters at another location and found that from a safety standpoint, working with 15 kW or more is no fun at 4 AM in the morning. With the Nautel unit, you have only 70 V to worry about, and that's a pleasure.

Unit worth waiting for

We heard about the unit a couple of years ago, and pursued the manufacturer to get one for us at the earliest possible date. It took over a year, but it certainly was worth waiting for. We are operating a two-tower directional on 1130 kHz with 50 kW.



Nautel AMPFET 50

Have we had any problems? A few transistors went bad, but the factory representatives have been super people to deal with, furnishing replacement units overnight, if requested. I have complete confidence in our Nautel.

You'll have to see it in operation and listen to the quality of the signal to properly judge the equipment. While the transmitter room noise level is extremely low, it does require a good supply of air to keep the FETs cool.

Though it's difficult to estimate our electrical power savings due to rate increases in this market, it's safe to say that there is a tremendous cost difference simply from the savings in filament power and from the efficiency of the transmitter itself.

Editors note: For more information on the AMPFET 50, contact Jorgen Jensen at Nautel: 902-823-2233. Call the author at 701-255-1234.

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Buyers Guide

AM Stereo: 'So Far So Good'

by Nick Pollacia, Jr.
Pres/GM, Pene Brdcstg

Leesville LA ... There is a grand line in the classic old western, *The Magnificent Seven*. Steve McQueen tells the story of the man who jumped off a 10-story building and, all the way down, people heard him say "so far, so good, so far, so good."

As a non-engineer, whose only knowledge of engineering has come from mistakes or osmosis, I have found that all too often many of my equipment purchases have put me on top of that same building.

With the passing of each month comes the sigh of relief, "so far, so good"; unfortunately there are also a great number of sudden stops.

When it comes to buying equipment we have made every imaginable mistake, from buying an FM transmitter from a company that went out of business, to buying consoles with insatiable appetites for RF that took years to tame.

In short, nearly every piece of equipment that belongs in a radio station has been purchased two ways, usually beginning with the wrong way.

With that background in mind, we approached the prospect of getting into the AM stereo business with the firm decision to do it right the first time.

The first step

The first step was the realization that over the years we had relegated our AM daytimer to second class status. This was a terrible mistake—one that could only be resolved by a complete house-cleaning. Therefore we bought all new equipment. Everything from the tower and ground system to the studio equipment was replaced.

User Report

We ordered a new Nautel AMPFET-1 transmitter, changed our format, and of course, we purchased the equipment necessary to achieve stereo broadcasting.

All of this was done methodically and with great deliberation on each piece, realizing that the new image we wanted depended on each new piece of equipment we ordered.

The single most difficult purchasing choice is the stereo generating equipment. This is an area of technology that was completly foreign to us. And with the type of investment we decided to make, we wanted a system that would give us the utmost clarity, good stereo separation and high efficiency.

Since Louisiana has a number of AM stereo stations, we started making calls to managers to see if any particular system seemed to have an edge in preference over the other systems. Our polling led us to the the C-QUAM system with a Broadcast Electronics (BE) AX-10 exciter.

Once we had a leading candidate we were able to talk more easily with enginers, consulting engineers and equipment representatives. We also knew where to start reading and where to go to start listening.

Second-generation equipment

I think the thing that impressed me most about the BE exciter was the fact that we were getting "second generation" equipment that had also been subjected to the most rigorous testing of all, the open market.

BE's equipment had also been improved by the lessons learned and by the incorporation of more digital technology into the model we were getting. In short, we felt confident we were getting the "state of the art."

The reliability of BE products was also factored into the decision.

In December, 1985 we commenced AM stereo broadcasting. In the short time that has passed, we have seen the "ugly stepchild" come bacck into its own.

Stereo paying off

Slowly but surely we are seeing more advertiser response and, just as surely, we are seeing the emergence of new AM radio appreciation from listeners. There is nothing that affords more pleasure than demonstrating AM stereo and FM stereo for the uninitiated and watching the disbelief on their faces.

For KLLA, AM stereo has been a revolutionary happening. It has moved us into a far more competitive position in our market. It has identified us as innovators and has given us the thrill that comes with being a part of a new technology. Finally, it has given us the sound that comes with being "the state of the art."

Back to the top of the building. It is the single best decision I have made in 10 years as the operator of my own radio station. Instead of "So far, so good," it's "So far, very good."

Editor's note: For further information on the AX-10, contact Steve Ford at BE: 217-224-9600.

LPB Gear Favorite

by Andrew L. Bater, Tech Dir
WPIX-FM

New York NY ... Most of us in this business get our information on new equipment from the press, sales literature, salespeople, peers, or, as is often the best way, from first-hand experience. Speaking from first-hand experience, the LPB low power AM transmitter series has been a good experience in my life.

User Report

During my college "daze," I became acquainted with what I thought at the time to be an odd beast, the LPB RC-25B AM carrier current transmitter. This tube type predecessor to the newer LPB AM-30P solid state transmitter ran continuously for years into a horrible mismatch with no maintenance.

The RC-25B transmitter was built like a battleship, was easy to service, and to top it off, didn't sound half bad.

I went on to purchase three LPB TX2-30 transmitters, seven LA2-30 linear ammplifiers, and even an LPB console (the LPB Signature S-13C is still my favorite) for my college. Last I heard, they were still cranking away.

LPB transmitters offer unmatched ease of installation with a minimum amount of connections and adjustments. I've always been skeptical of any piece of gear with lots of trimmers. LPB equipment has a minimum number of controls that can go out of whack, and it still offers superior specifications.

LPB linear amps can be used as power amps for AM stereo exciters, resulting in excellent separation and response.

The thing that sells me most on LPB products is durability.

LPB transmitters survive with poor or no maintenance, work into poor or no loads, survive short circuits, spilled beer, etc. with little or no damage. This type of durability is a plus for anyone considering purchasing a transmitter.

Last of all, LPB products come with excellent documentation, including schematics and concise operation manuals. All these things come in handy if repairs are ever required.

Unfortunately, I can't really assure you of this. Although I have installed and adjusted many LPB solid state low power AM transmitters, I've never repaired one. I guess that says something.

Editor's note: Contact Richard Crompton at LPB: 215-644-1123.

Buyers Guide

New Florida AM Picks Delta System

by Mark Persons, Pres.
M. W. Persons and Associates

Brainerd, MN ... The new Delta C-QUAM™ AM stereo system is excellent. It is a refined version of the AM stereo exciter/monitor system which Delta has sold for several years now.

> *The installation was easy and fast due to the fact that the new Delta exciter has provisions to feed two separate transmitters.*

I recently installed one at WDCQ in Pine Island Center, a suburb of Ft. Myers, Florida. Connected to two Nautel transmitters, it performed very well. WDCQ is a new 10,000 W three-tower day, 1,000 W two-tower night facility on 1200 kHz.

The installation was easy and fast due to the fact that the new Delta exciter has provisions to feed two separate transmitters. At WDCQ, a 10,000 W Nautel AMPFET 10 is used daytime and is automatically cut back to 1 kW at night auxiliary. The other transmitter is a Nautel AMPFET 2.5 running at 1 kW night, but will run 2.5 kW during the day if the 10 kW transmitter fails.

This is a good combination. However, the directional day and night common-point curves at WDCQ are different, and require different equalization settings to attain good AM stereo separation and distortion numbers.

This is a typical situation, and the Delta C-QUAM system accommodated it very well.

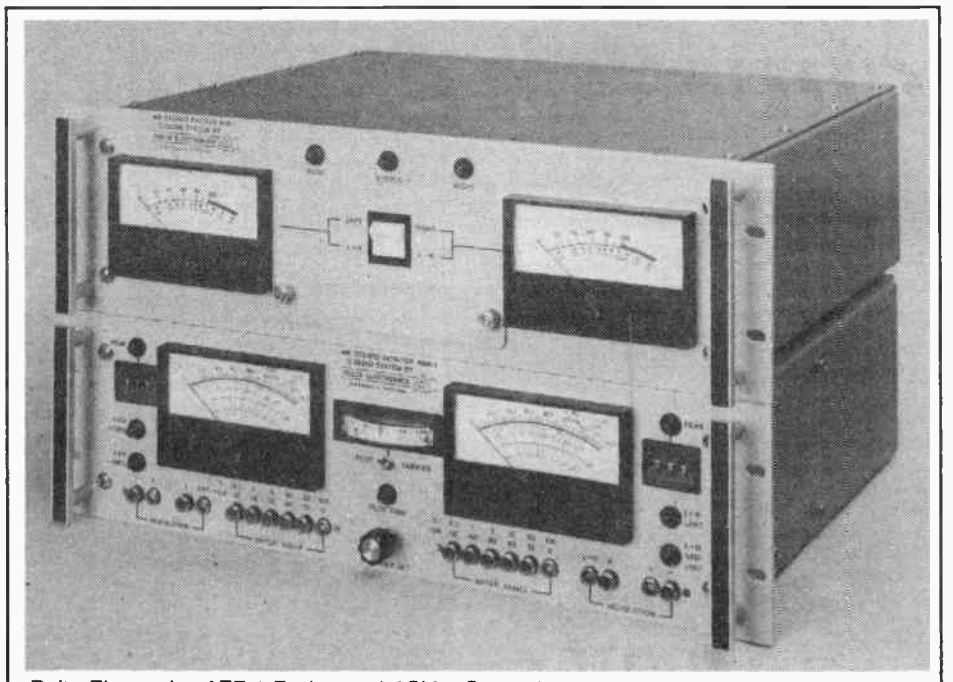
The Delta exciter

There are two different audio equalization sections in the exciter. Each one is adjusted to suit the transmitter and antenna situation. All that is required to switch equalization sections is a contact closure or ground-going logic from the staiton's phaser or transmitter.

Connecting AM stereo to a transmitter involves substituting the transmitter's RF oscillator with an RF signal from the stereo exciter.

L−R audio phase modulates the exciter's oscillator, while L+R audio is used to amplitude modulate the transmitter. This is done by running an audio line from the L+R output of the exciter to the standard audio input terminals of the transmitter. Obviously, this is a very simple overview.

The actual generation of a C-QUAM™ AM stereo signal is a bit more complex, but is elegantly handled by the stereo exciter.



Delta Electronics AEE-1 Exciter and ASM-1 Stereo Modulation Monitor

I make this point to illustrate that the AM stereo exciter output is actually an RF and audio feed to the transmitter. The Delta exciter has two RF output feeds and two audio feeds with separate L+R level controls, which allow it to run two different transmitters either as alternate main transmitters or as main and auxiliary transmitters.

User Report

The time has arrived when it is important to have auxiliary transmitters run in stereo so that listeners don't call wondering what happened to the stereo when the auxiliary transmitter is on the air.

One of the most noticeable changes in the Delta AM stereo system is the elimination of input circuits. Adequate RF protection seems to be included, as no noise problems have been experienced running the system just 20' from the hottest (8,500 W) tower in the array.

"Tweaks" improve separation

A number of minor circuit tweaks have allowed Delta to improve published separation specifications by 10 dB. All systems, in factory closed-loop tests, must have at least 40 dB separation from 50 Hz to 5 kHz.

Typically, I saw these kinds of numbers before the improvements. WDCQ's system showed numbers about 10 dB better. Remember, the published specifications are worst-case specifications that determine whether or not a unit leaves the Delta factory.

Removing the transformers was probably the reason Delta was able to tighten the frequency response specification from ±1 dB to ±0.5 dB, 50 Hz to 10 kHz and ±1 dB to 15 kHz.

All in all, the Delta system was easy to install, easy to tune-up, and produced a great stereo sound.

Two-way stereo effect

As a sidenote, the WDCQ main studio jock does a banter back and forth with the newsperson during morning and afternoon drive.

To add a stereo effect to the two-way conversation, I installed a switch in the main studio console that allows the main announcer's mic audio to drop by about 6 dB in the right channel audio.

The same is true of the newsperson, only he/she is heard 6 dB less in the left channel. So, driving down the street in an AM stereo equipped car, one hears the announcer on the left side and the newsperson on the right.

There is plenty of separation, and I detected no loss of mono loudness. The effect is a nice plus because stereo listeners and mono listeners don't miss a thing.

Editor's note: For further information on the Delta AM stereo system, contact Bob Bousman: 703-354-3350.

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CHUM-AM Chooses Continental

by Bruce Carnegie, CE
CHUM-AM/FM

Toronto, Ontario, Canada ... In late 1985, CHUM-AM decided to purchase a second 50 kW transmitter. At the time, the station already had a Continental 317-C1 transmitter with a 23-year-old 10 kW standby.

Although it was well maintained, the 10 kW, being kept on cold-standby, was progressively becoming more unreliable. Therefore, the decision was made to purchase a new unit.

User Report

In choosing a transmitter, the factors I considered most important were reliability and a proven track record, performance, installation ease and building compatibility, service, delivery and price.

At the time, other manufacturers had just come out with new 50 kW units. The other units, however, had little time in the field. Meanwhile, there were about 90 Continental 317-C2 units operating in the field.

I visited some of these real world transmitter sites, held discussions with several CEs, and found the C2 reported most reliable.

> *"Factors I considered most important were reliability and a proven track record, performance, installation ease and building compatibility, service, delivery and price."*

At one facility I visited, the engineer allowed me to put the station's machine through its paces. Its square wave response was most impressive, given the fact that most processors produce/regardless of what manufacturers might tell you/some square waves under normal operating conditions.

The Continental C2 we purchased was flat to 15 kHz ±0.15 dB. Distortion was at 100 Hz to 10kHz less than 2%, and typically less than 1%.

When built in the '60s, our building had been designed to house two 50 kW transmitters. Therefore, the compact layout of the C2 made the installation appear straightforward—except, of course, that the 10 kW was installed where the new C2 would be placed.

The transmitter was delivered just before last Christmas; to say the least it was a nice present for CHUM.

On Monday morning of that week we began the installation, the old standby 10 kW occupied the C2's location. However, by Wednesday, thanks to the earnest efforts of all concerned (and a little planning), the new Continental 317-C2 was in place and even saw a little on-air experience.

The C2 worked just fine. Our only modifications were to add the Magniphase mechanical counter and the UPS for overload logic.

We also instituted one factory modification. The internal/external RF oscillator selector switch was moved to the front panel, making it possible to switch to the other unit without turning off the C2.

One impressive point was the multitude of remote control and status functions that were already on the main front terminal strip. It seemed to me to be Continental's incorporation of engineers' wishes over the years.

To date, the transmitter has operated over 1,050 hours, and is performing with the best of reliability.

Editor's note: For further information on Continental transmitters, call Vernon Collins: 214-381-7161.

Buyers Briefs

Elcom Bauer

Elcom Bauer's medium power AM transmitter line, ranging in power output from 5 kW to 15 kW, offers 125% peak capability; AM stereo adaptability; high-level plate modulation; three tubes; plug-in, solid state, low-level audio and RF driver stages, and more.

These remote ready (wire or STL) transmitters, dubbed 705C, 710C and 715C, also come equipped with oil-filled modulation transformers, two ovenless switchable crystals, interfaces for standard telemetry control equipment, step-start and three-step overload, secondary operating parameters with multimeter readout, and front panel circuit breakers.

Elcom Bauer's low-power 701B AM transmitter operates at nominal power outputs of 1,000 W, 500 W and 250 W, with a maximum output of 1,100 W. Self-contained in one cabinet, the single-tube (4-500A or 4-400A) solid state 701B transmitter features a built-in dummy load that is capable of operating at full power with full modulation.

For more information on Elcom Bauer AM transmitters, contact Paul Gregg at 916-381-3750.

TTC Wilkinson

TTC Wilkinson's AM transmitters, which boast quiet operation due to oversized air intakes and direct-drive blowers, are equipped with a solid state RF exciter that generates a signal with enough voltage swing to drive the intermediate power amplifier.

A conventionally designed crystal oscillator operates at two or four times the final output frequency. The crystal oscillator operates at two or four times the drives a divider circuit providing the operating frequency.

Wilkinson AM transmitters, ranging in power output from 250 W to 25 kW, also incorporate heavy duty coils and vacuum capacitors in the final power amplifier, designed to ensure cool operation and long tube life. The output circuit is a vacuum capacitor tuned Pi-L

(continued on next page)

Consultants

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Buyers Briefs

(continued from previous page)
network, and the load control is a motor-driven air variable capacitor.

For more information on Wilkinson AM transmitters, contact Mark Hutchins at 303-465-4141.

CSI Electronics

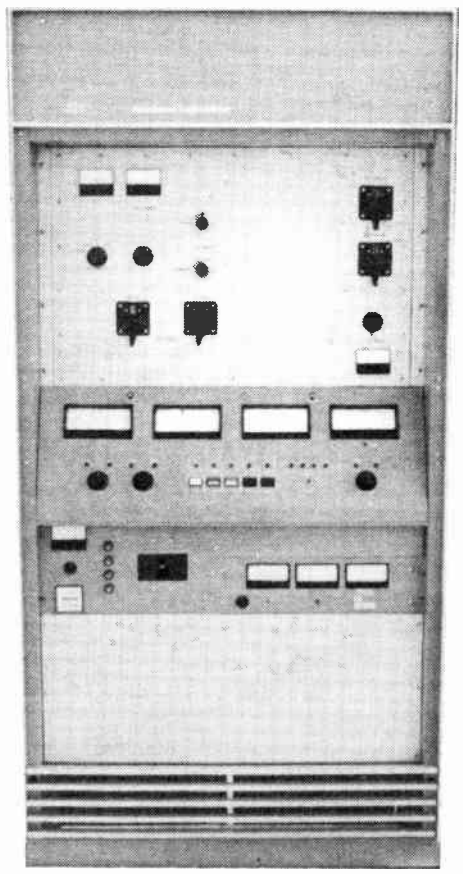
CSI Electronic's 1 kW, 2.5 kW, 5 kW, 10 kW, 25 kW and 50 kW AM transmitters, which are already prewired for remote control, come equipped with variable vacuum capacitor and slug tuning, loading and tuning front panel adjustments, a hinged exciter panel for accessibility, low voltage control circuitry, front panel plug-in relays that facilitate adjustments and maintenance and more.

CSI AM transmitters, including the T-50-A1, T-25-A1, T-10-A1, T-5-A1, T-2.5-A1 and the T-1-A1, utilize RF power output tubes (operating class "C") that, in conjunction with variable tube capacitors or slug-tuned circuits, provide "reliability and minumum operating costs," the company said. In addition, CSI parts and wire meet EIA standards.

For more information on CSI AM transmitters, contact Saul Gelman: 813-647-1904.

CCA Electronics

CCA Electronic's AM tranmsitter line ranges in power output from 2.5 kW to 50 kW. The self-contained 50 kW version, which is designed for 125% modulation, features conventional high level plate modulation and air cooling; RF and modular circuits; PA and modulator tubes (4CX35000C and 4CX15000D); more than 5 kW of reserve power and other standard components.



The company's 10 kW and 15 kW three tube AM transmitters, also offering 125% peak capability, have plug-in solid state low level and driver stages, dual crystal solid exciters, optional programmable phase locked loop exciters, a balanced or unbalanced transformerless audio input, remote control interface, relay control logic, automatic three-level overload recycling, more than 2,000 W of reserve power and more.

Rounding out CCA's Am transmitter line is a 2.5 kW and a 5.0 kW version, which offer several of the above features and specifications.

For more information on CCA transmitters, contact Ron Baker: 404-964-3530.

KDKA Debuts AM Stereo

(continued from page 27)
there were three calls commenting on how good the stereo sounded!

The next morning, KDKA once again signed off at 12:05 AM. At 5 AM we signed back on with transmitter #2 in C-QUAM stereo. That day there were several more calls about the stereo. A few days later we went public with the announcement of AM stereo.

BE system chosen

Both the Broadcast Electronics (BE) and the Motorola C-QUAM systems seemed to be equally reliable and able to accomplish the same end result. At KDKA the BE AX-10 won out because of the unit's physical/mechanical layout.

KDKA has two Harris MW-50-A transmitters with the MW-50-B audio boards installed. No difficulty was encountered interfacing the exciter to either transmitter. One MW-50 was set up using the day position of the AX-10, while the other was set up using the night position of the AX-10.

Stereo separation, at worst, is in the neighborhood of 25 dB. Throughout most of the audio spectrum, separation is better than 30 dB.

On more than one occasion I have listened to KDKA, in stereo, way out on the fringes of our groundwave coverage area. To my amazement, I neither floated off into space when the receiver lost lock on the stereo signal—as some have predicted would happen in the pages of this newspaper—nor did I become violently ill from platform motion, as others have also predicted.

As a matter of fact, at the point where the diminished signal strength caused the stereo signal to produce annoying results, the signal in mono left an awful lot to be desired. As painful as it might seem, at that point it's probably time to switch over and listen to station X!

The nighttime KDKA signal covers half the country. At 4:30 PM, local time, KDKA drops its music format and goes to news/talk until 5 AM the next day.

The only stereo material aired during this period is an occasional jingle in the wee hours of the morning. Unfortunately, this precludes almost any skywave evaluation of KDKA C-QUAM stereo.

Listeners responding

Meanwhile, the calls continue to come in, on the average of one a day, from listeners who either comment or ask about AM stereo. It's obvious that there are C-QUAM receivers out there, although maybe not as many as we would like.

I might add that all of the comments have been favorable, with one exception.

A few weeks ago a gentleman called and said he had been listening to KDKA in stereo (in his new GM car) since the beginning of November. He said, "I am disappointed. It sounds identical to FM stereo. I can't tell the difference. I really had expected something better than FM!"

Well, Mr. Anonymous, we here at KDKA took that as a compliment, even though that perhaps wasn't your original intent.

Editor's note: For further information on the C-QUAM system, contact Motorola at 202-862-1549 or BE at 217-224-9600.

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THERE'S AN IDEAL MIX FOR YOUR STATION.

For many top rated radio broadcasters, Pacific Recorders & Engineering consoles are essential to their operations. Our family of consoles was designed from the same set of functional and operational specifications, with each ascending model adding capabilities without giving up features or performance in the process.

Since their introduction, more than 750 of our BMX on-air consoles have been installed. There's now two models in the BMX family; the legendary Series II, and the new Series III (which offers many more features with the same reliability and performance as the original BMX-II).

A workhorse for production, our flexible, AMX console offers a powerful combination of sophisticated stereo production and advanced on-air features.

Because high quality multitrack capability has become a top priority for more competitive production, we designed the ABX-a serious multichannel, multi-featured production console which retains the control features of the BMX and AMX.

And, because it was high-time to improve a dismal equipment situation in news/edit rooms, we've built the compact and versatile Newsmixer.

Five consoles. Five different systems designed to help solve your station's unique operational problems-including the problem of operational ease since all our consoles have similar ergonomic designs.

You'll need more technical information of course, and we'll be happy to rush it to you. Just pick-up the phone.

Hands Down, The # 1 Choice.

Pacific Recorders & Engineering Corporation
2070 Las Palmas Drive
Carlsbad, California 92008
(619) 438-3911 Telex: 181777

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