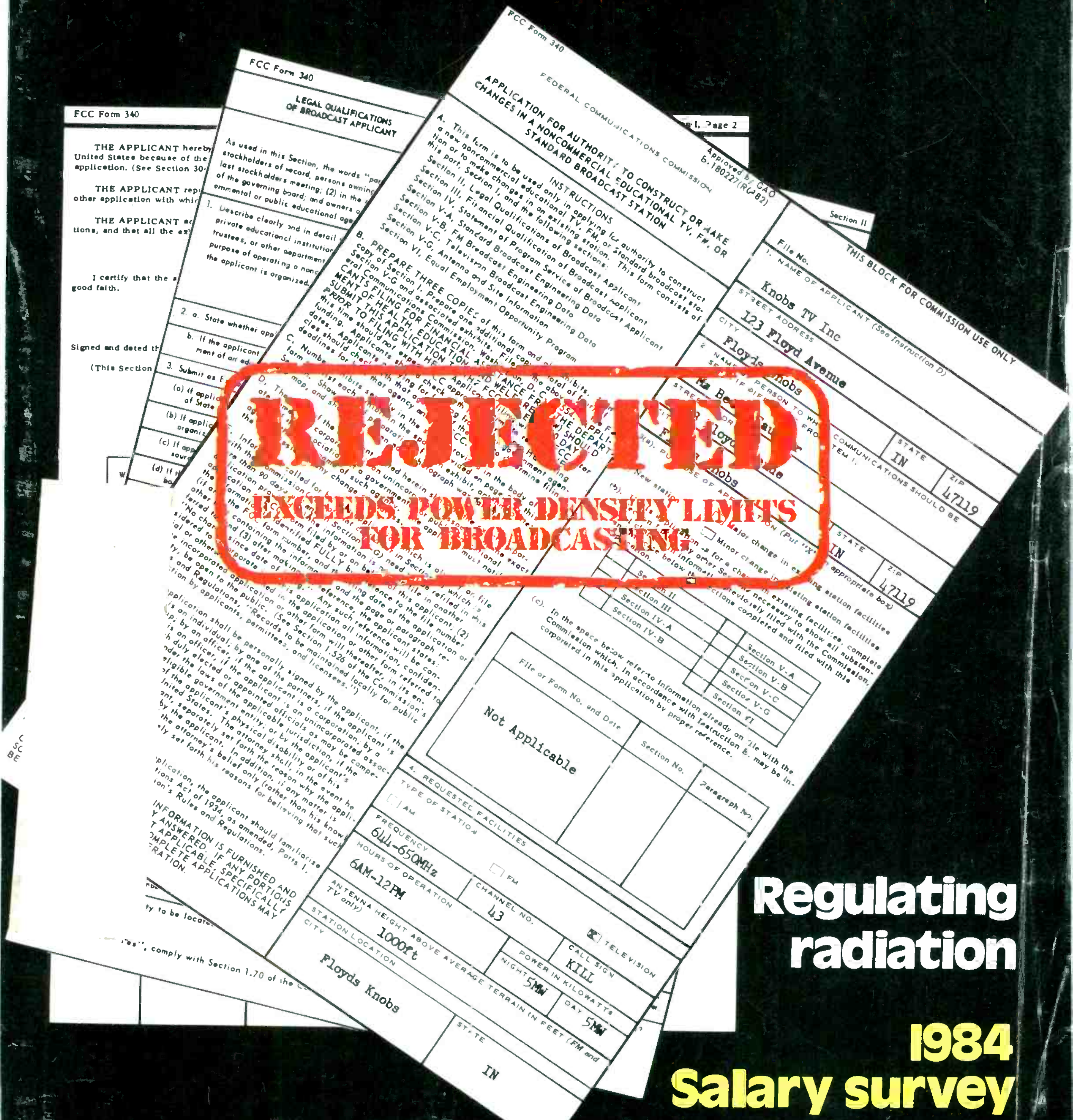
BROADCAST engineering®

October 1984/$3



Regulating radiation

1984 Salary survey

Lunchtime in the newsroom is a time for the News Director to chew over a thousand nagging questions. The stories are assigned. The day's programs are taking shape. But . . . is the intermittent problem in a field recorder fixed? Are all the facts nailed down on that enterprise story? Will the out of town crew get back in time? What's happening to pull the round-robin live remote together? Who's going to fill-in for the ailing late news producer? What about that report on political coverage for the GM? Where's the documentary outline? How about the sweep series production schedule? . . . A thousand questions.

The answer is in the newsroom somewhere. The Assignment Editor has lots of answers but she's on the phone. The producer has more answers but he's in the editing room with the investigative reporter. Nothing to do but interrupt them or catch them on the fly. No time for lunch. Someone's got to mind the store. . .

That's the way it is for News Directors in the best newsrooms at lunchtime. Too much to do. Too little time for getting it done. Staying in control and on top of the department doesn't make allowances for lunch.

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The journal of broadcast technology

October 1984 • Volume 26 • No. 10

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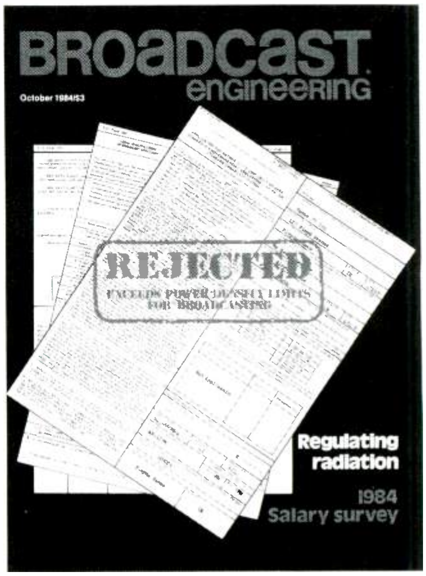


The cover this month dramatizes the possible adverse impact that regulation of electromagnetic radiation could have on the broadcast industry. See our series of articles on regulating radiation beginning on page 20.

Coming events

Oct. 8-11
AES 75th Technical Meeting & Exhibits, New York, NY

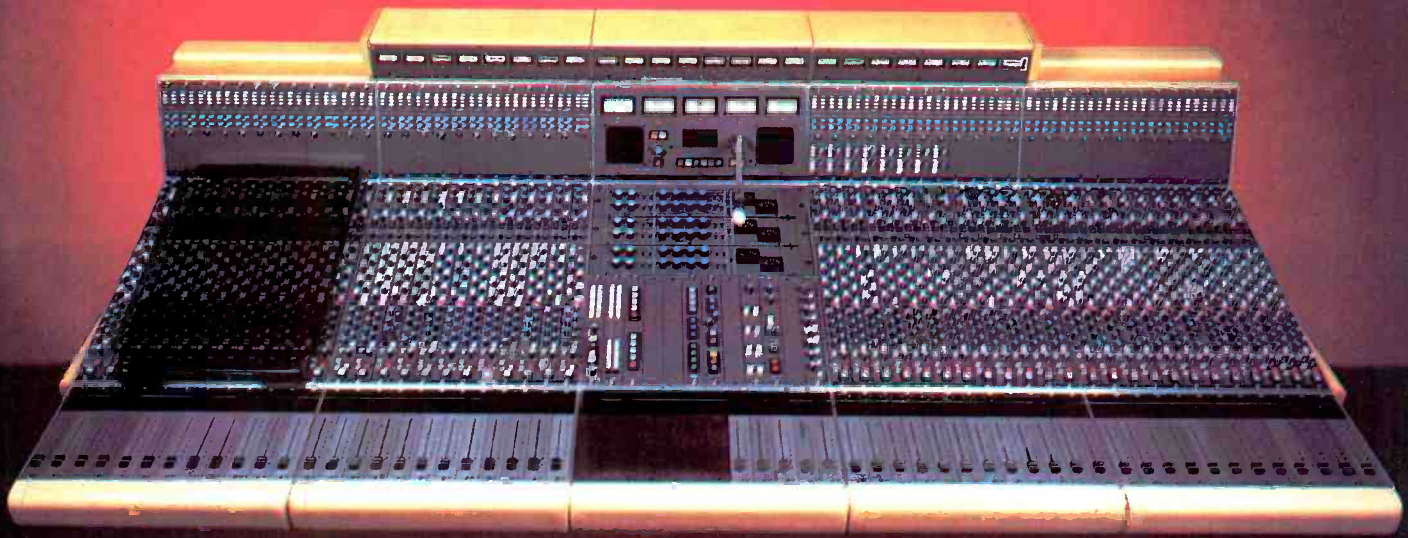
Oct. 27-Nov. 3
SMPTE 126th Annual Conference, New York, NY

Oct. 28-Nov. 1
Scientific-Atlanta Earth Station Seminar

Dec. 3-5
Radio Television News Directors Association (RTNDA) International Conference, San Antonio, TX

Dec. 5-7
Western Cable Show, Anaheim, CA

NEXT MONTH
- Station Maintenance Special
- NRBA conference replay



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By Joseph Sainton, principal engineer, Continental Electronics Mfg. Co., Dallas

Editor's note: With this issue of **Broadcast Engineering**, we begin a series of reports in this column on the process of converting a station from mono to stereo operation. The series begins with a look at transmitters.

For many broadcast engineers, the day is close at hand when your manager will say to you, "We've made the decision to go AM stereo." For some this will mean a green light to move ahead with plans already made, For others less prepared, it will conjure up visions of 80-hour weeks and major decisions involving new equipment purchases. Because of a widespread hope that stereo will put AM broadcasting back on a firm footing, there is bound to be some concern about whether the final result will have been worth the time and money. There may also be an underlying fear that the transmitter will be unsuitable for stereo, or that the station's number-one-rated mono signal will suffer. These concerns can be relieved by a wide-open airing of ideas and experiences gained in the stereo conversion process by those who have been there.

The complete stereo system can be divided into four major project areas. First, generating the stereo program signal at the studio complex. Second, getting the stereo program to the transmitter, which may be difficult because of STL frequency availability problems or Telco line costs. (There is bound to be some innovation forthcoming in this area.) Third, choice of a stereo processor and a stereo generating system. A well-reasoned choice here would have to be based largely on equipment specifications and—to some extent—on the subjective judgments of the users. Fourth, getting the stereo signal on the air through the transmitter/antenna system. It is in this area that we begin our examination of the AM stereo conversion process.

Incidental phase modulation

The multiplexing of the left and right stereo signals on an AM transmitter requires angular modulation of the RF carrier, in addition to the normal AM process. If the angular modulation component of the stereo signal is to be eventually demodulated in its original form, it must go undistorted through the transmitting system. This requires that any angular or phase modulation that accompanies the normal AM process be held to a minimum. Such phase wobble—called incidental phase modulation or IPM—will distort the stereo information being transmitted in the RF channel, causing a degradation in stereo fidelity and separation.

One of the questions more commonly asked in preparing for AM stereo is, what level of IPM is tolerable and how do we measure and deal with it? This question will be answered subsequently, but there should be just as much concern about other facets of the stereo process that are as important as IPM—namely the main and subchannel performance. By this we mean the capability of the audio modulator, as well as the angle-modulated RF channel, to transmit stereo information with acceptable distortion figures.

There is quite often some concern

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BROADCAST ENGINEERING

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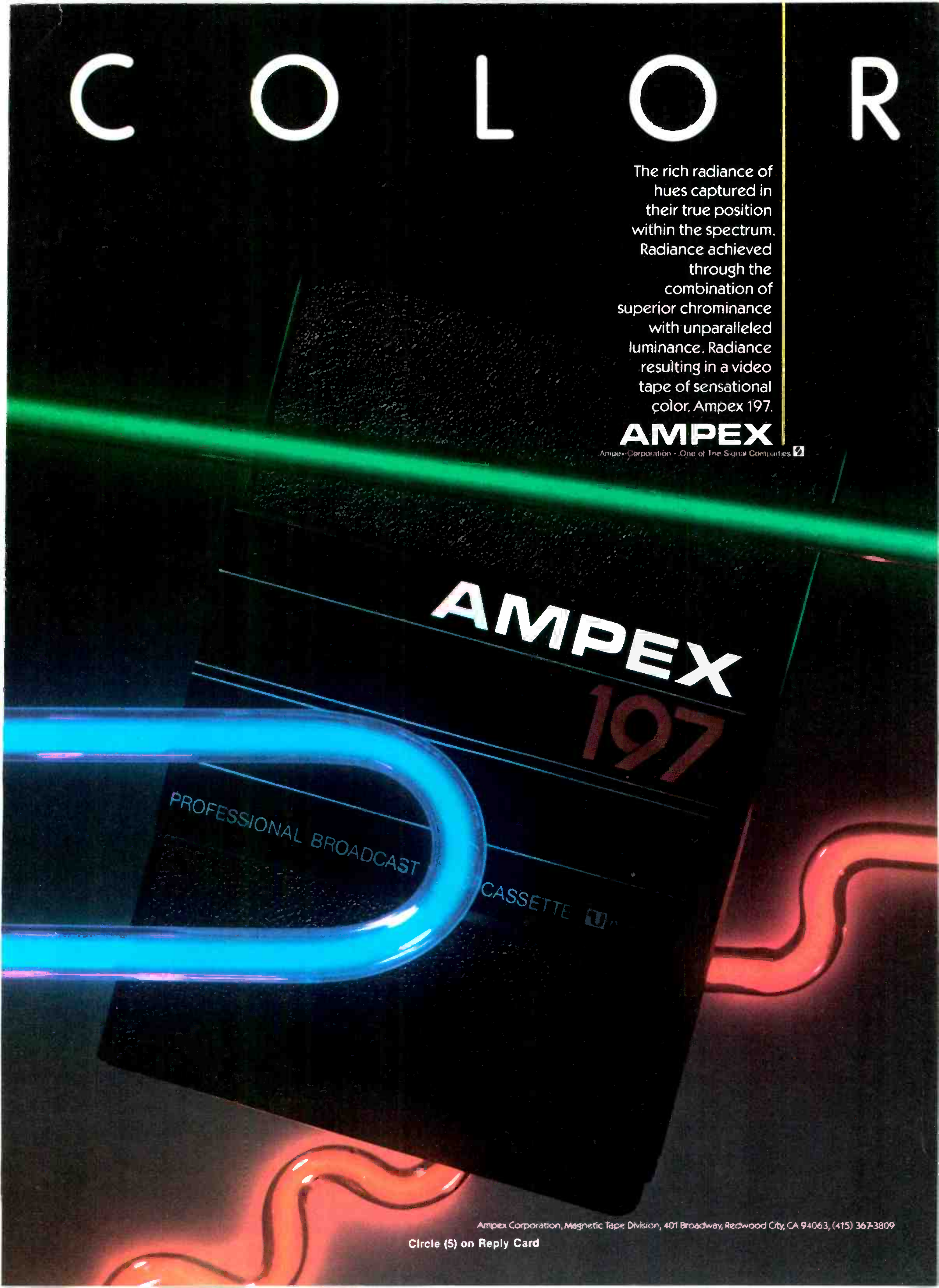
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FCC update

By Harry C. Martin, partner, Reddy, Begley & Martin, Washington, DC

7-station rule amended

The commission has replaced its "7-station" multiple ownership rule with a new limitation of 12 AM, 12 FM and 12 TV (whether VHF or UHF) stations. Even this 12-station limit will disappear after six years—leaving no FCC restrictions on the number of stations a broadcaster may own—if the FCC finds that within that time no undesirable concentrations of interests have developed.

The new rules, as they apply to radio station ownership, were to become effective on Sept. 10, 1984. However, the commission suspended implementation of the 12-station limit as it relates to television until April 1, 1985, or 60 days after reconsideration, whichever is later.

This additional time is needed, the FCC said, to assure adequate time for reconsideration in light of congressional concerns about the impact of the new rule on the TV industry. It is expected that on reconsideration the 12-station limit for TV station ownership will be replaced with a ceiling based on the percentage of total TV households served (for example, 25% for VHF, 30% for UHF and VHF).

In adopting the 12-station transitional limit, the commission noted that the nature and scope of broadcasting has greatly changed since 1953, when the 7-station rule was adopted. The 7-station restriction was adopted to encourage ownership diversity in order to foster varied programming and to safeguard against concentrations of economic power. But, the commission said, with a wide range of new broadcast stations and other services now available, and in light of the commission's local cross-ownership rules, there now is no threat to a diversity of viewpoints.

The commission will consider, but not routinely grant, waivers of its transitional 12-station limit.

Cutoff rules construction periods

The commission has proposed modifications to its cutoff procedures for FM and TV broadcast construction permit applications, and for applications for major and minor modifications to existing FM and TV facilities.

The agency proposes to replace its current cutoff procedures for commercial FM and TV applications with a 45-day filing "window" for vacant channels. Under the window system, a date would be announced when all applications for the vacant channels would have to be filed. All mutually exclusive applications would then be grouped together for comparative hearings.

Window processing would apply only to full-service commercial allocations. Non-commercial TV and FM educational channels would continue to be processed under the existing cutoff rules. Newly added allocations would trigger a future filing window for those new channels. Channels remaining vacant after the window closes would be processed on a first come-first served basis.

The commission also has proposed to eliminate cutoff procedures for both minor and major modification applications. Applications for new stations and mutually exclusive applications for modifications filed during a window period would be consolidated for hearing. If only a modification application were filed during the window period, it could be granted. If neither a vacant channel application nor a mutually exclusive modification application were filed during the window, the first filed application for a vacant channel could limit the modification options of existing stations. And, if modification applications were filed after the window, subsequently filed inconsistent applications for a vacant channel could be cut off as to their site selection options.

The commission said the proposed changes to its cutoff rules are intended to expedite new service to the public, but noted that service is being delayed through liberal grants of extensions of time to construct new stations. Therefore, the FCC also is proposing to strictly enforce its current limitations on the duration of construction permits: 12 months for FM and 18 months for TV.

"Major" change rule modified for FM and TV

In a related action, the FCC has amended its rules to remove from its definition of "major" changes FM and TV applications that involve at least a 50% change in coverage area.

In the past, such applications were subject to local publication requirements, a 30-day holding period and petitions to deny. Further, a change of 50% or more in the proposed coverage area of an application would subject it to dismissal if the application were mutually exclusive with another cut off application.

The FCC said it will continue to wait for 30 days after public notice before granting applications that are considered "major" actions from an environmental standpoint (for example, those involving construction of a new tower more than 300 feet high). Also, petitions to deny such applications based on arguments of adverse environmental impact will continue to be heard.

Rebroadcast of non-broadcast transmissions

The commission plans to amend its rules concerning radio and TV station rebroadcasts of messages transmitted by non-broadcast radio stations in the personal radio services (PRS). PRS includes CB, general mobile radio services and remote control radio services.

Under the commission's proposal radio and TV stations would be allowed to rebroadcast PRS transmissions without obtaining permission from the originating stations. The commission recognized that there are legitimate concerns about the quality of CB communications as a source of broadcast news and the need for verification of information received from CB stations, but said it would be more appropriate for individual licensees to assume responsibility for such matters.

The commission also proposed relaxing its requirements as to FCC notification of, or approval for,

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THE NEW TEKTRONIX 1750: HEADS OFF PROBLEMS YOU DIDN'T KNOW YOU HAD...UNTIL IT WAS TOO LATE!

Our new 1750 signal monitor gives you a unique, dynamic display of SCH phase relationships.

You can see at a glance if a video signal is properly SCH phased . . . or just as easily, compare two signals for color frame matching.

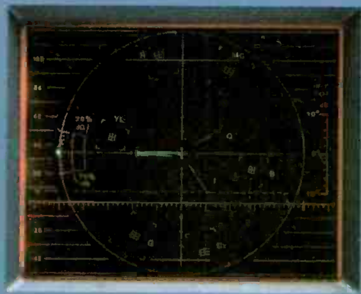
Hit-or-miss SCH phasing may have been tolerated in the past—but now it's costing you time and money every day.

The Tektronix 1750 can help you regain control. By maintaining consistent SCH phase . . . or by seeing potential problems *before* a glitch occurs, you'll avoid the frustration of multiple passes and enjoy getting it right the first time. Saving time saves you money and makes the best use of your valuable resources.

SCH phase, of course, isn't the only parameter you need to keep on track, and SCH display is only part of the 1750's comprehensive signal monitoring capabilities. At the push of a button it also displays vector mode . . . or waveform mode, enhanced by digital line selection through the vertical interval . . . or R-Y/sweep mode for easy interpretation of differential phase distortions.

Whether used for monitoring video in production and editing environments, or for making fast and accurate measurements during equipment maintenance, the 1750 Series is a new benchmark for comprehensive performance in both NTSC (1750) and PAL (1751) standards.

A compact 5.25 inch package, mechanically interchangeable with many other "half-rack" packages, allows easy installation in new or existing facilities.



Correct SCH phase relationship is clearly displayed on the 1750 when dot on the calibration circle is aligned with the vector on the −x axis.

Dot placement on the +x axis indicates an error in the color frame matching of two signals.

This 17-degree offset, indicating a 17-degree SCH timing error, would be impossible to perceive on an ordinary waveform monitor display.

If you see the advantages of comprehensive signal monitoring, you'll like what you see in the 1750.

For more information on this or other Tek television products, or for the number of your nearest Tek sales office, call our toll-free information service today: (800) 547-1512. In Oregon, (800) 452-1877.

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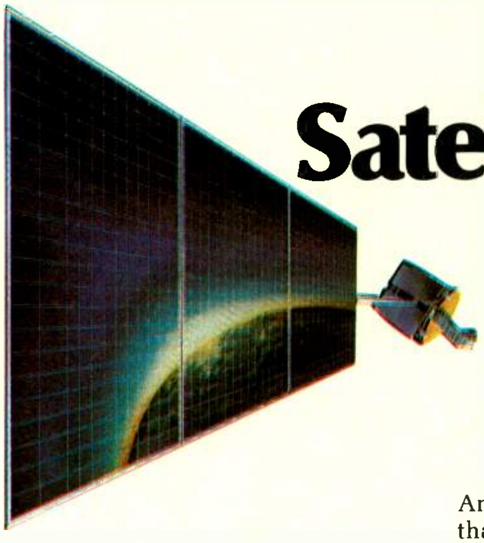


Satellite update

By the **BE** staff

NASA's Lewis Research Center has awarded a $260,304,000 contract to an industry team headed by RCA's Astro-Electronics Group, Princeton, NJ, for the design, development and construction of the Advanced Communications Technology Satellite (ACTS), regarded as the most advanced and complex space communications system in U.S. history.

The advanced satellite will be launched by the Space Shuttle in 1989, NASA said.

Other major participants of the industry team are TRW Electronics Systems Group, Space Communications Division, Redondo Beach, CA; COMSAT, Washington, DC; Motorola, Aerospace Electronics Office, Scottsdale, AZ; Hughes Aircraft, Electron Dynamics Division, Torrence, CA, and Electromagnetic Services, Norcross, GA.

Contract specifications call for a flight spacecraft, ground systems and operations. The contract calls for the work to be split among the several contractor facilities.

The Lewis Center has project management responsibility. The office of Space Science and Applications, at NASA headquarters in Washington, DC, manages the overall program.

Agreement responsibilities

Under terms of the agreement, RCA Astro-Electronics will construct the spacecraft and integrate and test the ACTS system. COMSAT will design and develop a master control station, a NASA ground station and operate and maintain the satellite when it is in space. TRW will develop the multibeam communications package, which will include a multibeam antenna, a baseband processor, low-noise receivers and traveling wave tube transmitters.

In announcing the contract award, Andrew J. Stofan, Lewis director, said that developing the ACTS technologies would help the U.S. maintain preeminence in satellite communications business.

"With ACTS, NASA and U.S. industry will work together to address required advances in frequency reuse through multiple spot beams, beam hopping and on-board switching and signal processing as well as operating at higher frequencies in the 30/20GHz Ka-band," Stofan said.

"These advances will be needed by future commercial space communications systems to be introduced in the 1990s in order to permit a more efficient use of satellite orbit positions and radio frequency resources and to allow for new forms of communications and data transfer," he said.

"Technologies to be tested in the ACTS program could lead to at least a 5-fold increase in satellite communications capabilities in the 1990s," said Joseph N. Sivo, chief of Lewis' Space Communications Division.

The capacity increases would be necessary to meet the expansion of telephone, television, teleconferencing, electronic mail, data communications and other communications satellite traffic, Sivo said, which is growing at about 20 percent a year.

A new band

The most widely used frequency band for domestic communications satellites is the C-band, from 4 to 6GHz, but this part of the radio spectrum is now saturated. Although there is still additional space available in the Ku-band, 14/12GHz, market studies show that these frequencies will be completely used by the early 1990s.

To permit further expansion of satellite communications service in the United States, there must be more efficient use of the spectrum currently in use, plus use of the next frequency band, the Ka-band. ACTS is designed to explore techniques of frequency reuse to be applied to present frequencies and overcome the technical problems associated with utilization of the higher band.

Domestic satellites presently operate with a single, continuous radio signal focused over the contiguous United States. The ACTS system will provide similar coverage via many spot beams, both fixed and scanning.

Trunking and CPS

ACTS technologies will allow two basic types of service: trunking and customer premises service (CPS). Trunking service will accommodate the high-volume user in metropolitan areas. A typical operational system would serve 10 to 20 trunking earth-station areas, each with a dedicated fixed spot beam.

CPS users, on the other hand, employing small and inexpensive earth stations located at their plant or office, would be served by either fixed beams or scanning spot beams.

One capability that will be offered by the systems will be satellite switching. In conventional satellite systems, messages must be switched to their destination by means of ground-based distribution networks.

With ACTS, an on-board computer will switch messages in the satellite, greatly simplifying ground-system design. With this approach, all terminals in the system will be interconnected through on-board routing and switching systems.

All satellite activity, including scheduling and message switching, will be controlled by a master control station. The MCS will be responsible for both satellite control and overall network control.

The 30/20GHz system will be comprised of four major elements: the satellite, trunking earth stations, customer premises terminals and the master control station.

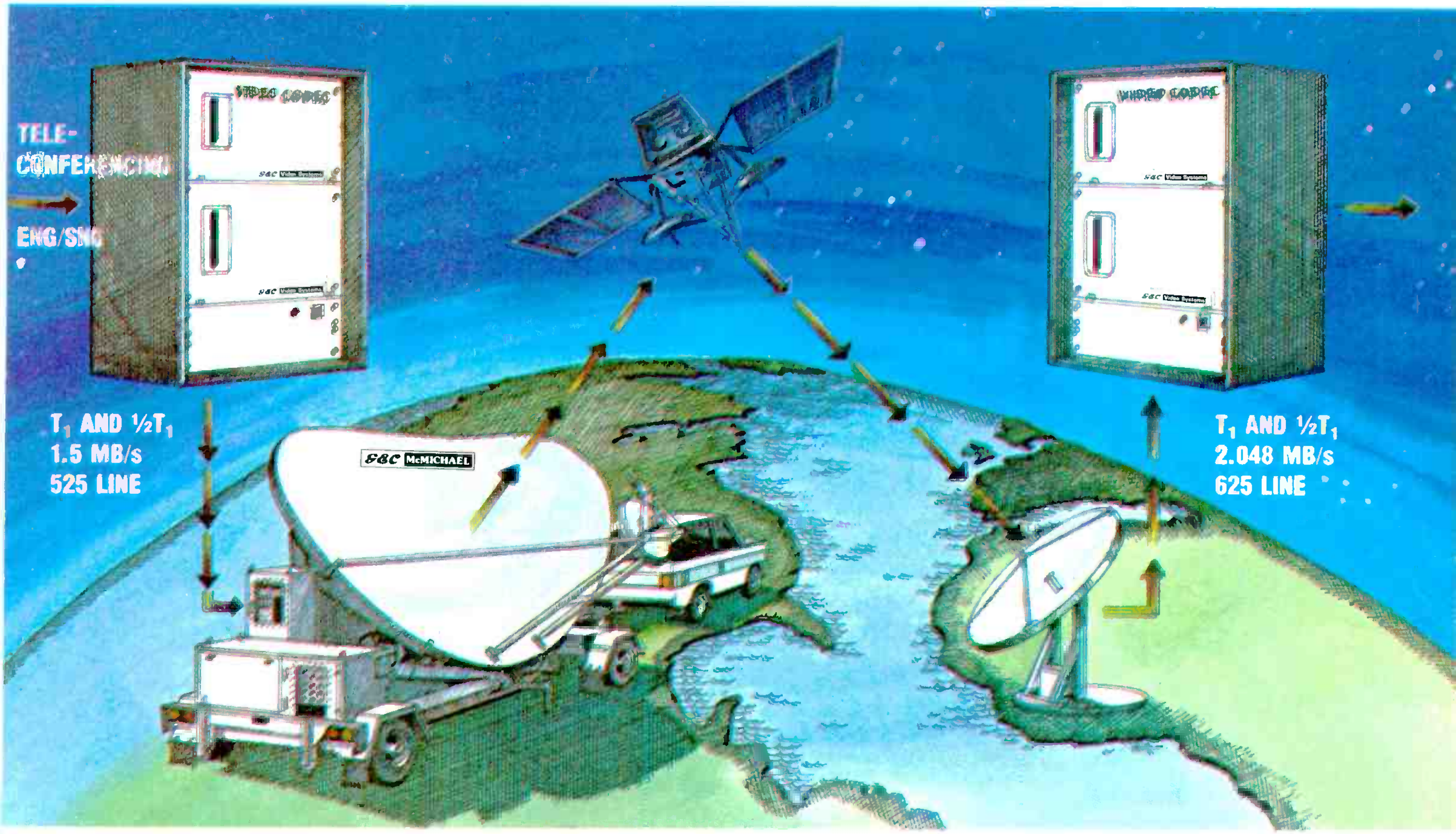
NASA has experimented in space communications since the early 1960s with such projects as ECHO, RELAY, TELSTAR and SYNCOM II, which established the feasibility of communications via a satellite in geosynchronous orbit.

Continued on page 16

GEC McMICHAEL/MARCONI STUDIO SYSTEMS

BROADCAST NEWS

SMALL TRANSPORTABLE SYSTEMS DESIGNED TO CHANGE THE WAY YOU TRANSMIT



Video CODEC compresses bandwidth, provides low-cost solution to teleconferencing and ENG.

GEC McMichael has introduced a T_1 / $1/2T_1$ compression bandwidth unit that is compact and light enough to go anywhere. In fact, the quality of the GEC Video CODEC—at 1.5 MB/s—makes it ideal for news department broadcasts as well as teleconferencing.

The CODEC, which is available in both 525- and 625-line versions, weighs only 116 lbs. and is 23 inches high.

When combined with GEC's small transportable KU band system, the new Video CODEC is easily the most versatile product of its kind available.

GEC McMICHAEL

Truly compliant KU band elliptical satellite terminals.

GEC McMichael offers a 5-meter equivalent terminal that fits easily inside a standard freight container and meets 29-25 LOG θ requirements in both planes.

The one-piece elliptical offset-fed C/KU band antenna can also be transported by a standard-size or ½-ton pickup. It is a completely redundant KU band system that is only 5.9 meters long by 2.6 meters high.

Since this is the smallest INTELSAT E-2 antenna on the market, it is ideal for hi-wind load, low-profile areas. The antenna's small size also makes it more environmentally compatible than competitive types.

GEC McMichael offers over half a century of broadcast experience.

GEC McMichael has been designing and manufacturing products for the broadcasting community since 1917. The company has been involved with KU band technology since 1977.

The ACE standards converter, a result of GEC's years of experience, is used by most major broadcast studios and is considered to be the standard of comparison throughout the world.

The broadcast experience and know-how that led to the development of ACE has also enabled GEC to design the highest quality compression bandwidth CODEC and KU band satellite systems.

GEC McMichael is a subsidiary of the General Electric Company of England.

For more information on any of the GEC McMichael broadcast products or systems, call 602/948-7255 or write GEC McMichael/Marconi Studio Systems at 8260 East Raintree, Scottsdale, Arizona 85260. TELEX 650-224-6202.

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Strictly TV

by Carl Bentz, television editor

Compatibility--an important factor

Various systems were suggested, but when the first TV system was standardized in 1941, it was the one recommended by the National Television System Committee (NTSC). NTSC specified 30 frames of 525 lines to create the image on the screen. Also, the frames would each be sent as two fields, in a technique called interlace.

With interlacing, a field of the odd-numbered lines was transmitted. Then a field of the even-numbered lines filled in between the others. The result of interlace was less chance for flickering images that might result from the short length of time that the phosphors on the TV CRT emitted light. Another factor was the improvement in motion that was allowed by the method.

Compatible color

The first color system, by CBS, was adopted in 1950. Transmissions began in June 1951, but were suspended in October of that year. To maintain compatibility with some 28 million b&w NTSC receivers, the FCC reversed its decision on the CBS color system and instead selected the compatible color NTSC approach, with transmissions starting in 1954.

Had the CBS line sequential color standard been used, the 405-line images would have made all the monochrome sets obsolete. The NTSC standard maintained compatibility by retaining the 525-line format, but changing the scanning rate slightly to 59.94 fields/s, a rate well within the tolerance of the b&w sets.

The NTSC signal has continued to serve its users quite well over the past 30 years.

Compatible stereo

When discussions for stereophonic aural transmissions for television began in 1979, several design and performance objectives were stated. First on the list was compatibility with existing NTSC monophonic receivers.

The same requirement was made when stereo service was added to FM broadcast. The transmission quality had to approach, if not equal, that of FM stereo broadcast, while including a separate audio program (SAP) channel and an auxiliary service capability. Switching from mono to stereo was to be done automatically through control signals within the transmitted signal. An audio processing system was suggested for improved dynamic characteristics and improved S/N ratios.

Compatibility required that the total signal remain essentially within the 6MHz bandwidth of the monophonic aural TV channel. The total of left and right should be received on non-stereo equipped sets. The additional information to be included in the signal could not cause undue interference in the picture of the mono receiver. Signal coverage in stereo must equal that of visual and mono sound.

And, finally, the sound on the mono receiver should not include any large increase in interference as a result of the new signal contents. To meet the compatibility requirements, several approaches to stereo TV sound were quickly rejected.

Japan leads

The first large-scale operation of stereo aural TV began in Japan in 1978. That system used an FM-FM approach to provide a stereo program, or dual-language service. Although it was compatible with existing receivers, the system did not fit the requirement of a SAP service. For the proposals made in the United States, the EIAJ (Electronic Industries Association of Japan) made modifications to provide the SAP channel.

Zweiten Deutschen Fernsehens

The second stereo service to go into operation was in Germany. The German approach was to transmit the two sets of audio information on separate carriers. Mono compatibility was retained because the L + R signal was carried on a subcarrier at 5.5MHz from the visual signal. L – R information was provided by a second aural transmitter at 5.74MHz from the visual carrier.

Along with incompatibility caused by the two aural transmitter approach, the German transmission standard uses a channel bandwidth of 7MHz. No modification of the German ZDF system was attempted for U.S. consideration.

The U.S. choices

When discussions for the U.S. system began, several entries were given. One was a modified version of the FM-FM approach used by NHK in Japan, called the EIA system. A second was offered by Telesonics. The third entry was from Zenith Radio Corporation.

Both Telesonics and Zenith used an AM modulated double sideband with suppressed carrier L – R channel. All three proposed FM-modulated SAP and "professional" channels along with a pilot tone system to cause automatic switching of the home receiver.

As examinations of the three systems progressed, modifications were made by the proponents, until by 1982, when it was time to select a recommended system, none of the three were really what they had been to start with.

The companies were asked to return for a second round of investigations, each with a proposed scheme that would be fixed in design. A decision would be made on those "final" versions.

As is now well known, the approach, recommended to the FCC for selection of a standard, was the Zenith method, combined with audio signal processing by dbx.

Another method

A different approach has been suggested by Grumman Aerospace Corporation. A second channel of audio could be converted to digital data and encoded into each video line. A total of 530ns would be used at the end of each line of video, occurring 2.12μs

Continued on page 16

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AM Stereo Update

Continued from page 4

about whether an *old* transmitter will be suitable for AM stereo because of a natural inclination to think of *old* as synonymous with *out-of-date* or *obsolete*. Nothing could be further from fact. Some older transmitters have produced stereo results superior to those attainable in new transmitters. Although the older generation units sometimes do not have the capability to supermodulate or transmit a picture-perfect square wave, they can usually produce very nice stereo.

Connecting the stereo exciter

Preparing a transmitter for AM stereo generally involves not only retuning and fine-tuning, but also some modification of existing circuits. First of all, the RF output of the stereo exciter must be connnected into the transmitter as a substitute for the internal crystal oscillator. In some newer transmitters, this connection has already been provided for. In others, the modification involves a means of selecting either the internal transmitter oscillator or the stereo generator using a 2-position switch, which also matches the RF output levels of both sources to provide equal RF drive to succeeding stages.

The RF level from the stereo generator can be as high as 40V peak-to-peak and can be either a sine or square wave. This is obviously too much drive for a solid state IPA stage and must be attenuated. For driving the grid of a vacuum tube, it may be insufficient and can be increased with a broadband step-up transformer in the transmitter. Prior consultation with the supplier of the AM stereo generator will be helpful in this regard. Some suppliers will ship the unit with an output level that has been specified by the user.

The mechanical switch used for the internal crystal/stereo generator selection should have provisions for completely disabling the crystal oscillator when operating in the stereo mode. Any small amount of cross-coupling can cause a low-frequency beat note if the two sources are not on exactly the same frequency. The beat note will show up as a phase modulated noise in the subchannel. The crystal can be disabled by removing the supply voltage or, in some transmitters, by grounding one of the crystal terminals.

Evaluating your transmitter

For someone contemplating the move to stereo, one of the troublesome unknowns can be the possible inability of the system to meet FCC performance specifications because of transmitter limitations. A fair approximation of what to expect in the way of stereo performance can be made by prior measurement of transmitter mono performance. The stereo quality will depend upon main and subchannel performance and IPM level. The main (or mono channel) can be measured in terms of harmonic distortion, frequency response and noise level by equipment already available at the station. The mono, or normal AM channel, transmits compatibility with existing mono receivers. The left and right difference information (L-R) is transmitted through the RF stages in the transmitter as angular modulation, which makes performance measurements impossible without some sort of PM or FM modulator/demodulator equipment. There are, however, some assumptions that can be made here. First, because this modulation is transmitted without any requirements for amplitude linearity—like FM—there should be no distortion or response problems. Second, because any amplitude variations brought on by induced noise or filament hum will be stripped off during the demodulation process, the noise level should be no problem.

Both of these assumptions are valid about 90% of the time. There is occasionally a case where power supply ripple will cause a phase modulated hum, or where the narrow or non-symmetrical bandwidth of tuned circuits in the transmitter will give rise to distortion and response problems at modulating frequencies above 5kHz.

The Sony AM stereo receiver will detect the presence of hum in the subchannel simply by listening to the station's mono program with the receiver switched to AM stereo mode, either A or B position. If hum is heard in stereo mode, and it isn't there in mono, then a phase noise problem exits. This is easy to correct with additional power supply filtering in the low-level RF circuits of the transmitter.

Subchannel distortion caused by tuned circuit bandwidth problems is usually no worse than the increase in distortion and decline in frequency response experienced in the mono channel as the modulating frequency is increased. Bandwidth is one parameter where older, all-vacuum tube transmitters have a slight edge over models with solid state RF drivers. The bandwidth problem stems from the large step-up in RF voltage required in the tuned circuit, which provides drive from the output transistor to the grid of the first vacuum tube. The step-up ratio is much smaller in tube-type drivers because they operate at high plate voltages.

Measuring IPM

Although an RF spectrum analyzer is not commonly included in a station's test equipment inventory, if one can be borrowed or rented, it can be used to access the condition of the transmitter's IPM performance.

A transmitter free of distortion and IPM that is modulated 100% at 1000Hz will display on a spectrum analyzer screen a carrier pip (referenced to the top or 0dB graticule line) and an upper and lower sideband each 6dB below the carrier amplitude and spaced 1kHz on each side of carrier. If the transmitter has 1% harmonic distortion consisting of pure 2nd harmonic but still no IPM, sidebands will appear at 2kHz on either side of carrier and will be 40dB below the 1kHz points (or 46dB below the carrier performance). If the transmitter has 3% harmonic distortion (still 2nd harmonic) and no IPM, the 2kHz traces will rise to 30dB below the 1kHz sidebands (or 36dB below carrier).

If we *measure* 1% 2nd harmonic distortion on a distortion measuring device and *see* 2kHz pips down only 30dB, we now have IPM. It isn't at all unusual to see the IPM pips down only 20dB, and occasionally just 10dB to 15dB. The source of the IPM will vary from one transmitter type to another, as will the level, which means that different transmitters require different treatments. This subject will be discussed in the AM Stereo Update column next month.

FCC Update

Continued from page 6

rebroadcast of the transmissions of private (other than amateur and CB) and government non-broadcast stations. The proposed rules would require broadcasters to obtain prior written rebroadcast permission from the originating station, but they would not require that such permission be filed with the FCC. Instead, the written permissions would have to be made available to the FCC on request and retained until final FCC action on the station's license renewal subsequent to the rebroadcast, or for one year, whichever is longer.

The commission also has proposed to allow AM stations to use a direct reading RF power meter. The instrument directly measures the operating power of AM stations, eliminating the need to calculate the power or to rely on the measured antenna resistance.

Strictly TV

Continued from page 12

before horizontal sync. With companding, a S/N ratio of 65dB and less than 2% THD has been noted as possible with this approach to dual-channel audio. Because it does involve digital processing, other information could conceivably be encoded into the same location for additional services.

The Grumman Rainbow Sound system has been rejected by some because of a non-standard receiver condition. The horizontal screen width of home receivers vary widely. As a result, the encoded information might be visible on the right edge of the picture, just as the vertical interval information often shows, especially when the ac line voltage dips during heavy ac power drains because of hot weather and air conditioning.

Demonstrations of the system at trade shows, however, have shown the system to be capable of high quality sound reproduction.

The FCC's regulation

When the commission approved the use of the Zenith/dbx transmission system, it wisely did not reject continued experimentation. No station shall transmit a signal that may be recognized as the pilot tone as used by the Zenith/dbx decoder plan. Doing so may get a citation from the commission, as it may be construed with interfering with an established mode of communications.

Recent FCC action has rejected complaints by one manufacturer of signal security products. The problem involved the pilot tone of an established scrambling system. It is assumed that the scrambling equipment will need to be retrofitted for another pilot, if it is to continue to be used.

The implementation of stereo is now under way, with several stations already on the air, including WTTW, Chicago, and WETG, Hartford, CT.

But the arguments remain. Some question the amount of distortion that will be present in the audio due to additional information being transmitted. It has been suggested that the distortion may reach to 10% for stereo mode transmissions received on established monophonic receivers.

It has also been questioned if the distortion level does not perhaps already reach 10% or more even without stereo transmissions.

The wider bandwidth response required for the stereo aural signals is not entirely compatible with cable TV equipment. A furor, prior to the FCC's decision, prompted a delay in the "must carry" portion of the regulations. Some questions are also raised in TV translators and repeaters in regard to the carriage of stereo. At this writing, the CATV and translator solutions have not yet been reached.

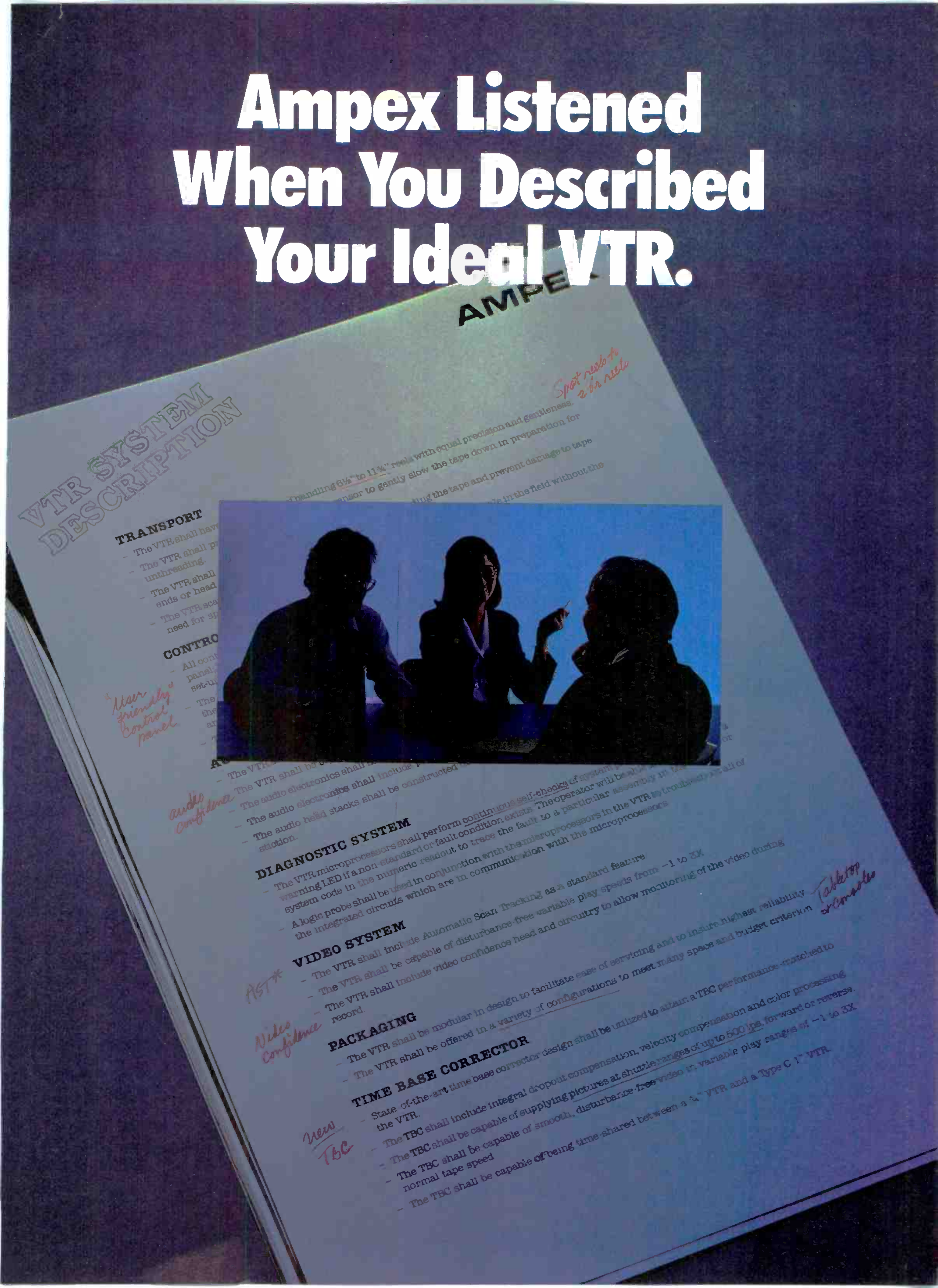
Satellite Update

Continued from page 10

assigned as the NASA lead center responsible for advancing satellite communications technology. At that time, it began laboratory studies development and testing of component technologies that will make up the ACTS system. In the program, these laboratory technologies will be tested together within a single satellite system and evaluated in an earth/space environment.

One of the primary goals of ACTS is to make the capabilities of the ACTS spacecraft and ground systems available for experimentation by the public and private sector.

Universities, companies and other research organizations that meet specified requirements for space communications research will participate in experiments during the flight phase of the program.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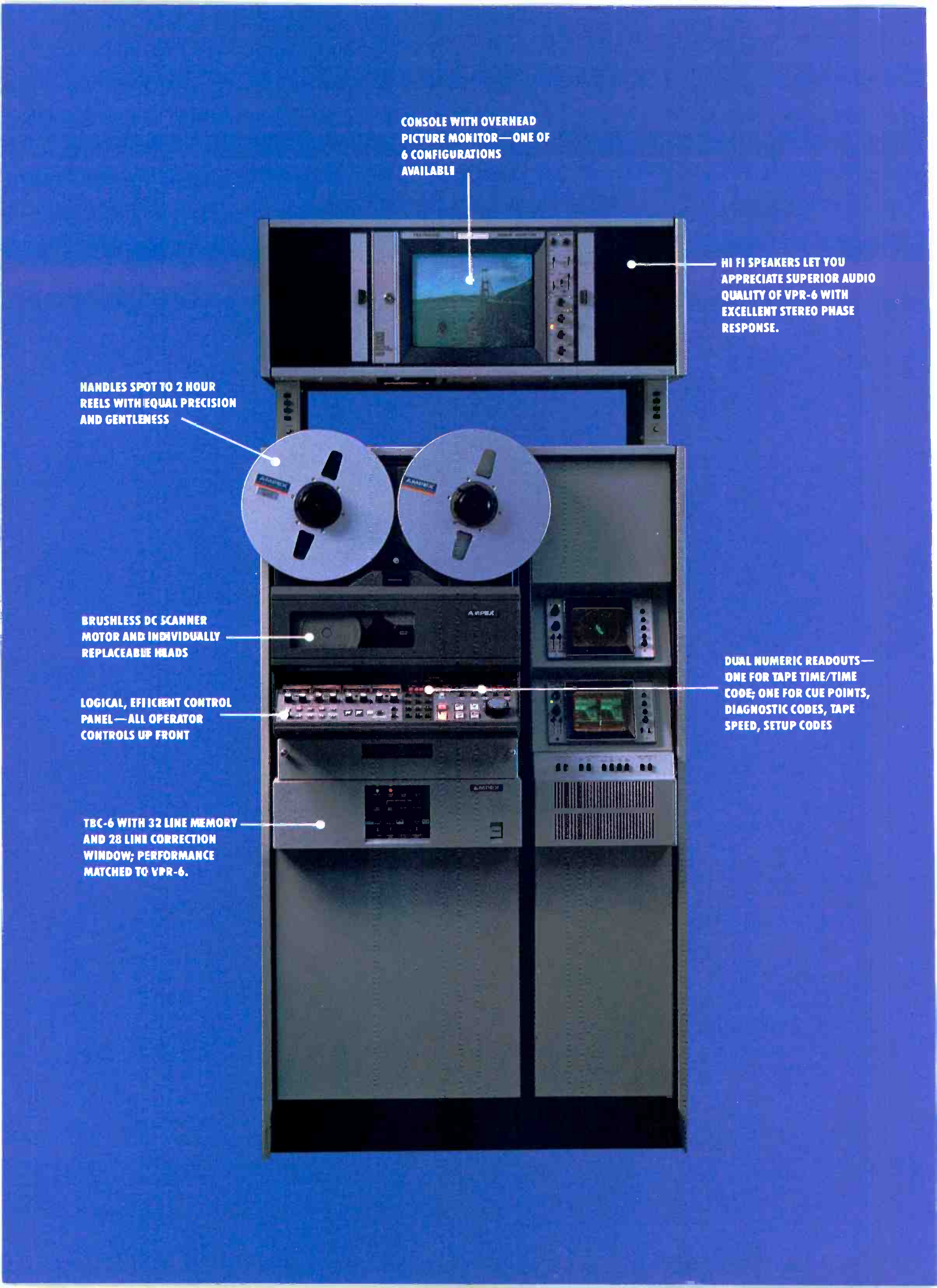
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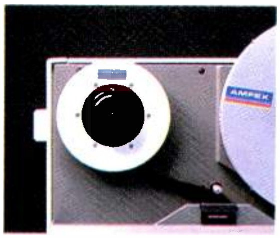

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editorial

Beware of radiation!

Mere use of the word "radiation" fascinates. It invokes fear. It causes emotional stress. It incites riots.

Yet, radiation is only a word. And a highly misunderstood word at that.

There are two kinds of radiation. Both are beneficial to man when properly handled. Both are deadly if improperly treated. Both can cause heating effects in matter. Both have existed since the dawn of the universe.

But beyond these three areas, however, similarities between nuclear radiation and electromagnetic radiation differ.

Nuclear radiation is capable of significantly altering the molecular structure of matter upon contact through the interaction of subatomic particles. Such particles exist in a background form to which we are constantly exposed and over which we have no control. Some suggest they could be an explanation for human life through molecular and genetic alteration of living tissue as the basis of evolution.

If responsible individuals are involved in constructing power generating facilities, such installations can operate safely, as European experience shows. But nuclear radiation has no significant relationship with broadcasting.

Electromagnetic radiation is more difficult to grasp. It does not appear to exist as particles, but rather in a wave nature, emanating outward from a source, such as light, radio waves and magnetic fields. It can also be generated, and to a large degree controlled, by man's inventions. It does not alter or destroy subcellular structures in living tissue or other matter upon initial contact.

It is the basis of radio and TV communications throughout the world, as well as serving medical and industrial purposes. Without electromagnetic radiation there would be no radio, no television, in fact, no sight.

A large segment of the public is unfamiliar with electromagnetic radiation or RF energy. They equate it with the same destructive capability that was witnessed in Hiroshima. Too often they are misled by the media, because qualifying words to designate radio frequency are not given to them. The result is a vast fear and misunderstanding of our industry.

The energy emanating from many different types of communications antennas is regularly targeted by the uninformed as a possible hazard to human health. Since the Sixties, many organizations have studied the possible effects of RF energy on the human body. Regulatory limits were set in 1979 on the amount of exposure the general public should endure. Those limits were tightened in 1981.

At present the Environmental Protection Agency is still, since 1979, trying to determine perhaps tighter limits to be placed on RF energy. The agency's results, if and when they might appear, are to be taken as the basis for federal regulations to govern our industry. By having federal restrictions, we are told, the general public will be more at ease with our industry.

The most curious thing about radio frequency radiation is that there seems to be no proven health-related problems from RF energy transmission on record from the general public since man discovered his ability to transmit radio waves in 1875. Security measures are required at all transmitting sites to keep the general public from coming in contact with RF generating and radiating devices.

There are occupational health problems, but they involve individuals who were required to be working in and around generating or radiating equipment. The known occupational effects include burns, from accidental contact with radiating antenna elements and occasionally by leakage from broken transmission lines. Another occupational hazard involves tower workers and the possibility of falling from the tower.

It is interesting that we, as a group of broadcasters, plead for additional regulatory relief, we must also plead with agencies that are seeking to place additional restrictions on our operation.

Can these new regulations, which will ease the public's mind, mean any more to them than those that are currently on the books? Would it not be more to the point for broadcasters to organize in providing information regarding what RF energy is?

And while some research should undoubtedly be continued to search for possible problems, does it make more sense to have scientists acquainted with the industry looking for those problems with money from the private sector, rather than a tax-supported federal agency?

Perhaps more to the point, if a federal regulation is required for peace of mind, and as there is no proof that the $10mW/cm^2$ energy density value is unrealistic for exposure to broadcast signals by the general public, then can we not live with the FCC "enforcing" that level?

Regulating radiation

Alphabet soup: Who is running this show anyway?

Through the recent concern over radiation and exposure, the biggest question has been who or what will be the governing force.

By Penny Sirna Weigand

A recent article in the *New York Times* stated that the Environmental Protection Agency planned to recommend for the first time that the federal government limit the strength of radiation from the antennas of radio and television transmitters because of possible human health risks.

The reason for this recommendation was that new studies had suggested that radio broadcast transmissions may, under certain circumstances, cause disorders in the nervous and immune systems. Apparently, according to EPA and broadcast industry sources, the federal government is moving toward certain limitations regarding the emission of radiation from broadcast towers, which would in many cases specifically restrict broadcast power allowed to stations now operating.

Scientists disagree as to the effects that may be caused by radiation exposure from broadcast towers, but regulations will apparently be enacted in the name of protecting the public health and safety. The proposed standards will be stricter than the voluntary standards now set by the industry, but no word has become public as to how strict the proposed standards will be.

Restricted power, restricted revenues

The issues broadcasters raise include losing power means losing broadcast coverage. Stations then lose revenue from advertising sources, because advertising revenues are based in part on their transmitted signal coverage.

The basic problem relates to the distance of one's location from the transmitting antenna because the radiated power falls off measurably with distance, i.e. as the inverse square of the distance. No one seems to know exactly what a safe distance is or what a safe dosage of radiation might be.

It has been suggested that the human body may be on the same wavelength as many antennas and is thereby "tuned in" to FM and television broadcasts.

Who runs the show?

The question next is, who or what governing bodies are in a position to control broadcast transmissions? Assuming your television transmitter is located in a populated area, how can this affect you?

The obvious answer is that the FCC controls your transmissions as they have done for years, but now the EPA is getting in on the act and is saying some things about broadcast transmissions that may ultimately affect your potential to reach your audience.

Next, the local government comes in and decides to provide a few more regulations. After all, they owe it to the community to protect them from seen as well as unseen dangers, no matter how illusive those dangers may be.

Local government regulation is presently the biggest concern. There are a number of reasons for this. One reason is that local regulation pro-

Splitting hares: 100mW or 10mW

Research in 1966 to determine hazardous RF energy exposure levels was carried out with rabbits as subjects. After many tests, it was noted that an exposure level of at least 100mW/cm² was required to produce cataract effects in the rabbits. Realizing that variations between body sizes would cause some variation, the research workers were prompted to suggest a safety factor of one-tenth the amount causing the cataracts. Thus, a level of 10mW/cm² was selected as the original "safe level" for humans.

Weigand is an attorney who lives in Jamul, CA.

vides no basis for uniformity. Another is that presently the local government, unchecked, can probably do whatever it wants.

Who does the checking and how is it done? First of all, you may find you need an attorney to argue your case. You can do it yourself, but this is a legal matter. If you want your best shot at keeping your coverage, figure your possible loss. An attorney will come cheap.

Here are the basic rules. If the local government passes a statute regarding your transmission, possibly even requiring you to relocate (this has been done in some communities), the rule is that if the federal government has effectively covered the regulated field. The statute will be regarded as preempted by the federal laws.

This means that what broadcasters probably want is effective governmental regulation by the federal government so that the broadcast associations can effectively lobby to assure that their interests are adequately protected. Additionally, uniform regulation will adequately prevent local community hysteria concerning the matter. There may still be a problem, however, even if a uniform standard is passed, because federal law generally allows a stricter standard to be imposed by local and state governments, while not allowing a lesser standard.

The argument should be made that because broadcast transmission is traditionally regulated by the federal government, rather than the local government, federal law should prevail over any local law. This is an argument that may prevail over imposition of any stricter standard that may be applied by local governments.

There is a test that may be imposed by the courts when making such a determination, commonly called the Subject Matter Regulation Test: 1) if the subject matter does not require uniform regulation; 2) if the reason for enacting local regulation is a rational one; and 3) if the balance of the local need as against the need for regulation on the federal level shows that the federal government will be bearing an unreasonable burden, then the local government will prevail.

Adapted to the issue, the broadcaster must show that broadcasting does require uniform regulation; that the reason for enacting local regulation was not a rational one, (perhaps this can be shown by pointing to inconclusive studies on broadcast radiation); and that in balancing the need of the local community against the need for uniform regulation, the community danger in light of inconclusive studies is slight.

Another local high card

There is another problem, however, that the broadcaster should note. The local government may not even need to pass a local ordinance, in that it has the power of control in its zoning rules.

Put simply, the local government could feasibly do one of two things: if you are presently operating under a conditional use permit, the permit could be taken away; and if you are *zoned* for operation, your zoning could be taken away.

Your remedies may include a Fifth Amendment "taking" argument, in that you may argue that your property through the zoning was effectively taken without just compensation. However, in many states, California among them, any reasonable use left for your property will mean that there has not been a taking.

If you try to argue that there has been a loss of value, you may then find that your property (that is the land itself) is now worth more, rather than less. Perhaps it is prime condominium property in an exclusive area of town.

The general rule is that governmental action that results in a lowering of value does not necessarily result in a taking, because reduction in economic value is an inevitable effect of governmental regulation. It's all a matter of degree.

What constitutes a taking?

A taking occurs if it is not reasonable to effect a substantial public purpose, or if it has an unduly harsh impact on the distinct investment-backed expectations of the owner. However, there is again a balance, the public need against the private cost. Where the police power of public health safety and welfare is concerned, one finds himself with a difficult argument.

For takings the property owner must be afforded two things: reasonable notice and an opportunity to be heard. It is for this reason broadcasters who may be affected should consult their attorneys.

Cable

One problem that some broadcasters may encounter is that the burden on their side may be found to be substantially lessened through cable coverage. That is, there would be an alternative means available to serve the public need and that the stations could arguably be carried through the cable system.

The argument the broadcaster would then have to make would be one of uneven distribution, that free public service would no longer be free, and the poor and minorities would be effectively deprived of a valuable public service and information tool.

The future

It is apparent that the broadcast industry is headed for a state of flux. Changes appearing upon the horizon will change the broadcast industry as it is known today. The problem broadcasters will face is how to minimize their losses throughout the change.

Perhaps effective controls on radiation emissions will be possible in the near future, eliminating the need for more drastic measures on behalf of governmental bodies. There is the possibility that perhaps satellite transmission is the answer.

Whatever the answer, broadcasters should be informed of their rights to eliminate unnecessary loss. Knowing the legal implications involved will help to alleviate this loss. [BE]

Editor's Note:
This article is a general statement of law and is one person's opinion. It is not meant to give specific advice. For specific advice on any area of the law, please consult your attorney.

Are you running a risk?

For convenience the electromagnetic spectrum is subdivided into sections. Of interest to broadcasters, these spectra include:

- **300kHz to 3MHz:** Low Frequency (LF)
  AM, shortwave (SW) communications.
- **3MHz to 30MHz:** High Frequency (HF)
  SW, FM communications.
- **30MHz to 300MHz:** Very High Frequency (VHF)
  VHF TV (channels 2-13), FM broadcast, mobile radio.
- **300MHz to 3GHz:** Ultra High Frequency (UHF)
  UHF TV, aural STL, ENG microwave, MDS/ITFS service.
- **3GHz to 30GHz:** Super High Frequency (SHF)
  ENG microwave, video radio (TV STLs), C and Ku satellite transmit/receive systems, DBS TV service.

According to various studies, the frequencies most likely to


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pose health hazards are those between 30MHz and 300GHz. From 3MHz to 30MHz and from 300MHz to 1.5GHz, possible effects follow a linear prediction curve.

Use of frequencies from 30MHz and above requires antenna systems with directional characteristics. Directional characteristics are necessary for efficient transmission of the RF energy into the areas to be served by the signals. In some cases, the directionality involves forcing energy that would go skyward into a more horizontal pattern, i.e., FM, TV, MDS and ITFS.

In other cases, antennas aim the transmitted energy in a specific direction from the antenna site, i.e., STLs, TV, FM, TV ENG microwave and satellite uplinks. Without highly directional antennas, these modes of operation are not viable. Line-of-sight paths are necessary for these directional applications.

The attenuation characteristics of the signals are also of interest. For example, using an 800MHz STL system, suppose that the signal leaves a microwave antenna at a 10W level. It is known that at 0.1-mile, the signal is attenuated by 76.15dB. If a loss of 3dB represents a reduction to one-half of the original power, then the 76dB figure represents a reduction of 76/3, i.e., halving by 25 times. The 10W signal is reduced to 2.98x10nW at the 0.1-mile distance. Out of line of the directed signal, levels of microwave energy fall into the picowatt or even femptowatt level.

As frequencies increase, signal energy also increases, but so does free space attenuation. Therefore, a video radio link at 7GHx would show a smaller signal level than the 800MHz system at the 0.1-mile distance. A 13GHz link poses still smaller possibilities for levels dangerous to the public.

Generally, energy from an antenna decreases as the inverse square of the distance. That is, the amount of energy falling on a unit surface at 2m from the source will be one-fourth of the amount received by the unit surface area at 1m from the source. At 10m, the level is 1/100; at 100m, 1/10,000 and so on.

Microwave Effects

The mechanism by which microwave ovens cook involves water molecules within tissue cells. Nearly all molecules are electrically polarized, positively and negatively. Under the influence of the electrical and magnetic fields of microwave energy operating at 2.5GHz, water molecules attempt to align themselves with the impressed energy waves.

In the attempt to change their alignment 2.5 billion times per second, the molecules experience molecular friction. It is friction-caused heat that cooks food. In the oven, efficient and effective use of energy is possible by the concentration and confinement of the energy within the reflective walls of the oven. In broadcast use, no such confinement is involved.

In Practice

Radio frequency energy used for broadcasting within the spectra of major concern emanates from directional antenna systems. Whether the transmission mode is FM, TV or STL, antenna design forces the energy to cover a specified area, for typical broadcast, or is pointed as a narrow beam at a specific destination point. In either case, if a major change occurs in the directional pattern of the radiated energy, the station would be aware of the change.

Directional antennas for FM, TV and STLs is elevated in nearly every case, with the exception of satellite uplink systems. Fencing or other security barriers are provided to keep the general public from coming in contact with the radiating system or to keep intruders out of the major beam of the transmitted energy.

What is a safe distance from a radiating source? According to recommended safe values stated in 1974, for a station transmitting an EIRP power of 1MW, a safe distance would be 186 feet for a 6-minute period. For a 100kW FM or TV station, a separation of 58 feet would be safe.

Most stations use the antenna height advantage to get greater coverage, thus making the distance between the radiating source and the general public even larger. The exposure to RF energy by the general public seems to become a moot point.

Local fears silence WORD

In April 1984, WORD Broadcasting approached the planning commission of Floyd County, IN, asking to erect a 1000-foot tower in Floyds Knobs, IN. Proposing a Channel 21 service of religious broadcasting, WORD was denied the tower location. The denial was based upon health hazards caused by exposure to radio frequency radiation, and that the tower would create an eyesore in the community.

Conveniently located outside flight paths for Standiford Field, the Louisville, KY, airport, the tower would be located near a dozen towers already present. To date the denial has not been overthrown.

According to directories, the area includes towers for WLKY-TV32 (ABC), 4.3MW; WKMJ-TV68 (ETV), 1.176MW; and EKPC-TV15 (ETV), 590kW, as well AM and FM stations. In nearby Bald Knob, IN, are WAVE-TV3 (NBC), 100kW; WDRM-TV41 (IND), 1.5MW; and WHAS-TV11 (CBS), 135kW. With start of transmission dates ranging from 1948 to 1971, there have been no reported cases of human health impairment because of RF energy radiation.

In a statement prior to her motion to deny the tower, one commission member said, "We have something (exposure to radio frequency radiation) that no one knows anything about. I will not vote for a tower that could endanger my kids. I teach out there."

A petition circulated against the tower site approval and cited that the tower would harm the "beauty of the Knobs."

Why 10mW/cm²

As early as 1966, studies of non-ionizing radiation dosage limits were done by the American National Standards Institute. In 1974, a limit of 10mW/cm² was recommended by ANSI as a safe limit of RF energy absorption. The value indicated the amount of absorbed energy, or the heating which resulted in living tissue averaged over any 6-minute period.

In 1980, a review of RF energy absorption data led to a revised recommendation of 1mW/cm² for signal frequencies between 30MHz and 300MHz. A frequency-dependent level below 30MHz and between 300MHz to approximately 1.5GHz was included, with signals greater than 1.5GHz to be limited to 5mW/cm² (See Figure 1).

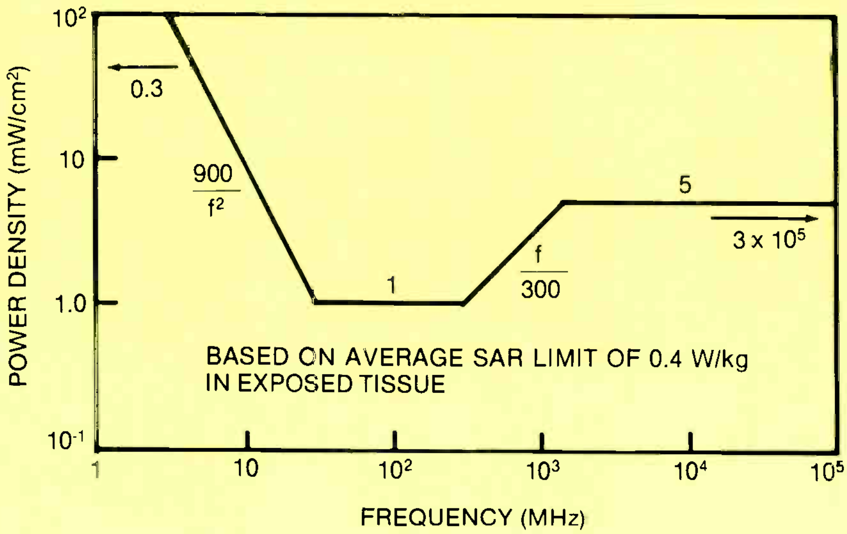

Figure 1. The proposed ANSI C95.4 Human Exposure Guide (based on whole body exposure).

Measuring power density is a difficult procedure and requires special instrumentation. It is possible to relate a signal power at the antenna to that distance at which the 10mW/cm² level occurs as follows:

$$D = [(EIRP)^{1/2}/5.4024]$$

where D is distance in feet and EIRP is in kilowatts relative to a half-wave dipole in direction D.

Another quick reference is that 10mW/cm² = 194.2V/m or 0.5A/m, relating field strength to the power density.

With the frequency-dependent factor of energy absorption, there is a dependence upon size of the absorbing body. Models of materials simulating living animal tissue have been used for absorption tests. For a man-sized object of 175cm length and a specific absorption of 10mW/cm², with the long axis parallel to an incident electric field, a maximum absorption of 2W/kg occurs at approximately 75MHz. As length decreases, frequency increases. A 7.5cm mouse model, for example, tends to have a *resonant frequency* of 1.5GHz with an absorption rate approaching 15W/kg.

Although the numbers appear otherwise, the actual absorption by the mouse is much smaller, due to the relative cross-sectional area of the mouse compared to the man. An easy interpolation is not possible, as scaling factors must be used to relate cross-sectional areas of the bodies. The measurements using model tissues do not take into consideration circulation of blood, which effectively dilutes the energy absorption effect.

In the case of man, it is interesting to note that the internal heat generation resulting from basal metabolism is equivalent to 1W/kg. The basal metabolism rate (BMR) is the heating effect that occurs as food materials are burned by the body. The BMR is almost a constant heating condition. RF energy heating values are derived from the average over a 6-minute period.

Call EEPA for action

Has your station received questions regarding exposure to RF energy? There is an organization that wants to know about it. The Electromagnetic Energy Policy Alliance (EEPA) combines forces of manufacturers and users of electrical and electronic systems. The members include the NAB, RCA, Raytheon, Rockwell International, Motorola, MCI Telecommunications, GTE and Bell Labs.

This committee was formed in April 1984 to advise federal and state governments on all aspects of production, use and effects of electromagnetic energy. The alliance plans to use public education and independent research to reduce public fear of electromagnetic (RF) energy and to correct public misconceptions. One problem will be to help people realize the difference between non-ionizing radiation and the more dangerous ionizing radiation associated with nuclear reactions and x-rays.

Technical seminars will be held by EEPA in Chicago on Oct. 31 and Nov. 1 at the Westin Hotel, O'Hare International Airport. For details about these seminars, contact Richard Ekfelt at EEPA, 1800 M St. NW, Washington, DC 20036; 202-452-1070.

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With RF rule, Boston tops Washington

Existing stations and other users of RF energy were exempted through "grandfathering" when the statute 105 CMR 122.000 went into effect on Oct. 1, 1983. The grandfather provision would probably never have been considered had the discussions been left to the original Non-Ionizing Radiation Ad Hoc Committee.

The committee began as a group of university professors, doctors and government representatives, none of whom held the interests of broadcasting. The makeup of the committee was eventually changed to include members of the broadcast industry.

The statute covers the field of RF users, as it is titled, "Regulations governing fixed facilities which generate electromagnetic fields in the frequency range of 300kHz to 100GHz and microwave ovens."

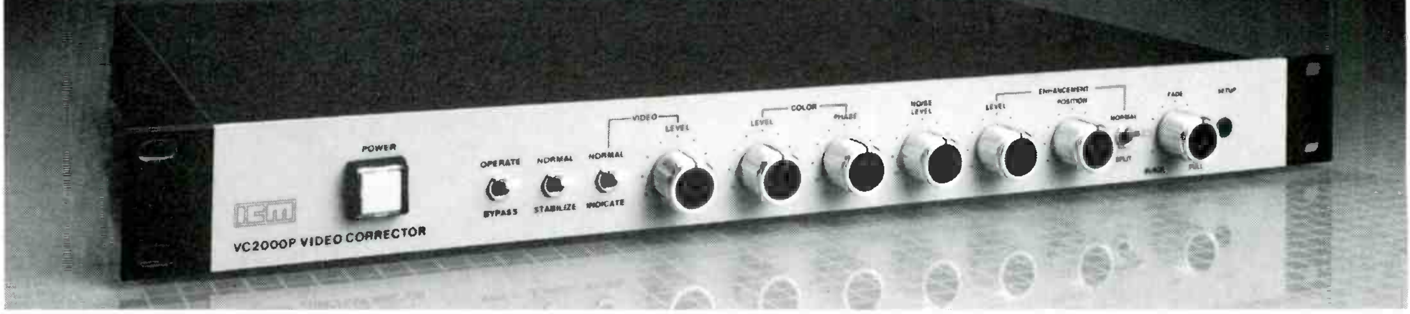
Exclusions, however, include government facilities; non-fixed RF machines (portable, hand-held and vehicular RF machines); scientific and medical machines per FCC rules and Class A and B computing devices; RF machines with an ERP of 7W or less; consumer products, except microwave ovens; RF machines which are in storage, shipment or on display for sale (non-operated); and RF machine's not connected to a radiating device.

Without an enforced federal RF energy policy, the Commonwealth of Massachusetts took a common "local" approach. If the federal guideline of 1mW/cm² exposure that averaged more than six minutes for frequencies between 30 and 300MHz was safe, then to be sure, a lower exposure (0.2mW/cm²) but allowable for 30 minutes would be better. Across the spectrum from 300kHz to 100GHz, the Massachusetts ruling is five times stricter than the 1981 ANSI recommendations.

All new broadcast facilities in Massachusetts must notify the Department of Public Health with a form similar to an FCC application. The notification must occur after the FCC has assigned call letters. If the department director approves, action may proceed. The director may request measurements of the environment before installation for which approval is sought.

Rules for measurement procedures are included in the document. Energy levels shall be measured at three locations: a point nearest the radiator on the facility property line; a point on the property line of predicted maximum radiation; and the nearest point regularly occupied by the public. Additional rules govern height above ground for the measurements and duration of measurements.

Had the provision excluding existing facilities not been included, some cases of severe hardship would have occurred for some stations in the state. There have been no reports of radiation-related injuries by the general public from conditions before the adoption of 105 CMR 122.000.



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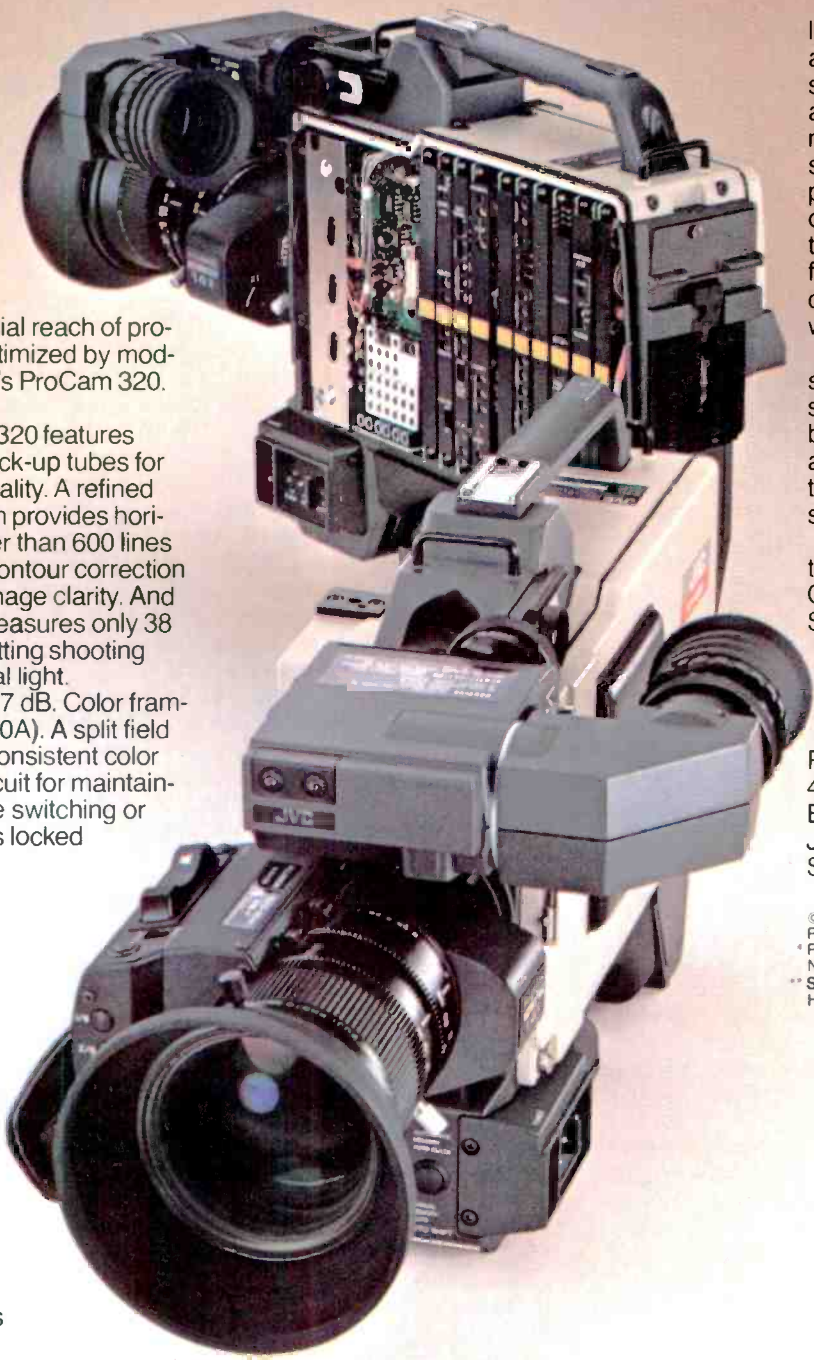
The ProCam™ Video Camera with Plumbicon* tubes at Saticon** price.



JVC's experience—and success—in designing the highest quality and reliability into compact video production cameras is unmatched. Now, continuing this tradition of high performance at an affordable price, JVC has brought a "high-end" teleproduction camera within the financial reach of production people often victimized by modest budgets. This time, it's ProCam 320.

What a package!

SENSITIVITY. ProCam 320 features three, 2/3" Plumbicon pick-up tubes for incomparable picture quality. A refined f/1.4 prism optics system provides horizontal resolution of better than 600 lines at center. A 2H vertical contour correction circuit further assures image clarity. And minimum illumination measures only 38 lux (3.6 fc) at f/1.7, permitting shooting even in limited or artificial light.

A video S/N ratio of 57 dB. Color framing output signal (RS-170A). A split field color bar generator for consistent color reference. A genlock circuit for maintaining a stable picture while switching or mixing with other signals locked on the same source.

EASY OPERATION. Several 8-bit data memory chips offer operator conveniences for quick set-up and consistent performance. These include: Auto centering, auto-black balance and auto-white balance, auto black level stabilization and auto beam control circuits. Matrix masking for true color reproduction and automatic protection for the pick-up tubes are a few of the many features standard on this new camera.

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Corporate profile:

Dynatech

By Bob Paulson, AVP Communications, Westborough, MA

Utah Scientific and Colorgraphics Systems both produce equipment for the broadcast industry and operate under the same corporate umbrella. This umbrella is Dynatech Corporation and also includes data communications, medical diagnostics and test instrument manufacturers.

At the start

In 1959, two professors from MIT, J. P. Barger and Warren M. Rohsenow, who were recognized in heat transfer technology, founded Dynatech Corporation. Today, Barger continues as full-time president and CEO at the headquarters in Burlington, MA. Rohsenow retains his chair in mechanical engineering at MIT and serves as chairman of the corporation.

Product diversification into the data communication industry began in 1974 as an experiment within the medical division with the establishment of Dynatech Data Systems, Springfield, VA. The first product, Dyna-Patch, was a multicircuit jack, which could divert signals around faulty equipment automatically.

By 1980, the corporation had grown to $50 million in sales and included medical diagnostics, data communications and test instruments in its worldwide marketing program. Two products in data communications bolstered the totals. One is Dynatest test equipment to monitor and to simulate an entire data communications network. The second, DynaNet, forms a network management system controlling and monitoring an entire system from a central location. A key product is the CTM-100, an electronic matrix switch that allows networks to keep data traffic flowing in large communications systems. It has given Dynatech prominence in the data communications industry.

This product line and other acquisitions resulted in a virtual doubling of the total business within three years to almost $100 million in fiscal year 1983. Communications business segments that joined the corporation included microwave systems, all-digital test systems and satellite simulators. Expansion in the data communications marketplace was provided by the X.25 protocol converter and multiplexer products that interface public and private data networks to high-speed packet switching networks.

Why broadcast?

Dynatech's dominant operating objective is supplementing internal growth and returns to its stockholders through company acquisitions in high-tech, high-risk, potential high-return industries. It was reasonable, then, that the corporation joined the technology explosion of the broadcast industry with the purchase in 1982 of Utah Scientific, manufacturers of distribution routing and master control switching systems.

Lyle Keys, founder and president of the Salt Lake City company, explained that Utah Scientific's products were always based upon needs expressed by users. "We didn't have preconceived ideas about what we wanted to build," Keys said. "The same philosophy prevails today, two years after Dynatech bought us," he said during the recent NAB exhibition. No formal organizational chart exists, and marketing consists of being involved in customer requirements. The monthly obligation to Dynatech from Keys is to report excess cash, along with a brief statement, which Utah Scientific would want to do regardless of its connections with Dynatech.

Terry Kelly, ColorGraphics Systems president and founder, has similar comments regarding the acquisition of his company in 1983. Although the sale provided the cash necessary to finance business expansion, "Dynatech has given us a large overseas market potential," Kelly said. "They have sales companies in all major TV markets from Europe to Japan."

The relationship with Dynatech has also allowed ColorGraphics Systems to purchase Integrated Technology, a Kansas City, MO, company that markets a newsroom automation system, originally designed to CBS specifications. The newsroom product, which was installed at KCBS Radio, San Francisco, nicely parallels the computer-generated weather graphics and TV newsroom equipment from Kelly's company, which is based in Madison, WI.

Due to an underlying corporate desire for concept and technology exchange between members of the Dynatech family, both Keys and Kelly can describe their respective products as high tech, using Z-80, 8086 and 65002 microprocessors with extensive memory RAM devices throughout the systems and control panels.

The corporate concept

Too often, acquired companies are merged into larger organizations, eventually losing their autonomy, names, founders, entrepreneurial spirit and the ability to respond rapidly to customer-defined needs. The broadcast group vice president, Jack Reno, responsible for much of Dynatech's growth into communications, said that the corporate approach tried to avoid such losses of individuality.

Reno considers himself the coach of the team. "Tactical business decisions are made by people closest to the customer base. Dynatech has no corporate vice presidents of marketing or product development," he said. His role focuses on strategy, making operations consistent and finding the right people to carry out the strategies.

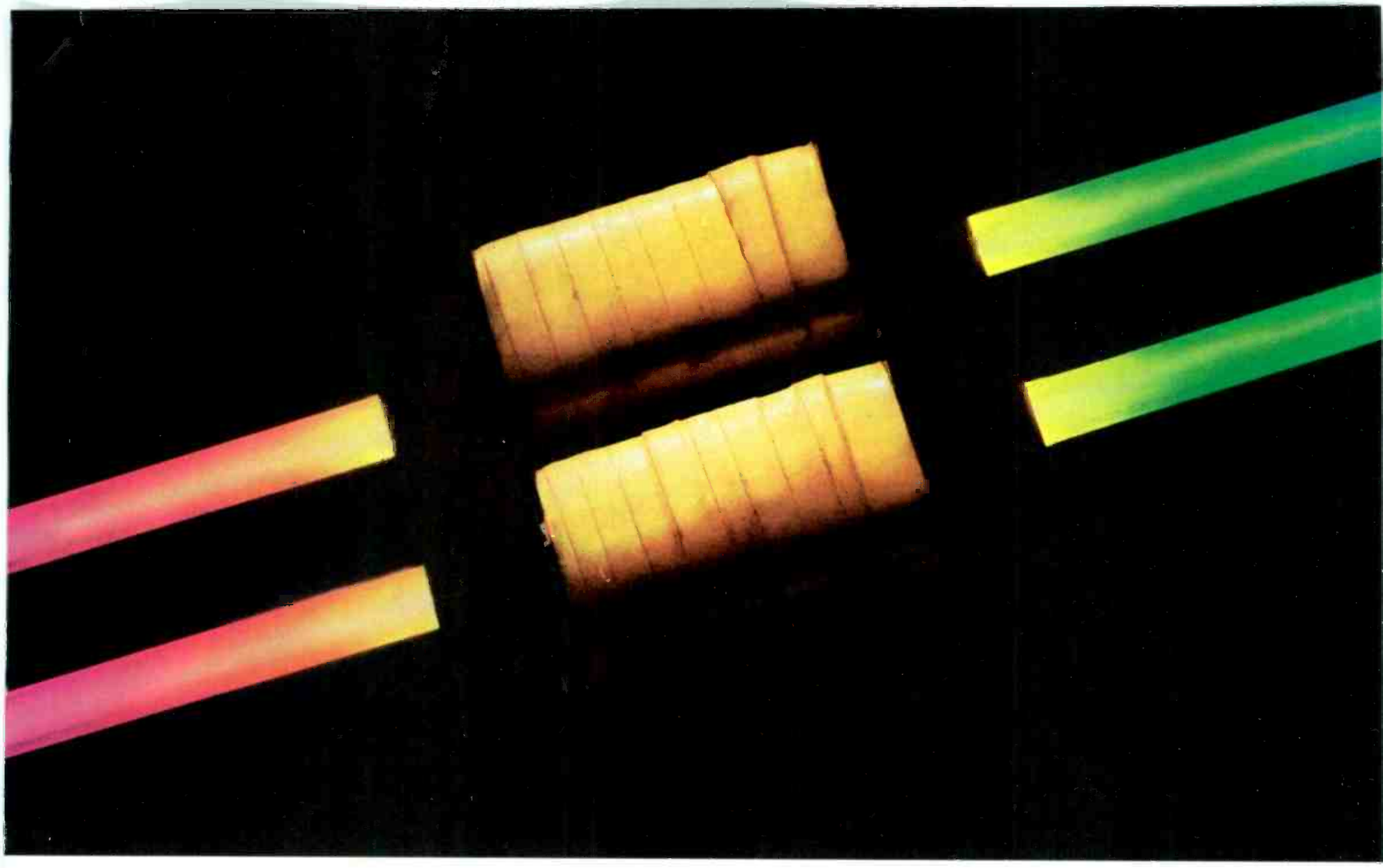
Another approach used by Dynatech is to promote a cooperative effort between its locally managed operations. An excellent example is shown in plans for ColorGraphics Systems and Utah Scientific for NAB-'85. The forecast plans to show the NewStar electronic newsroom products integrated with distribution/routing and master control switching equipment combined with automation.

To the future

Dynatech grew 160% between fiscal years 1980 and 1983. Reno projects a doubling of growth in fiscal years 1984 and 1985. That outlook is based on one or two more broadcast equipment companies joining the corporate umbrella by mid 1985.

What criteria defines a Dynatech company? Foremost, the company must mesh with the corporate needs for entrepreneurial and innovative products. Leadership in high technology products, with both high risk and high rates of market opportunity, are particularly attractive. Additions to the group should be capable of creating opportunities for diversification of products, systems and market segments.

To Dynatech, the Industrial Age philosophy of *management by objectives* against 5-year plans is no longer possible. Therefore, real predictions about the product range and market objectives of the broadcast communications group in 1985 and beyond are somewhat superfluous. If you are not part of the action, you may well be part of the emerging customer base for new products.



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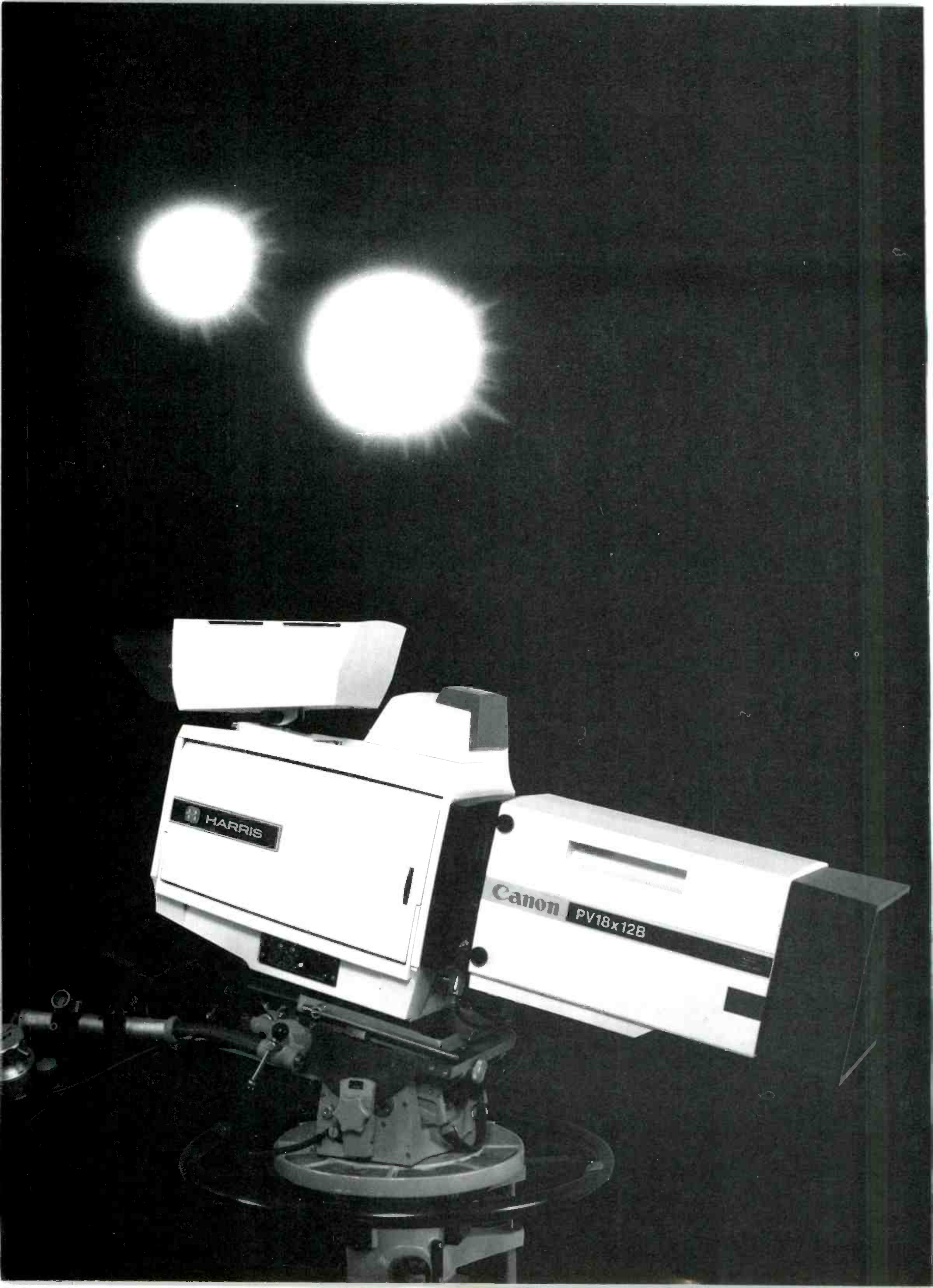
HARRIS
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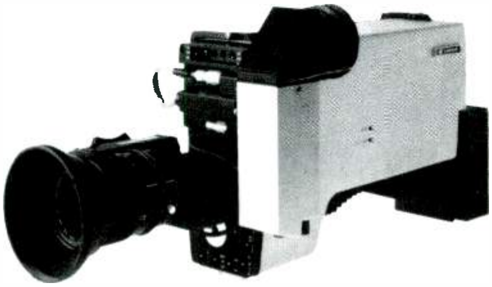
Which camera company offers a unique new process that sharpens your image without dulling the colors?



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Weighing about 8 pounds, the TC-90 is one of the smallest. But we deliberately made it a little bit bigger than it had to be to add balance and stability. A little longer to let the cameraperson grasp the lens in a natural, comfortable, controlled way. And we carefully shifted extra weight to the tail, so that the weight of the lens is counterbalanced.

Most cameras blind-side you to the right. Not the TC-90. Its low profile lets you see right over the top for total right-side visibility. And that low-profile body is constructed of a rugged graphite composite that is unaffected by the inevitable rough treatment in the field.

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An impressive 48 operator functions are controlled by the computer in the TC-85C, and adjusted according to preset parameters. Each camera has a built-in independent computer so that all cameras can be set up at the same time. Even by an inexperienced cameraperson. With just the touch of a button.

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HARRIS

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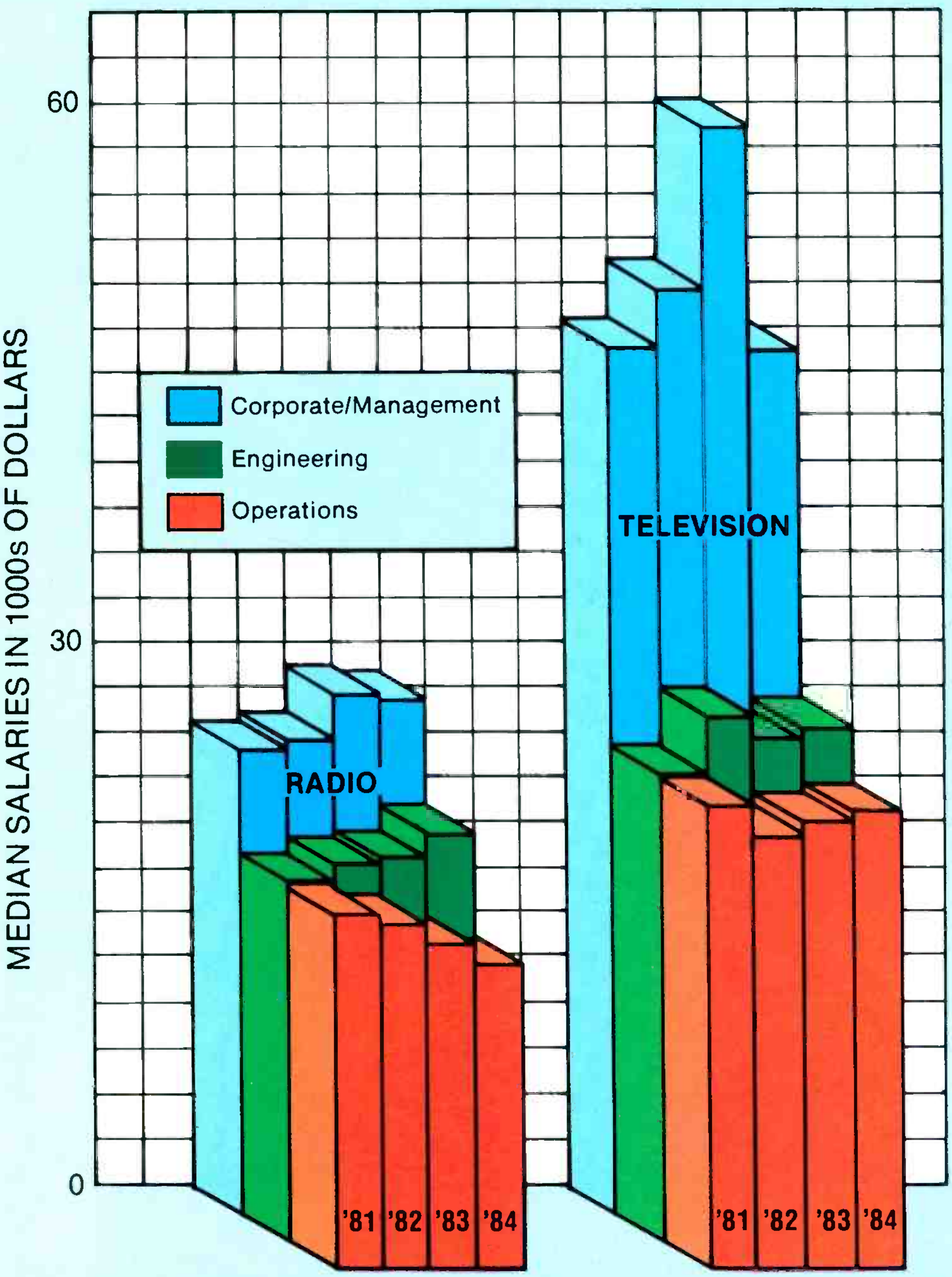
$alary Survey

How much do you get paid? Is it enough? Are your fringe benefits on a par with other broadcasters? Find out by reviewing the results of our national survey.



How much does the job pay? How often can I expect a raise? What are the fringe benefits? These questions are important to employees at any station, in any job, in any size market. And although job compensation may not be the *most* important aspect of a person's career development, it usually ranks No. 2. The rate of compensation for services performed is viewed by many—if not most—professionals as more than simply a discussion of dollars and cents. It is rather a statement of the respect for and the value placed upon a person's work.

The fifth annual **Broadcast Engineering** national survey of salaries and benefits addresses the question of industry pay, and arrives at some surprising conclusions. Further, the significant effect that employee pay can have on the way managers, engineers and operations personnel at radio and TV stations across the country view their jobs and their futures, is brought into clear focus by the comments we received in compiling statistics for the report. (See the sidebar article, "Money Talks," on page 48.)

The **BE** survey is designed to enable readers to compare their job compensation with that of colleagues in similar positions within comparably sized market areas. The 1984 study was scientifically conducted by the marketing research department of Intertec Publishing Corporation, under the direction of Kate Smith. On June 18 of this year, 1954 questionnaires were mailed to recipients of **BE** on an "nth name" basis. On Aug. 15, 695 of the forms had been received, for a response rate of 35.6%. The data contained in this report are based on these responses.

Our survey targeted the radio and TV industries separately so that trends in each branch of broadcasting could be pinpointed. Results of the big question—"What is your present salary?"—are shown in the accompanying chart, which illustrates several significant, and unexpected, developments in the industry. Major points brought out in our survey include:

- The overall pay level for TV management positions took a nose

TABLE I. – MANAGEMENT STAFF PROFILE*

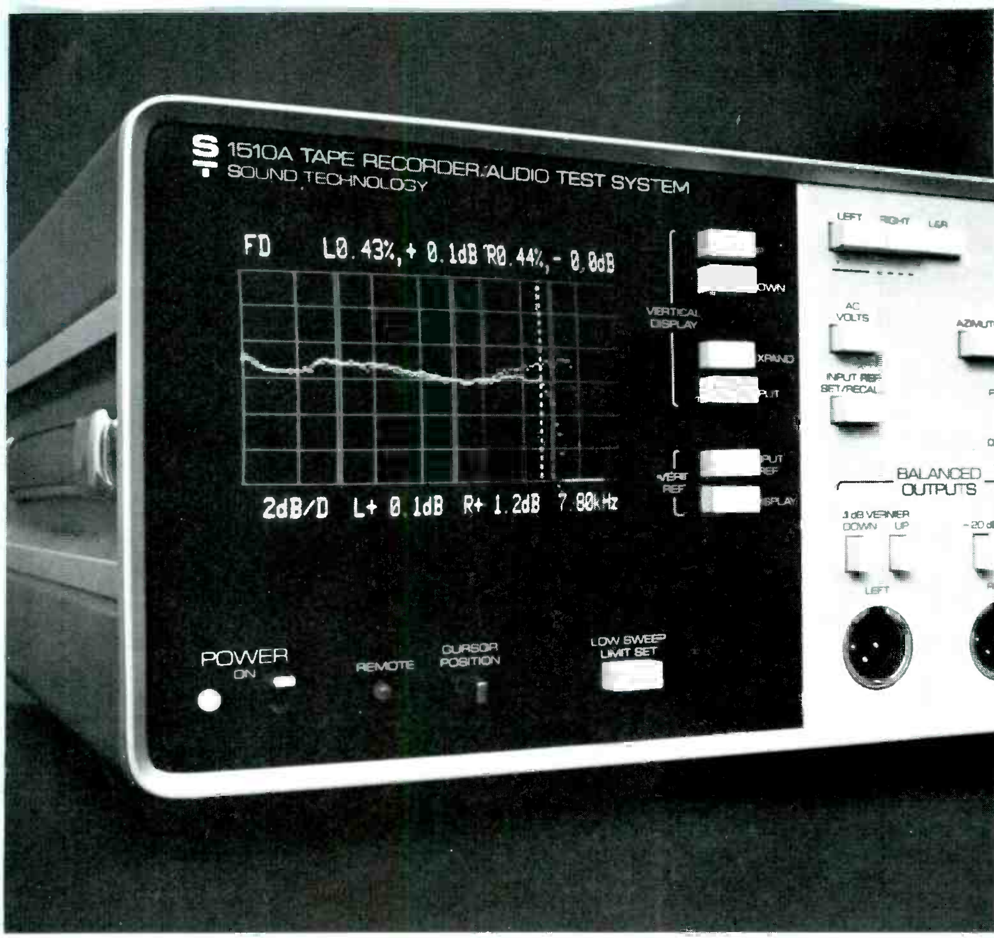
	ALL MARKETS	TELEVISION				RADIO			
	Total %	Total TV %	Top 50 %	Top 100 %	Below Top 100 %	Total Radio %	Top 50 %	Top 100 %	Below Top 100 %
Salary Level									
Less than $10,000	5.3	.....	.....	.....	.....	8.6	.....	6.2	10.7
$10,000 to $14,999	8.2	3.1	.....	.....	7.2	11.4	7.1	6.2	13.3
$15,000 to $19,999	5.3	1.5	.....	.....	3.5	7.6	21.5	18.8	2.7
$20,000 to $24,999	11.2	7.8	12.5	.....	7.2	13.3	.....	18.8	14.6
$25,000 to $34,999	21.8	16.9	.....	23.1	28.6	24.8	14.2	43.8	22.7
$35,000 to $49,999	21.1	27.7	29.2	30.8	25.0	17.2	14.2	6.2	20.0
$50,000 to $74,999	15.3	21.5	20.8	30.8	17.8	11.4	21.5	.....	12.0
$75,000 or more	10.6	21.5	37.5	15.3	10.7	3.8	21.5	.....	1.4
Not given	1.2	.....	.....	.....	.....	1.9	.....	.....	2.6
Median =	$33,900	$46,250	$60,000	$48,200	$37,100	$28,300	$42,500	$25,000	$28,200
Received Salary Increase During Past Year	60.6	81.5	91.7	100.0	25.7	47.6	85.7	56.3	38.7
Percentage of Increase									
Less than 5%	13.6	9.4	9.1	15.4	5.5	18.0	.....	22.2	24.1
5% to 9%	46.6	58.5	54.5	69.2	55.6	34.0	41.7	22.2	34.5
10% to 14%	25.2	24.5	18.2	15.4	38.9	26.0	25.0	22.2	27.6
15% or more	9.7	7.6	18.2	.....	.....	12.0	33.3	.....	6.9
Not given	4.9	.....	.....	.....	.....	10.0	.....	33.4	6.9
Median =	8.7	8.5	8.8	7.5	9.0	9.0	11.7	7.5	8.3
Fringe Benefits Received (Adds to more than 100% due to multiple answers)									
Medical insurance (paid)	78.8	89.2	92.0	92.3	85.7	72.4	78.6	75.0	70.7
Dental insurance (paid)	29.4	49.2	70.0	30.8	50.0	17.1	28.6	12.5	16.0
Life insurance (paid)	63.5	78.5	87.5	76.9	71.4	54.3	71.4	43.8	53.3
Sick leave	72.4	89.2	91.7	92.3	85.7	61.9	71.4	56.2	61.3
Vacation	82.9	92.3	95.8	92.3	89.3	77.1	100.0	68.8	74.7
Stock purchase plan	18.2	30.8	41.7	7.7	32.1	10.5	21.4	12.5	8.0
Profit sharing plan	17.6	29.2	33.3	30.8	25.0	10.5	21.4	6.3	9.3
Savings plan	11.2	15.4	25.0	7.7	10.7	8.6	14.3	.....	9.3
Pension plan	33.5	60.0	66.7	69.2	50.0	17.1	42.8	25.0	10.7
Bonus	33.5	41.5	50.0	30.8	39.3	28.6	50.0	6.3	29.3
Tuition refund plan	16.5	32.3	41.7	15.4	32.1	6.7	28.6	.....	4.0
Automobile furnished	45.9	60.0	54.2	61.5	64.3	37.1	35.7	37.5	37.3
Years in Present Job									
1 to 2	24.6	24.7	33.3	15.4	21.4	24.8	21.4	18.7	26.7
3 to 4	17.1	16.9	12.5	7.7	25.0	17.1	35.7	18.7	13.3
5 to 9	21.1	20.0	20.8	30.8	14.3	21.9	21.4	18.7	22.7
10 to 14	11.2	16.9	8.3	23.0	21.4	7.6	.....	18.7	6.7
15 to 24	17.1	15.4	20.8	15.4	10.7	18.1	14.4	6.3	21.3
25 or more	7.1	4.6	4.3	7.7	3.6	8.6	7.1	6.3	9.3
Not given	1.8	1.5	.....	.....	3.6	1.9	.....	12.6	.....
Median =	6.8	6.9	6.0	9.4	5.7	6.6	4.6	6.7	7.2
Years in Broadcast Industry									
Less than 5	1.2	1.5	.....	.....	3.6	1.0	.....	.....	1.3
5 to 9	12.3	13.9	20.8	7.7	10.7	11.4	35.8	18.7	5.3
10 to 14	18.2	13.9	16.7	7.7	14.3	21.0	21.4	25.0	20.0
15 to 24	27.1	26.1	25.0	7.7	35.7	27.6	21.4	12.5	32.0
25 or more	38.8	41.5	37.5	76.9	28.6	37.1	21.4	31.3	41.4
Not given	2.4	3.1	.....	.....	7.1	1.9	.....	12.5	.....
Median =	21.3	22.4	20.0	25.0	20.0	20.7	13.4	15.0	22.3
Do Part-Time or Free-Lance Work	30.6	27.7	33.3	23.1	25.0	32.4	35.7	31.3	32.0
Education									
High school	13.5	4.6	4.2	7.7	3.6	19.0	7.1	25.0	20.0
Two years of college	25.3	20.0	20.8	15.4	21.4	28.6	28.7	37.5	26.7
Four years of college	30.0	30.8	29.2	38.5	28.6	29.5	50.0	18.7	28.0
Post-graduate college	21.2	29.2	29.2	15.4	35.7	16.2	7.1	12.5	18.7
Voc/tech school	8.8	13.8	16.6	23.0	7.1	5.7	7.1	6.3	5.3
Not given	1.2	1.6	.....	.....	3.6	1.0	.....	.....	1.3
Age, Years									
Under 25	3.5	3.1	8.3	.....	.....	3.8	.....	6.3	4.0
25 to 34	18.8	15.4	16.7	7.7	17.8	21.0	42.8	18.7	17.3
35 to 44	30.0	23.1	25.0	15.4	25.0	34.2	28.6	50.0	32.0
45 to 54	26.5	35.4	41.7	30.7	32.2	21.0	14.3	18.7	22.7
55 or over	20.6	21.5	8.3	46.2	21.4	20.0	14.3	6.3	24.0
Not given	0.6	1.5	.....	.....	3.6	.....	.....	.....	.....
Median =	44.1	47.2	45.0	53.8	46.7	42.4	37.5	40.0	44.0

*Management staff: president, owner, partner, vice president, general manager.

TABLE II. – ENGINEERING AND TECHNICAL STAFF PROFILE*

	ALL MARKETS	TELEVISION				RADIO			
	Total %	Total TV %	Top 50 %	Top 100 %	Below Top 100 %	Total Radio %	Top 50 %	Top 100 %	Below Top 100 %
Salary Level									
Less than $10,000	4.8	0.6	.....	.....	2.4	9.8	.....	11.1	18.8
$10,000 to $14,999	7.4	4.2	2.2	2.8	9.5	11.2	1.7	5.6	21.9
$15,000 to $19,999	15.4	13.7	10.1	24.3	11.9	17.5	4.9	38.9	23.4
$20,000 to $24,999	18.0	20.8	9.0	27.0	40.5	14.7	8.2	33.3	15.6
$25,000 to $34,999	26.7	27.4	27.0	29.7	26.2	25.9	45.9	11.1	10.9
$35,000 to $49,999	19.9	23.8	36.0	10.8	9.5	15.4	31.1	.....	4.7
$50,000 to $74,999	7.1	9.5	15.7	5.4	.....	4.2	8.2	.....	1.6
$75,000 or more	.....	.....	.....	.....	.....	.....	.....	.....	.....
Not given	0.7	.....	.....	.....	.....	1.3	.....	.....	3.1
Median =	$26,500	$28,900	$35,750	$24,250	$23,250	$23,700	$32,700	$19,300	$17,000
Received Salary Increase During Past Year	73.0	85.1	82.0	97.3	81.0	58.7	68.9	55.6	50.0
Percentage of increase				of					
Less than 5%	15.9	14.0	5.5	22.2	23.5	19.0	19.0	10.0	21.9
5% to 9%	55.9	58.0	64.4	58.3	44.1	52.4	57.1	60.0	43.8
10% to 14%	16.3	15.4	19.2	11.1	11.8	17.9	19.0	30.0	12.5
15% or more	9.3	9.1	8.2	5.6	14.7	9.5	4.9	.....	18.7
Not given	2.6	3.5	2.7	2.8	5.9	1.2	.....	.....	3.1
Median =	8.0	8.0	8.4	7.3	7.7	7.9	7.7	8.4	8.1
Fringe Benefits Received (Adds to more than 100% due to multiple answers)									
Medical insurance (paid)	83.0	90.5	93.3	91.9	83.3	74.1	88.5	83.3	57.8
Dental insurance (paid)	39.9	51.8	62.9	40.5	38.1	25.9	41.0	5.6	17.2
Life insurance (paid)	64.0	75.0	83.1	67.6	64.3	51.0	67.2	66.7	31.3
Sick leave	83.3	92.9	91.0	94.6	95.2	72.0	88.5	55.6	60.9
Vacation	95.2	98.8	98.9	100.0	97.6	90.9	98.4	100.0	.....
Stock purchase plan	14.8	18.5	30.3	5.4	4.8	10.5	23.0	.....	1.6
Profit sharing plan	10.6	8.9	11.2	5.4	7.1	12.6	19.7	5.6	7.8
Savings plan	15.8	20.8	29.2	13.5	9.5	9.8	21.3	.....	1.6
Pension plan	41.8	60.7	66.3	59.5	50.0	19.6	31.1	5.6	12.5
Bonus	19.0	15.5	14.6	21.6	11.9	23.1	31.1	16.7	17.2
Tuition refund plan	24.1	26.8	31.5	16.2	26.2	21.0	37.7	11.1	7.8
Automobile furnished	18.3	15.5	5.6	18.9	33.3	21.7	31.1	11.1	15.6
Years in Present Job									
1 to 2	24.8	25.0	20.2	27.0	33.3	24.5	21.4	33.3	25.0
3 to 4	21.5	20.9	22.5	18.9	19.0	22.4	26.2	22.2	18.7
5 to 9	22.2	23.2	25.8	24.3	16.7	21.0	22.9	11.1	21.9
10 to 14	11.3	8.9	9.0	13.6	4.8	14.0	6.5	27.8	17.2
15 to 24	13.8	14.3	13.5	8.1	21.4	13.3	16.4	5.6	12.5
25 or more	5.8	7.7	9.0	8.1	4.8	3.5	3.3	.....	4.7
Not given	0.6	.....	.....	.....	.....	1.3	3.3	.....	.....
Median =	5.8	5.9	6.4	5.9	4.8	5.6	5.2	4.5	6.5
Years in Broadcast Industry									
Less than 5	10.0	9.6	9.0	13.5	7.1	10.5	6.5	33.3	7.8
5 to 9	15.7	19.6	19.1	16.2	23.9	11.2	8.2	5.6	15.6
10 to 14	20.9	17.8	20.2	10.8	19.0	24.5	24.6	27.8	23.4
15 to 24	28.9	25.0	22.5	32.5	23.9	33.6	39.4	22.2	31.2
25 or more	22.6	26.2	29.2	27.0	19.0	18.1	18.0	11.1	20.3
Not given	1.9	1.8	.....	.....	7.1	2.1	3.3	.....	1.7
Median =	15.8	15.8	15.8	17.9	14.1	15.8	17.3	12.0	15.8
Do Part-Time or Free-Lance Work	46.9	43.5	42.7	32.4	54.8	51.0	47.5	66.7	50.0
Education									
High school	7.1	6.5	3.4	8.1	11.9	7.7	1.6	11.1	12.5
Two years of college	28.6	24.4	22.5	24.3	28.6	33.6	36.1	44.4	28.1
Four years of college	28.6	31.0	36.0	27.0	23.8	25.9	29.5	11.1	26.6
Post-graduate college	9.0	9.5	13.5	8.1	2.4	8.4	6.6	22.2	6.2
Voc/tech school	25.7	28.0	24.6	29.8	33.3	23.1	24.6	5.6	26.6
Not given	1.0	0.6	.....	2.7	.....	1.3	1.6	5.6	.....
Age, Years									
Under 25	3.6	2.4	2.3	2.7	2.4	4.9	1.6	16.7	4.7
25 to 34	33.4	31.5	29.2	32.4	35.7	35.7	36.1	44.4	32.8
35 to 44	31.5	31.5	33.7	27.1	31.0	31.5	34.4	22.2	31.2
45 to 54	15.1	16.7	19.1	16.2	11.9	13.3	13.1	16.7	12.5
55 or over	15.8	17.9	15.7	21.6	19.0	13.3	11.5	.....	18.8
Not given	0.6	.....	.....	.....	.....	1.3	. 3.3	.....	.....
Median =	39.0	40.1	40.5	40.5	38.8	37.8	38.1	32.5	32.0

*Engineering and technical staff: technical manager, chief engineer, engineer.



Clean Up Your Audio with the Sound Technology 1510A AUDIO TEST SYSTEM.

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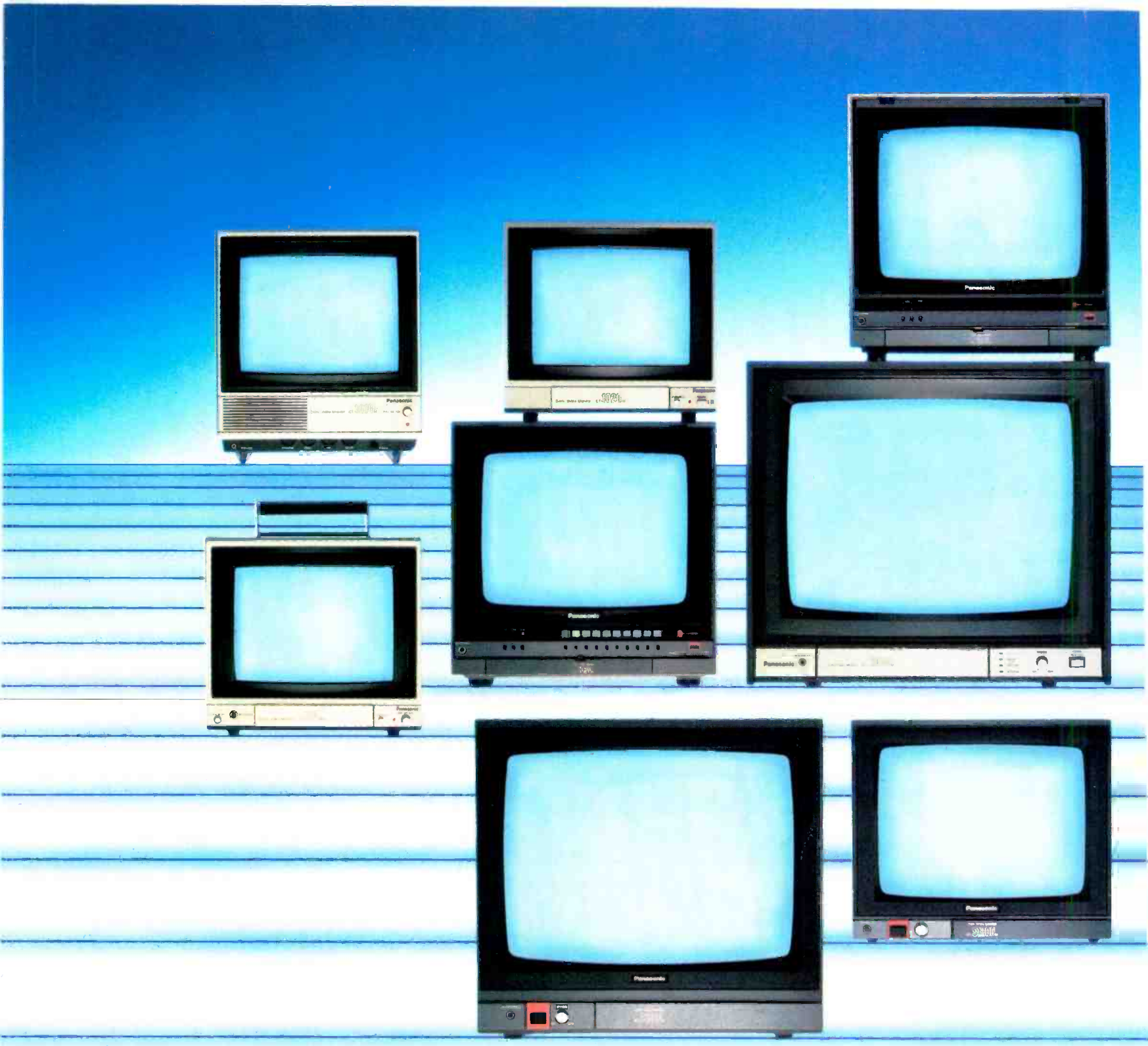

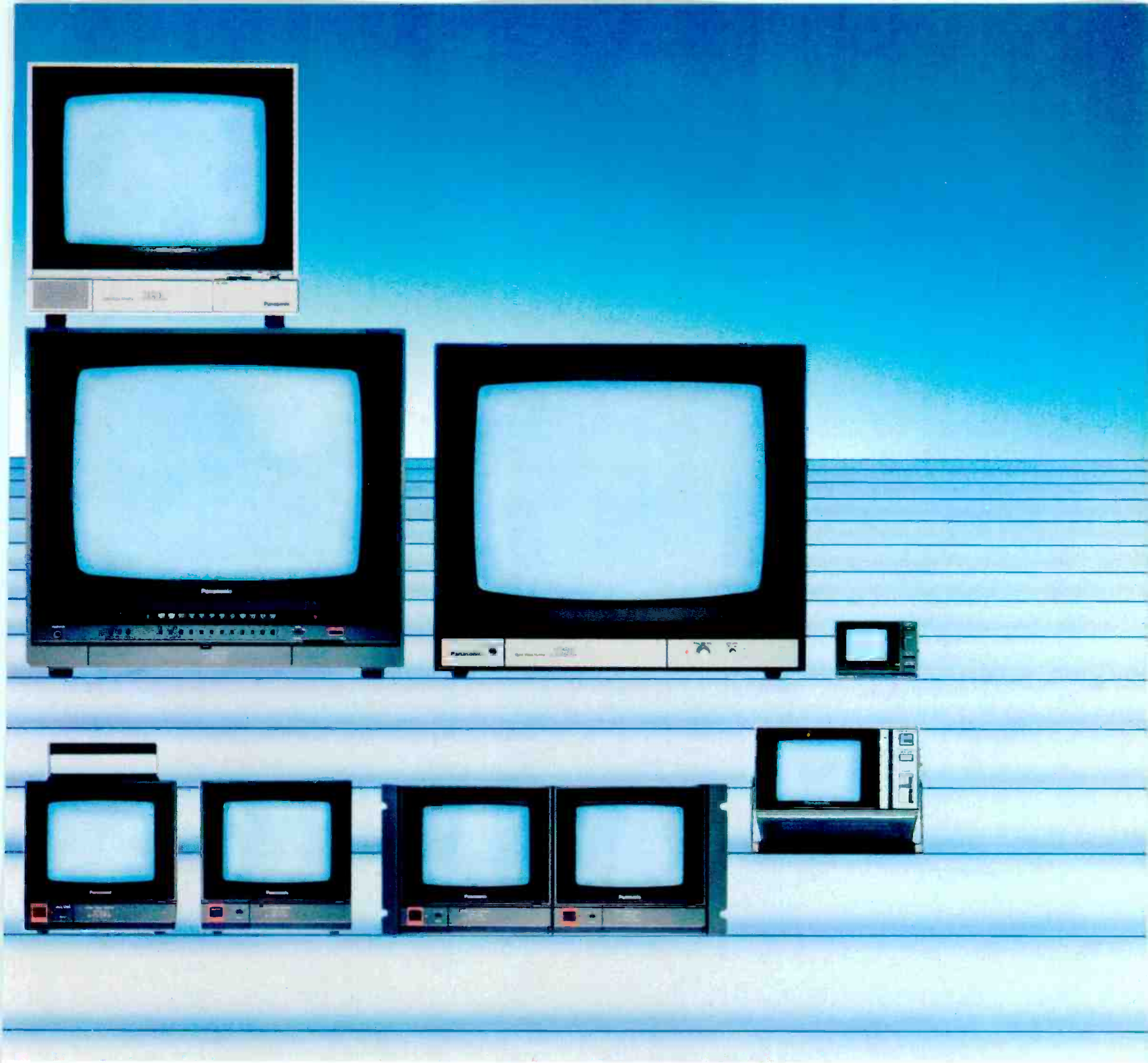

a dual rack adapter.

The Panasonic CT series will also show you a picture that's clear, well-defined and brilliant in color. Because both monitors have either CompuFocus or Quintrix II® picture tubes. And, of course, all models have 8-pin video input and output connectors as well as loop-through capability for easy system adaptation.

When portability and light weight are important, choose from two AC/DC monitor/receivers: the 5" CT-500V, or the CT-300VT with its 2.6" screen—the world's smallest industrial color monitor.

There are also three 10" monitors for educational, industrial, computer, medical, and scientific applications. There's the CT-1330V monitor/receiver, the CT-1330M monitor, and the CT-1350MG with NTSC composite and RGB inputs.

If you're big on 19" monitors, the CT series keeps you covered in a big way. Both our CT-1930V monitor/receiver and our CT-1920M have comb filters for increased picture definition, while the CT-2000M lets you switch from PAL to SECAM to either NTSC 3.58 or NTSC 4.43.

So, no matter what you are looking for, you can't afford to overlook Panasonic Industrial Monitors.

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Panasonic®
AUDIO-VIDEO SYSTEMS DIVISION

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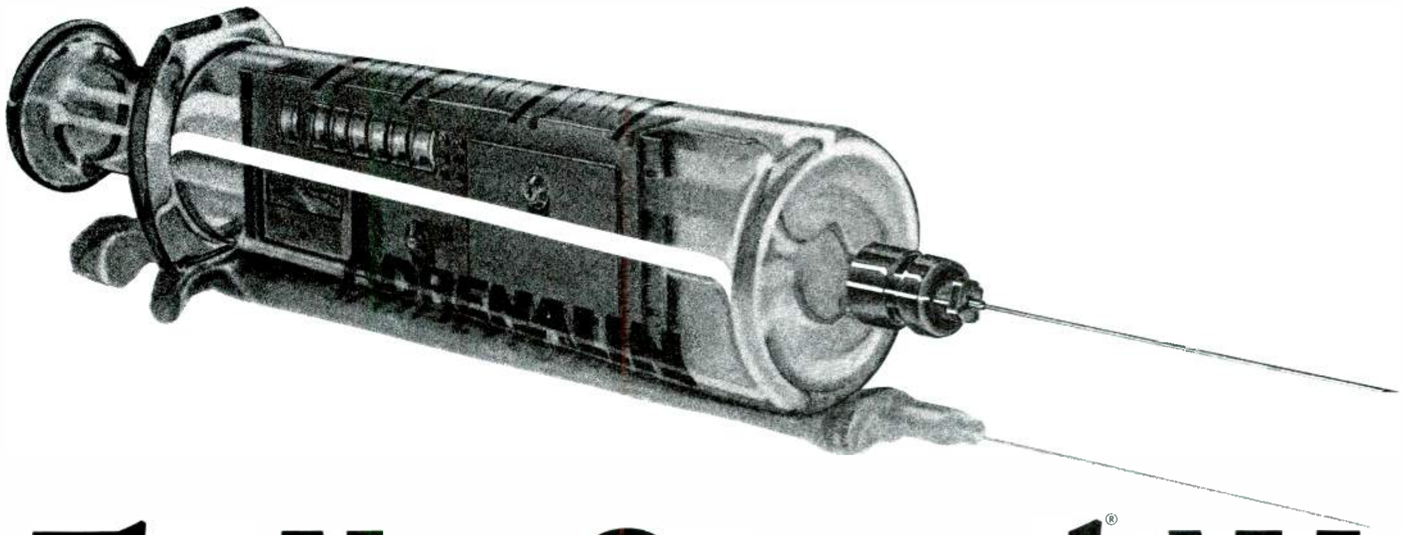
TABLE III.—OPERATIONS STAFF PROFILE*

	ALL MARKETS	TELEVISION				RADIO			
	Total %	Total TV %	Top 50 %	Top 100 %	Below Top 100 %	Total Radio %	Top 50 %	Top 100 %	Below Top 100 %
Salary Level									
Less than $10,000	7.0	2.5	2.8	4.5	.....	13.6	5.0	22.3	15.3
$10,000 to $14,999	18.2	11.1	5.5	22.7	15.6	28.4	10.0	33.3	33.9
$15,000 to $19,999	20.1	16.7	13.9	18.2	21.8	25.0	15.0	33.3	27.1
$20,000 to $24,999	17.8	18.2	11.1	22.7	31.2	17.0	25.0	.....	16.9
$25,000 to $34,999	18.2	23.8	27.8	18.2	18.7	10.2	25.0	11.1	5.1
$35,000 to $49,999	12.6	19.8	25.0	13.7	12.7	2.5	10.0	.....	.....
$50,000 to $74,999	3.7	5.5	9.7	.....	.....	1.1	5.0	.....	.....
$75,000 or more	0.9	0.8	1.4	.....	.....	1.1	5.0	.....	.....
Not given	1.5	1.6	2.8	.....	.....	1.1	.....	.....	1.7
Median =	$21,100	$25,300	$30,500	$21,000	$22,000	$16,500	$24,000	$14,150	$15,000
Received Salary Increase During Past Year	**80.4**	**88.9**	**88.9**	**86.4**	**90.6**	**68.2**	**75.0**	**55.5**	**67.8**
Percentage of increase									
Less than 5%	12.8	8.9	3.1	15.8	17.2	20.0	20.0	20.0	20.0
5% to 9%	50.0	52.7	54.7	36.8	58.6	45.0	53.3	40.0	42.5
10% to 14%	19.8	23.2	26.6	26.3	13.8	13.3	13.3	20.0	12.5
15% or more	12.2	10.7	9.4	15.8	10.4	15.0	6.7	20.0	17.5
Not given	5.2	4.5	6.2	5.3	.....	6.7	6.7	.....	7.5
Median =	8.5	8.7	9.0	9.3	7.8	8.0	7.5	8.8	8.1
Fringe Benefits Received (Adds to more than 100% due to multiple answers)									
Medical insurance (paid)	80.8	84.9	91.7	72.7	78.1	75.0	95.0	66.7	69.5
Dental insurance (paid)	34.6	42.1	56.9	22.7	21.9	23.9	60.0	22.2	11.9
Life insurance (paid)	61.2	66.7	76.4	59.1	50.0	53.4	70.0	44.4	49.1
Sick leave	80.4	86.5	86.1	86.4	87.5	71.6	85.0	66.7	67.8
Vacation	90.6	90.5	91.7	86.4	90.6	90.9	100.0	88.9	88.1
Stock purchase plan	13.5	19.8	27.8	18.2	3.1	4.5	10.0	11.1	1.7
Profit sharing plan	15.9	17.5	16.7	18.2	18.8	13.6	10.0	22.2	13.5
Savings plan	15.0	23.8	26.4	13.6	25.0	2.3	10.0	.....	.....
Pension plan	37.9	53.2	54.2	54.5	50.0	15.9	40.0	33.3	5.1
Bonus	23.4	25.4	16.7	77.3	9.4	20.4	10.0	33.3	22.0
Tuition refund plan	24.3	30.9	30.5	31.8	31.2	14.8	35.0	.....	10.2
Automobile furnished	7.9	6.3	6.9	.....	9.4	10.2	15.0	11.1	8.5
Years in Present Job									
1 to 2	37.4	36.5	43.1	63.6	3.1	38.6	30.0	.....	47.5
3 to 4	15.9	15.1	16.7	27.4	3.1	17.0	20.0	11.1	16.9
5 to 9	24.3	23.8	25.0	4.5	34.3	25.0	35.0	33.3	20.3
10 to 14	10.3	8.7	6.9	.....	18.8	12.5	10.0	33.3	10.2
15 to 24	7.9	9.5	6.9	4.5	18.8	5.7	5.0	22.3	3.4
25 or more	3.7	5.6	1.4	.....	18.8	1.2	.....	.....	1.7
Not given	0.5	0.8	.....	.....	3.1	.....	.....	.....	.....
Median =	4.6	4.7	3.4	2.6	2.1	4.3	5.0	10.9	3.3
Years in Broadcast Industry									
Less than 5	14.5	15.1	19.4	13.6	6.2	13.6	5.0	11.1	16.9
5 to 9	24.8	25.4	22.2	27.4	31.2	23.9	15.0	11.1	28.8
10 to 14	23.8	22.2	18.1	40.9	18.8	26.1	40.0	22.3	22.0
15 to 24	20.6	19.8	22.2	9.1	21.8	21.6	20.0	44.4	18.6
25 or more	13.1	14.3	16.7	4.5	15.8	11.4	20.0	.....	10.3
Not given	3.2	3.2	1.4	4.5	6.2	3.4	.....	11.1	3.4
Median =	11.9	11.8	12.1	10.9	12.5	12.1	13.8	15.0	10.6
Do Part-Time or Free-Lance Work	47.2	43.7	47.2	36.4	40.6	52.3	75.0	88.9	39.0
Education									
High school	8.9	5.6	4.2	4.5	9.4	13.6	5.0	11.1	16.9
Two years of college	23.4	20.6	23.6	9.2	21.9	27.3	15.0	33.3	30.5
Four years of college	43.9	50.0	52.8	54.5	40.6	35.2	45.0	33.3	32.2
Post-graduate college	19.2	19.8	18.1	22.8	21.9	18.2	35.0	22.3	11.9
Voc/tech school	3.7	2.4	1.3	4.5	3.1	5.7	.....	.....	8.5
Not given	0.9	1.6	.....	4.5	3.1	.....	.....	.....	.....
Age, Years									
Under 25	10.3	9.4	6.9	9.1	15.7	11.4	.....	11.1	15.3
25 to 34	45.3	42.9	47.2	36.4	37.5	48.9	55.0	44.5	47.4
35 to 44	26.2	29.4	30.6	31.8	25.0	21.6	20.0	22.2	22.0
45 to 54	10.3	9.5	8.4	4.5	15.6	11.4	15.0	22.2	8.5
55 or over	5.1	4.8	6.9	.....	3.1	5.7	10.0	.....	5.1
Not given	2.8	4.0	.....	18.2	3.1	1.0	.....	.....	1.7
Median =	33.5	34.0	34.1	33.8	33.8	32.8	34.1	33.8	32.1

*Operations staff: operations manager, station manager, production/program manager.



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It doesn't have to be that way. The new OPTIMOD-AM Model 9100A can inject your listeners' radios with a sound so close to FM that it's hard to tell the difference! By boosting the highs at the transmitter, OPTIMOD-AM compensates for the dullness of most radios. It then applies some *very* sophisticated, patented processing to make sure that the high-end boost doesn't cause problems. There's never any hole-punching, de-essing, pumping, or loudness loss. In fact, loudness is *highly competitive* with the strident, clipped processing that used to be necessary to get loudness.

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TABLE IV. — MEDIAN SALARY SUMMARY FOR 1983 AND 1984, TV

	1983 SURVEY				1984 SURVEY			
	All Markets	Top 50	Top 100	Below Top 100	All Markets	Top 50	Top 100	Below Top 100
Management	$60,000	$68,750	$62,500	$51,000	$46,250	$60,000	$48,200	$37,100
Engineering	$27,600	$31,600	$23,500	$23,000	$28,900	$35,750	$24,250	$23,250
Operations	$24,750	$28,700	$23,350	$21,500	$25,300	$30,500	$21,000	$22,000

TABLE V. — MEDIAN SALARY SUMMARY FOR 1983 AND 1984, RADIO

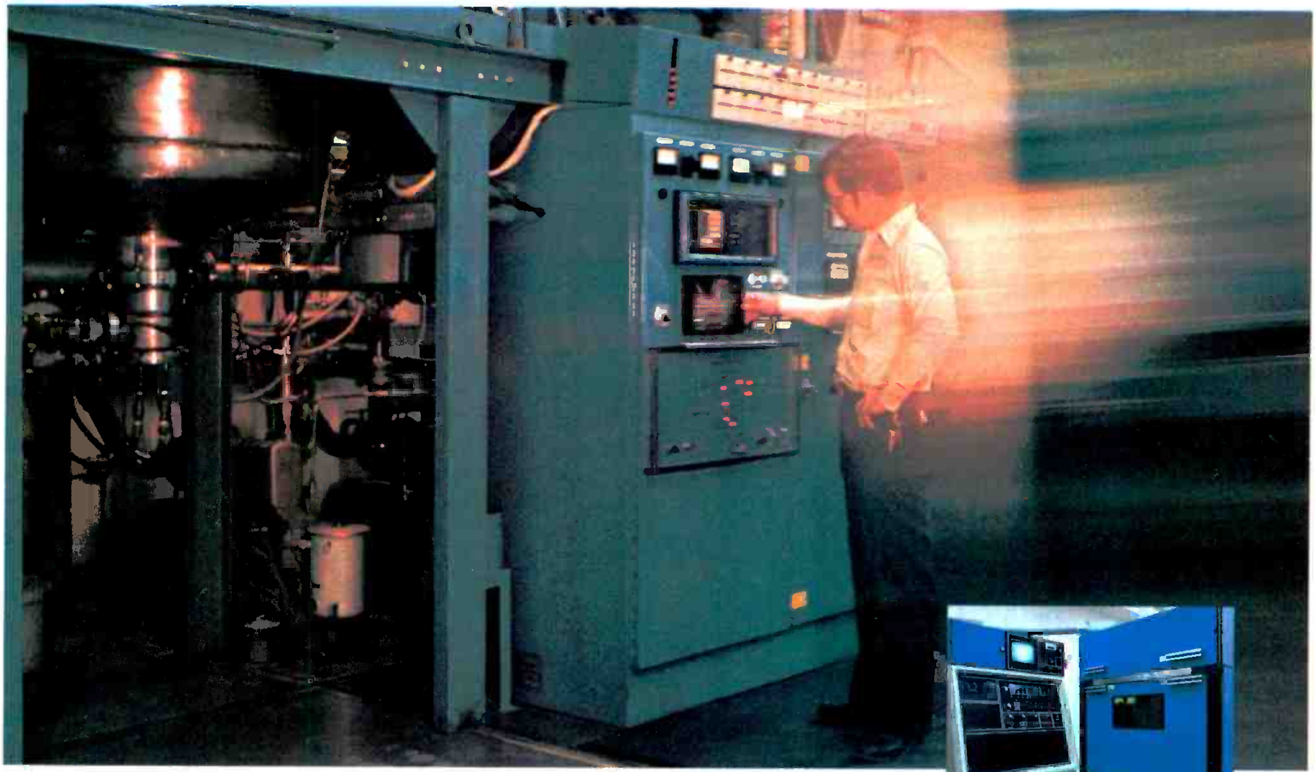
	1983 SURVEY				1984 SURVEY			
	All Markets	Top 50	Top 100	Below Top 100	All Markets	Top 50	Top 100	Below Top 100
Management	$28,600	$38,000	$45,500	$25,300	$28,300	$42,500	$25,000	$28,200
Engineering	$20,850	$30,500	$19,400	$17,500	$23,700	$32,700	$19,300	$17,000
Operations	$17,350	$22,150	$17,750	$16,050	$16,500	$24,000	$14,150	$15,000

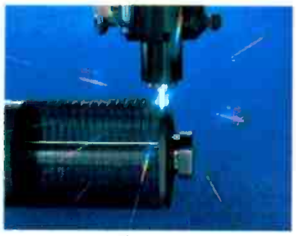
TABLE VI. — MEDIAN SALARIES ACROSS ALL MARKETS

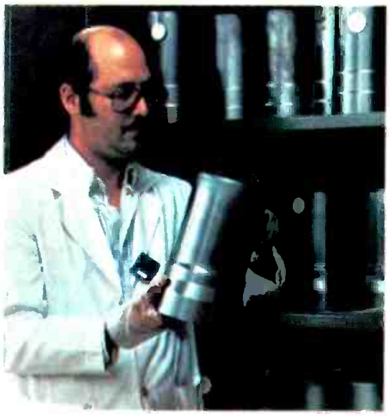
	TELEVISION				RADIO			
	1981	1982	1983	1984	1981	1982	1983	1984
Management	$47,150	$52,000	$60,000	$46,250	$25,800	$26,900	$28,600	$28,300
Engineering	$25,800	$29,000	$27,600	$28,900	$19,900	$20,700	$20,850	$23,700
Operations	$25,650	$23,800	$24,750	$25,300	$19,100	$18,650	$17,350	$16,500

TABLE VII. — MEDIAN VALUE PROFILE OF BROADCASTERS (Radio and TV Combined)

	MANAGEMENT			ENGINEERING			OPERATIONS		
	1982	1983	1984	1982	1983	1984	1982	1983	1984
Salary Level	$33,900	$37,550	$33,900	$25,300	$24,600	$26,500	$21,500	$21,300	$21,100
Received Salary Increase	54.6%	57.5%	60.6%	79.8%	73.0%	73.0%	74.9%	73.8%	80.5%
Amount of Increase	12.3%	10.3%	8.7%	8.7%	8.1%	8.0%	10.2%	8.2%	8.5%
Years in Present Job	7.2	7.1	6.8	7.8	6.4	5.8	3.5	4.3	4.6
Years in Broadcasting	21.4	21.2	21.3	18.3	17.2	15.8	13.0	12.9	11.9
Does Free-Lance Work	25.2%	23.4%	30.6%	48.2%	46.2%	46.9%	51.7%	53.6%	47.2%
College >2 years	83.3%	80.5%	76.5%	63.1%	66.3%	66.2%	84.5%	86.0%	86.5%
Age, Years	44.3	44.9	44.1	41.7	40.6	39.0	33.6	33.3	33.5







dive during the past year, dropping from an all-market median value of $60,000 yearly in 1983 to $46,250 this year. Major market (*top 50*) managers reported a median salary level 13% below last year, while smaller markets (*top 100* and *below top 100*) reported the sharpest drop in median salaries (23% and 27%, respectively) of any TV classification in our survey.

• The composite (all-market median value) salary level for radio operations personnel is steadily decreasing, dropping $850 from the median annual all-market salary of $17,350 reported last year. This came despite a modest (8%) increase for workers in the *top 50* radio markets. The composite salary level was pulled down by a big drop in reported earnings in the *top 100* markets, where a decrease of 20% was noted. It should be pointed out that an unusually small number of questionnaire forms were returned from this group, which could result in the painting of a more gloomy picture than actually exists.

• The composite pay level for radio engineering personnel is steadily increasing, posting a significant gain of more than $2800 (14%) from last year, to bring the current all-market annual median pay to $23,700. This development is interesting in view of widely expressed concerns over the technical deregulation policy of the FCC. It is truly amazing in view of the comments we received from radio engineers in preparing this report (see the "Money Talks" sidebar story). A 7% salary gain was reported in the *top 50* market stations, while small overall losses (1% to 3%) were reported in smaller markets.

• Composite salary levels for TV classifications other than management looked strong in 1984, compared with last year. Small overall increases were posted in both engineering and operations positions. The biggest salary gains for TV engineering came in the *top 50* markets (up 13%), but smaller areas saw increases as well (from 1% to 3%). TV operations salaries were also up by a respectable amount in the *top 50* markets (6%), but down considerably (10%) in the *top 100* markets. *Below top 100* markets reported a 2% salary increase over last year.

• The composite salary level for radio management personnel showed a small overall reduction, because of a whopping 45% drop in pay reported for managers in the *top 100* markets. This decrease came despite the fact that more than 56% of those in the *top 100* management category who returned our questionnaire form reported having received a pay raise within the last year. We are at somewhat of a loss to explain such a drastic change. To further complicate matters, radio managers in other markets (*top 50* and *below top 100*) reported substantial salary increases (12% in both cases) during the year.

Tabular results

Complete details of the 1984 **BE** salary survey are compiled in three tables. Table I covers the management and corporate staffs; Table II, the engineering and technical staffs; and Table III, the operations staff.

This year's survey follows the same format used last year. Therefore, a comprehensive comparison of year-to-year salary and benefit changes can be made by referring to the October 1983 issue of **BE**. Tables IV and V present a tabular summary of significant salary data for the years 1982-84. These data report *median* salaries, which may differ considerably from *average* salaries. The median salary is the midpoint for the group considered, with half of the group above that point and half below it. Median values provide a better statistical representation of the overall data and are, therefore, used throughout this report.

Although salaries received for services rendered have remained the survey's key question, other data were also requested. Respondents were asked to provide information on the number of years spent in their present job, the number of years in the broadcast industry, whether they do any free-lance work, their educational background and present age.

Industry profile

Tables I, II and III give a detailed breakdown of salaries and benefits for radio and TV personnel in three market divisions: *top 50*, *top 100* and *below top 100*. Some generalizations can be made, based upon the **BE** survey results, including:

• Salaries for management, engineering and operations positions are significantly higher in television than they are in radio.

• Management positions in both radio and TV command considerably higher pay than do jobs in either engineering or operations.

• The larger the market size, the better the pay. This holds true for both radio and TV in all three job classifications (management, engineering and operations), with the exception of a few difficult-to-explain categories in the *top 100* markets. Radio and TV operations salaries are both slightly lower in the *top 100* market classifications than they are in the *below top 100* categories. *Top 100* radio management pay is also shown in our survey to be lower than salaries in the *below top 100* classification.

• Fringe benefits, such as medical insurance, stock purchase plans and pension programs, are provided for employees more often in television than they are in radio. And, the larger the market, the more numerous the benefits, with some exceptions in the *top 100* categories.

• Operations personnel make up the youngest of the three job classifications, with a median age for all markets—radio and TV—of 33.5 years. Engineering personnel check in with a composite age of 39 years. The management group is the oldest, at 44.1 years.

• The category "Years in the present job" follows along the same lines as employee age, with operations personnel reporting the shortest length of time on the job (4.6 years for all markets—radio and TV), and management the longest (6.8 years).

• The survivors award goes to management for the longest time spent in the broadcast industry, 21.3 years (all markets—radio and TV), compared with 15.8 years for engineers and 11.9 years for operations personnel.

• There has been little change in the amount of free-lance work done by operations and engineering personnel at radio and TV stations over the last year. The one exception to this rule is engineers in the *top 50* TV markets, where an increase of 43% was reported compared with 1983 figures. Free-lance work done by managers in radio and TV—all markets—was up from last year, but still considerably below the level of engineering and operations personnel.

In conclusion

The broadcast industry is changing, and the figures presented in this report bear out that fact. A close examination of the data shown in Tables I, II and III allows broadcasters to gauge their career positions against those of other engineers, managers and operations personnel in similar jobs and comparable markets. Although this report is not meant to be the final word on the compensation levels that are "customary" for various jobs in our industry, it does provide an interesting and useful glimpse of broadcasting and the people who make it work.

Money talks

Candid comments voiced through the salary survey questionnaire

One of the most fascinating parts of the annual **BE** salary survey is the comments section. Space is provided on the questionnaire form for comments from the respondents on the status of the broadcast industry. Responses this year ranged from, "I can't believe I get paid to have this much fun," to, "If you're considering a career in broadcast engineering, shoot yourself now, and save the trouble later."

More than 300 individual comments were received, and by far the majority expressed a negative attitude toward the present situation and/or the future. Interestingly, many of these negative comments came from employees at stations in large markets.

A case can certainly be made that the large number of negative comments is because of the fact that people are more likely to take time out of their day to complain than they are to compliment. Whatever the reasons, the comments give a unique insight into how at least a portion of the broadcast community views its present state and future.

"The broadcast industry is no longer the 'glamour' field of electronics. Quality people with knowledge of electronics engineering are becoming harder to find because of better pay and 9-to-5 working hours in other fields."

"Compensation in public TV continues to lag behind commercial stations while the job is—in many respects—more difficult and demanding. Many public TV 'diehards' are moving into the commercial arena because of compensation disparities."

"Labor/management relations must be reassessed. Labor must concede that things are different now than they were 20, or even 10, years ago. Management must be given more jurisdictional flexibility in order to survive the rapid, high-tech developments. But, management cannot cave-in to outrageous wage demands either. Profit sharing, partial ownership and other avenues have worked in the recent past and seem to be worth exploring. More productivity has been seen when employees have a piece of the action."

"Technical minded people are becoming extinct."

"Productivity is up, but salaries are down. The quality and experience of new personnel in the business is low. Technically minded people are becoming extinct."

"More AM stations should go ahead and make the investment in stereo. We broadcasters are responsible for the success of FM and FM stereo. Let's put some life back into AM before it is too late."

"It is disturbing to see a supermarket bag boy making more money hourly."

"Personality is slowly returning to radio, but still, salary levels stink unless you are in a Top 10 market. It is disturbing to see a supermarket bag boy making more money hourly."

"There are many opportunities in small market stations, but I believe that because of automation and satellite programming, staff size will shrink. As a new part-owner, we've cut our staff in half by running unattended. I hope to break even shortly so I can take home a few dollars."

"Standards have been thrown out the window. Deregulation has created many more problems than it has solved. The FCC has made the broadcast engineering profession less appealing, compared to private industry."

"The 'good days' of radio and TV are in the past. Elimination of FCC licensing requirements will make it much worse."

"I see an ever-widening gap between the salaries given middle and upper management that isn't commensurate with responsibilities and duties."

"The broadcast technician/engineer usually does not share in the rewards granted the up-front talent. I do not see a great many technically oriented people choosing broadcasting as a first career choice. Deregulation has taken much of the integrity and pride of performance away from the professional broadcast technician."

"Deregulation has given management an excuse to reduce or eliminate equipment measurements and other routine preventative maintenance work. There is a trend toward farming-out some formerly in-house engineering duties. Contract engineers may have a bright future, but overall, engineering quality is deteriorating."

"Now that some stations have had a chance to experience bad engineering practices, there are slowly increasing numbers of stations willing to pay for good engineering practices."

"There seems to be a trend toward hiring consultants and contract maintenance people, rather than full-time employees. The bottom line is that when the consultant says to do something, the station does it—even if the full-time employee has been asking for the same thing for years. (If the information source is costly, the information must be right!) Now is the time to consult, and owe allegiance to no single company."

"Broadcasting is becoming an endangered industry. The bright, young, energetic, educated engineer is looking elsewhere for greater opportunities."

"Broadcast companies—large and small—are finding a shortage

of highly skilled engineers, yet they are doing almost nothing to encourage trade schools and universities to provide the needed education. Instead of sewing the seeds for a technically proficient work force in the next decade, they guard their bottom line like some museum policeman."

"As companies attempt to maximize profits, and the FCC deregulates the broadcast industry, I see a trend developing where owners ignore technical standards more of the time. Concurrently, they tend to overlook the importance of competent, hardworking engineers, and their contributions to the station. Unfortunately, many engineers are viewed as a necessary evil on the payroll."

"There appears to be plenty of opportunity ahead for those who prepare for it. However, I do not feel that much of the FCC's deregulation work has been beneficial to the technical end of the broadcast industry. It is becoming more and more difficult to find technically qualified and motivated broadcast technicians."

"I love my job and the work I do, but I do not feel that I am being paid enough."

"I love my job and the work I do, but I do not feel that I am being paid enough. The 4% pay increase I received was tough to take, considering staff reductions and increased workloads. I feel that broadcast industry pay is lower than many other electronics fields."

"There is a disturbing attitude on the part of station management to believe that stations can virtually 'run themselves,' because of increased reliability and the diagnostic features of new equipment. For stations wise enough to keep a technical department, it is becoming increasingly difficult to find competent technicians who will work for the salaries being offered by many stations. College and technical school graduates are finding far better oportunities in other areas of the electronics industry."

"There should be more respect directed to the qualified broadcast engineer from the FCC and from station management. A good way to show this is through higher salaries."

"Deregulation seems to be having a negative effect on the feelings of upper management toward engineers. They feel as if anyone can fill the position, regardless of what the person really knows. I think we have hurt the engineering community through deregulation. I was one of the early proponents of deregulation, but I feel now that I was wrong. Deregulation does not help the industry. The latest FCC rulings have made my job harder, not easier."

"Good opportunities for qualified engineers and technicians are available now, and for several years more."

Management considerations: How you act can save your job

Management decisions to reprimand, fire, promote or give raises to employees at commercial TV stations are most often based on the workers' personal qualities than on job ability, according to research done at Indiana State University.

In a survey of 118 stations chosen randomly, management considered personal characteristics nine times more often than specialized professional skills.

Gale R. Adkins, director of radio-TV research at ISU, said management comments emphasized that competence in the professional skills needed for a job is simply assumed as a minimum requirement.

One station manager said, "It's the behavioral and attitudinal problems that most often result in a person's termination. Lack of ability to do the job is seldom the reason for dismissal."

"Most of the time, management does not recognize good work because it is expected."

The survey indicated that an individual's attitude toward the job was the factor involved in the greatest number of actions to reward or discipline employees.

Other positive qualities important for successful station employment are discipline, to know and follow the rules, proficiency in working with others, punctuality and reliability.

Failure to comply with or apply station policies contributed to the greatest number of disciplinary actions. Lack of punctuality, especially being late for work, was the most likely reason for firing an employee.

Adkins said negative encounters made up nearly two-thirds of all incidents reported by station management.

"That should not be interpreted as a comprehensive measure of employee performance," he said. "It is an indication of the kind of information that comes to the attention of management."

"Most of the time management does not recognize good work, because it is expected," one manager said. "However, poor work is constantly recognized because it is not accepted. Superior work, too, is recognized because it is above the norm and is seldom seen."

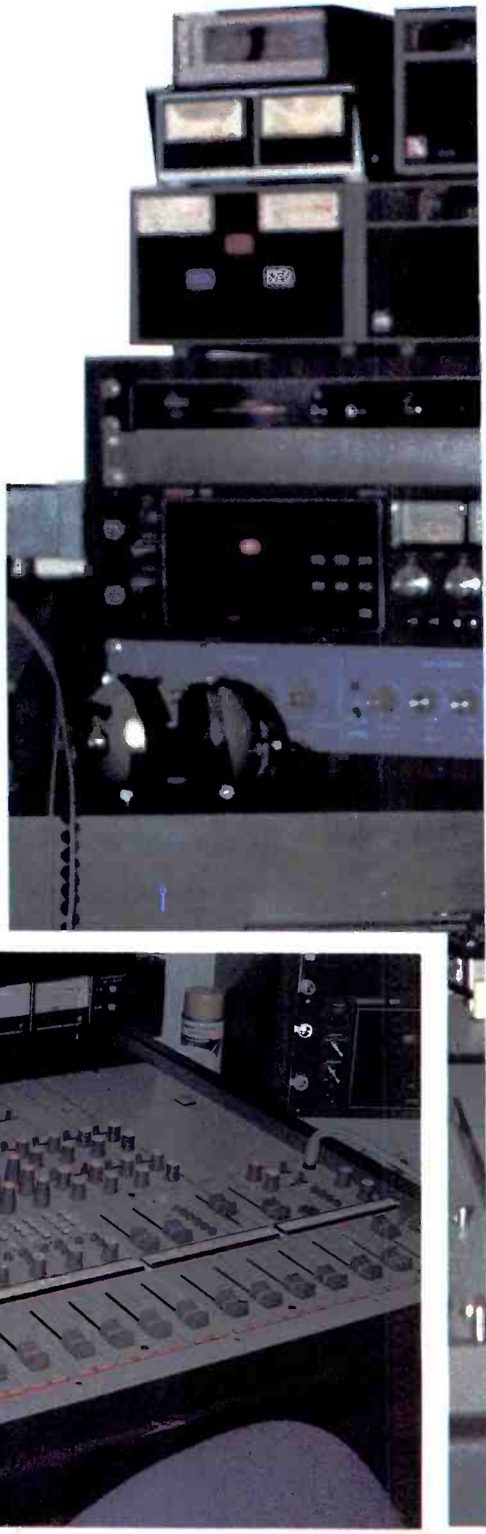
BE proof, Part 3:

Understanding audio monitor EQ

By Dennis Ciapura, BE consultant on technology

In the third part of our series on the *Broadcast Engineering* audio proof of performance program, we examine an area of broadcast operation that is all too often ignored or poorly executed: audio monitor equalization. Parts 1 and 2 of this special series examined the measurements required of an FM station to remain competitive with other broadcasters and advanced technologies. This part discusses the studio monitor system and how equalization—if used at all—should be applied.

Additional information on audio monitoring for broadcast applications is contained in the articles "Monitor speakers analysis" (page 69) and "Selecting power amplifiers" (page 88).



One of the most frustrating and least understood areas in broadcasting today is control room and production room equalization. The fact that more has been written on the subject and more test gear is available than ever before seems only to have added to the confusion. Half- or third-octave real time analysis of a pink noise source often suggests equalization parameters that just don't sound right. On the other hand, swept frequency measurement made in real broadcast studio environments are often so erratic that interpretation is difficult.

Many broadcast engineers have made the obligatory pink noise tests, adjusted for "flat" response, and hated what they have heard. At that point, the system is either restored to an unequalized state or equalized "by ear" for a pleasing response characteristic. The one-third octave analyzer is then employed to document the results and retired to the shop.

The routine just described is not a scientific approach and few real engineers are happy with such a state of affairs. The scientist lurking within all of us demands a more precise and logical approach and, fortunately, one is at hand. As is often the case, we must start by thoroughly understanding the physics at work.

Double hearing

The heart of the problem lies in how we hear the speakers in a typical studio environment. The ear has the remarkable ability to hear two simultaneous response patterns. The first is the near-field output of the drivers, which is heard through the acoustic anomalies of the room. Researchers have long been amazed at the ability of the ear to detect less than 1dB response differences, even in a reverberant environment.[1] The problem is that the reverberant environment causes such gross response errors that the driver irregularities are small by comparison, yet they can be heard. Otherwise, all speakers would sound alike when emersed in echoic room environments.

What to EQ?

Is it any wonder, then, that EQ adjustments to compensate for some room responses cause the overall

The **BE** proof program for FM radio stations is designed to encourage a renewed spirit of technical excellence in the broadcast industry. The program, as we now see it, will begin with FM and later be expanded to the AM radio and TV services. The basic performance objectives and measurement techniques of the **BE** proof were outlined in the August and September issues. We invite reader comments on the program, which may include certification of outstanding facilities.

audio signature to sound unnatural? In fact, should any room compensation be attempted at all, or should we equalize only the speaker near-field response? The answer is a partial yes to both questions.

Before tackling the room, let's take a look at the speakers. With multidriver systems, the best approach is to sweep each driver with a sine wave input and mic the output near each speaker at about its center. Although 1m response is standard for anechoic tests, one foot or less is better in a room to minimize the effects of standing waves. The higher the audio frequency, the shorter the wavelength and the closer the mic. Don't worry about the different distances from each speaker shifting the sensitivity reference; all we will be concerned about at this point is the response within each driver's range.

Hunting resonances

In almost all cases, there will be some kind of primary bass resonance, a smooth midrange and some type of tweeter resonance at the very high end of its range. Most speaker designers prefer critically tuned low-frequency systems over highly damped ones, because of the low-frequency extension afforded by the former, hence the ubiquitous peak that usually occurs about one-half octave above the driver's free air resonance.

Good tweeters will be designed to have their resonances below and above the specified frequency range, but occasionally the higher resonances will appear in the 7kHz-15kHz region. Audiophiles often mistake such high-end tweeter resonances for extended response. Monitors should, of course, be as flat as possible.

Response peaks are generally more audible than dips of the same magnitude. In either case, the broader the peak or dip, the more audible it will be.[2] The first step is optimizing the near-field response is to identify and correct any significant system resonances, paying particular attention to peaks in the 60Hz-10,000Hz range.

Pink noise analysis is not useful for this stage of work because of the need to find the exact center frequency of any peaks so that they may be compensated. Graphic equalizers are also of limited value in this application for much the same reason. The ideal tool is a parametric equalizer with variable frequency and gain/loss. The September **BE** Buyer's Guide lists several equalizers of various types.

By the way, if an audio sweep oscillator and chart recorder or low-frequency sweep and storage scope are not available, there is nothing wrong with totally manual measurements. It just takes longer. System EQ is usually a single event and not a weekly chore, so it is well worth the effort. The pickup mic should be a flat omnidirectional instrumentation-grade unit. A calibrated SPL meter with at least 15kHz bandwidth is required for reliable results. If none is available, a good broadcast quality condenser or electret mic is a fine substitute. Be sure to note any significant response anamolies depicted in the manufacturer's response chart.

Before attempting any corrective EQ, sweep all of the drivers and take a look at the overall picture. It is not practical to equalize all errors, so the first step should be to identify the most significant ones. It is best to sweep high-frequency drivers three times at different distances from the drivers to be sure that any major peaks observed are really resonances, and not the result of reflections off the cabinet. If the same peak(s) are observed at one inch, three inches and six inches from the driver, you can be almost certain that they're real.

Figure 1 illustrates the response within the passband of a dome tweeter widely used between 1973-1983. Note that there are two major peaks: one at 7kHz and another at about 15kHz. In this case, the 7kHz peak was quite audible, and the higher one was not. Also, a very high-Q corrective dip would have been required at 15kHz to avoid overcompensation.

When the worst near-field peaks have been identified, and equalizer bands are dedicated to each, the following procedure is quick and easy. Set the sine wave source to the center frequency of the peak while monitoring the acoustic output. Set the appropriate equalizer band to -6dB and tune the frequency of the equalizer until the peak is minimized. Adjust gain and Q as necessary for best results.

It is a good idea to avoid applying more than 4dB-6dB of correction, especially at high-Q settings, because the resulting phase shifts on the slopes of the EQ response curve will become audible. Listen to pink noise while switching the EQ in and out to be sure that a nasal sound has not developed. If so, reduce the correction.

At this point in our quest for optimum system/room response, we have flattened the speakers in a completely valid and logical way, and the system should sound better already. An interesting confirmation test can be made by feeding a pink noise source and listening to the system while switching the corrective EQ in and out. The equalized results should sound smoother, like a broad swish of coherent noise. A system with peaks will sound like multiple noise sources with slightly different sonic color overlayed. Attempting combined system and room EQ with one-third octave methods and graphic EQ often produces such results, and it sounds unnatural with music as well.

Note that we are calling upon listening tests at intervals in the EQ process. This is important because it is easy to go too far with corrective EQ and actually make the system sound worse. If you were equalizing pure electrical response errors, the phase shift induced by the equalizer would likely be offset by the phase shift accompanying the response error. Therefore, phase and response EQ would occur simultaneously.

The peaks caused by driver resonances and/or room standing waves do not exhibit the same phase

Figure 1. The near-field frequency response of a popular dome tweeter above its 4kHz crossover point. Note the response peaks at 7kHz and 15kHz.

BOSCH TVS/TAS-2000 and MCS-2000

UPDATE

STEREO CONVERSIONS FOR SWITCHERS

Bosch Goes Stereo

With the increasing consumer demand for higher quality receiving equipment—component systems, high resolution screens, high fidelity audio—has come a milestone in broadcasting: stereo television. To give you the technical edge in stereo production, you need to know just one name. The name is Bosch.

The Video Equipment Division of Robert Bosch Corporation has carefully monitored the evolution of stereo television. But, unlike so many other manufacturers of so-called high technology equipment, the Bosch response was one of anticipation, not an after-the-fact race to catch up.

In terms of your current investment in Bosch Video production and broadcast equipment, this means that you can convert your installation to monaural/stereo capability without the inconvenience of returning equipment to the factory. It means that with minimum effort and cost, you can convert to stereo now. A not inconsequential benefit of this rapid technology upgrade is the increased promotional mileage your broadcast facility will gain.

Now, any Bosch switcher, including the MCS-2000 Master Control Switcher and the TVS/TAS-2000 Distribution Switcher, can be converted to stereo.

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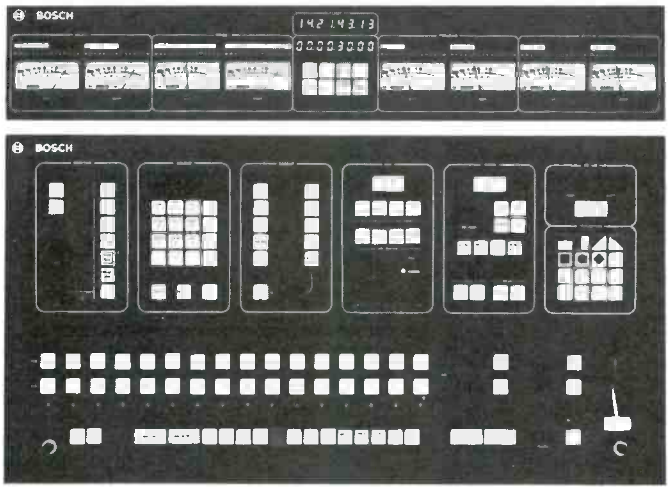
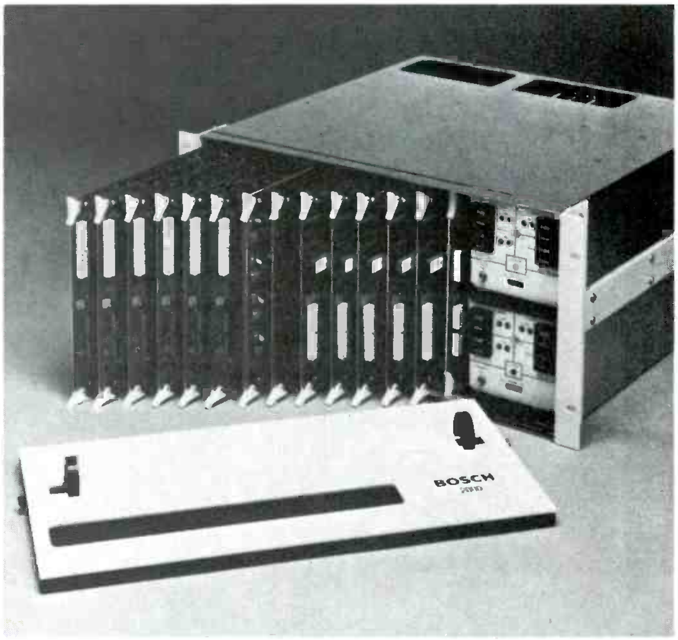
The MCS-2000 Master Control Switcher



The TVS/TAS 2000 Video/Audio Distribution Switcher



BOSCH

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Canon in Action at the 1984 Olympics

The world saw the Games through Canon Lenses.

For 16 days during the summer of 1984, the world saw the Games of the XXIIIrd Olympiad through Canon TV lenses.

From a crane high above the Los Angeles Coliseum, a Canon PV 40 x 13.5 was able to show the spectacle of the Games unfolding, and with its awesome 40X reach, isolate a single athlete on the field.

At venues throughout Southern California, a total of 135 Canon lenses captured every aspect of those rare moments that are now sports history. ABC cameras were equipped with Canon PV 40 x 13.5, PV 25 x 20 and PV 18 x 12 lenses. A Canon J20 x 8.5 was used on ABC's Super Slo-Mo camera, while a Canon J25 x 11.5 was shooting aerial pictures from the Goodyear® blimp. ENG camera operators used the Canon J13 x 9BIE and the incredible new J18 x 9BIE for the extra reach that brought us face-to-face with the competitors.

Canon broadcast lenses were also the choice of many independents on the scene in Los Angeles, because Canon's proven performance and reliability assured them of getting the shots they needed at this once-in-a-lifetime event.

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characteristics on the slopes, so be careful not to swap the response error for a phase error. If you are unfamiliar with the sound of such defects, set up a high-Q, high gain or loss EQ setting, and listen to its impact on pink noise reproduction as the boost or cut is varied. The nasal sound that emerges as 6dB of gain or loss is rolled in, thus supports our recommended limits.

Analyze the room

The second audio source that the ear hears is the room. It is useful to analyze the room's theoretical characteristics before actually beginning any corrective EQ.

Figure 2 is a simplified layout of an actual monitoring room that was tested. Although the room obviously contains furniture and other items, only the walls forming acoustic boundaries, the speaker locations and microphone at the listening position are shown. These elements form the principal standing wave conditions. When calculated, their effects will help pinpoint the major room resonse anamolies when the tests begin. These major dips are primary candidates for corrective EQ.

In Figure 2, the major cancellation frequencies at the listening position are predicted by calculating the frequencies at which the reflected wave will be out of phase with the main wave from the speakers. Whenever the difference between these distances contains a 0.5 fraction, a cancellation should be expected. Obviously, everything in the room affects these patterns and there will be thousands of interactions, but it is not productive to consider anything beyond the major room nodes (if the sanity of the tester is a consideration.)

Although these cancellations will appear at octave intervals, the lowest frequency cancellations in a group are the easiest to predict, because the path length accuracy is less critical. As you can see from Figure 2, we should expect to find major dips at 70Hz, 45Hz and 450Hz, as well as a chain of dips at octave intervals up the scale until the room reverberant effects and a thousand other peaks and dips cloud the issue. To make matters more interesting, a system with a remote subwoofer was selected.

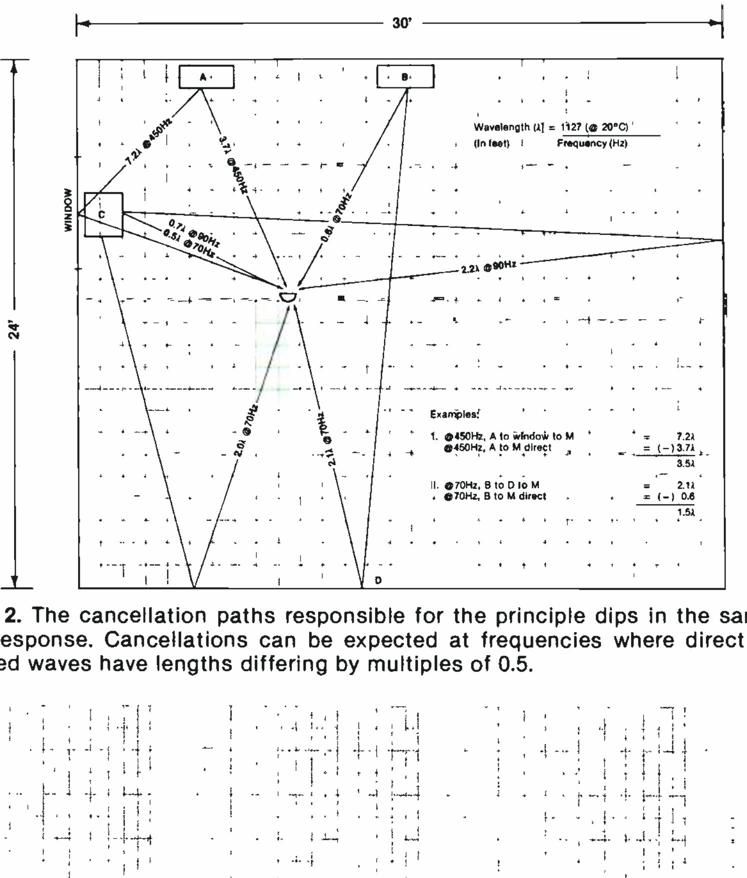

Figure 2. The cancellation paths responsible for the principle dips in the sample room response. Cancellations can be expected at frequencies where direct and reflected waves have lengths differing by multiples of 0.5.

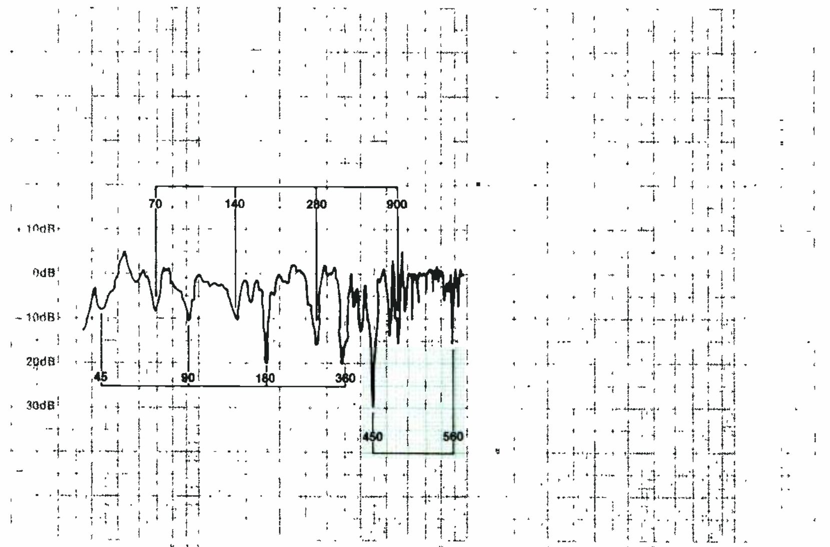

Figure 3. The actual low end response of the example system in the room illustrated in Figure 2. Note the occurance of three groups of major dips, as predicted by the mathematical analysis.

Just playing with the room diagram is a sonic adventure in itself before we even radiate a test tone. One of the major nulls in the radiation pattern of the subwoofer falls right on top of a major null from the main speakers. This is fortunate, because one of the primary problems with subwoofers is that they can generate their own null patterns if they are not located close to the main speakers. Also notice that the window off to the left side causes a null pattern in the midrange. Almost every studio has a window off to the side of the console and many have one dead ahead, too. These short wavelength reflections have special significance, as we shall see later.

The floor of the sample room shown in Figure 2 is thickly carpeted, but the ceiling height is also an influence. There is usually some reinforcement in the bass at frequencies corresponding to twice the wavelength of the ceiling height.

The sample room had a sloped ceiling averaging about nine feet, which suggests that we might see a buildup around 60Hz. With a good feel for what to expect, tests can now be made with an excellent likelihood of easy interpretation.

The microphone can now be moved to the listening position so that the room can be sampled. Once again, manual spot frequency checks with a simple audio oscillator are perfectly valid as long as these data are recorded at frequent intervals. Evey 1Hz from 30Hz to 100Hz and every 10Hz from 100Hz to 1000Hz is recommended. Swept sine wave measurements above 1000Hz in a live room for other than near-field tests are usually useless. Pink noise tests with one-half or one-third octave analyses are more appropriate.

Figure 3 shows the best results obtained with the room illustrated in Figure 2. Note that the anticipated nulls did appear. There are three

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Fidelipac Corporation □ P.O. Box 808 □ Moorestown, NJ 08057 □ U.S.A. □ 609-235-3900 □ TELEX 710-897-0254 □ Toll Free 800 — HOT TAPE distinct cancellations trains. The first is 45Hz, 90Hz and 360Hz. The next is 70Hz, 140Hz, 280Hz and 560Hz. Finally, there is the window reflection dipping in at 450Hz and 900Hz.

There are, of course, countless other smaller irregularities, but knowing the sources of the major ones helps in planning correction. In the case of the test sample room, these irregularities are because of speaker placement and the window. Moving the speakers would simply create a different set of nulls, and window treatment was not practical in the example. Therefore, any correction must be electrical in this case.

Figure 4 is the one-half octave picture of the same system and room. As expected, the low-frequency reverberant buildup shows up better than in the swept sine wave test because of the wider time window. However, the one-half octave analysis gives no clue of the null patterns disclosed by the swept tones, because they were averaged out and obscured by the reverberant effects. Clearly, both types of analyses are required to see what is really happening.

Now, in deciding how to EQ, remember the dual hearing phenomemon. The ear/brain system has the remarkable ability to process comb filter patterns for directional cues[3,4] and also to hear the speaker response through the room. Therefore, we must be extremely careful in applying room correction to the audio sytem. In this case, a 2dB shelf was introduced to tame the buildup, and the 45Hz and 90Hz dips were filled by 4dB. The other dips were left alone. The 450Hz and 900Hz dips are so narrow that the required equalizer Q would have been excessive, and any significant fill would have generated audible phase shift on the slopes. Sharp dips are not really audible anyway as response errors, but if they fall in a train (in comb fashion) they will give false imaging cues.[4]

The omnidirectional speakers bouncing mid- and high-frequencies off the walls—popular with many audiophiles—play on this phenomenon. The comb filter patterns generated "create" a more "open" sound, because the ear is fooled into thinking that it is hearing delay patterns from a larger room. Some electronic processors used in pop recording insert electrical comb filters to achieve the same effects and can actually throw sources beyond the speakers. Far left, far right and even up and down are possible.

For studio monitoring, the objective is faithful reproduction with uncolored response and imaging. Avoid 360-degree radiating speakers and reflective surfaces near the speakers, because these short wavelength patterns change a great deal with small changes in the listening positioning.

When in doubt, don't EQ

As a rule of thumb, partially correct the wider low-frequency peaks or dips that are most likely to be audible, and stay away from the midrange and highs when compensating for room effects. Also, a 6dB drop toward the last octave is normal for good listening positions, and corrective boosts should not be applied. As a matter of fact, headphones are designed to a standard treble response droop similar to that. Modern recording technique has everything closely microphoned or fed direct (in the case of electronic instruments), and the whole mix is equalized during production, assuming normal roll-off to the listening position.[5,6]

Another good rule of thumb when working with the room is, when in doubt, don't equalize. The ear may hear through the room and think that it's listening to a speaker with a crazy response. We optimized the driver response at the beginning, so if you don't do anything about the room, at least you can feel confident about the speakers. In other words, partially correct the major problems; equalize as little as possible.

Checklist for success

By starting with a maximally flat source of radiation on a near-field basis, we can discriminate between room and driver error. Then, by exploring the theoretical implications of the room's dimensions, reflective surfaces and speaker placement, the major room response problems can be anticipated. Further, when the response problems show up in the room tests, they are real and not a fluke caused by something in the room that might be moved later.

Using swept tones for driver optimization and low-frequency room work ensures the excellent resolution necessary to reveal sharp resonances and room dips, while pink noise one-half or one-third octave room analyses reveal low-frequency reverberant buildups and shorter wavelength trends.

Ear tests along the way confirm that things are being improved and not overcompensated. In the end, an A-B comparison at the listening position with a good pair of headphones should provide similar response. In the final analysis, what we have really done is used the instruments to guide our ears to the problem areas. Without the test procedure, ear adjustments alone are very approximate. Electrical tests alone without "ear checks" can result in accidental degradations. Combining electronic and biological resources yield the confidence level that good engineers demand.

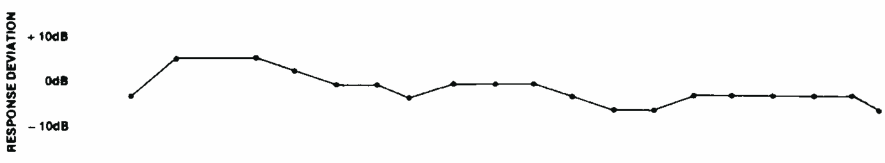

Figure 4. The ½-octave response of the example speaker system and room to a pink noise source. Note the low frequency buildup and the gentle roll-off at the high end of the spectrum.

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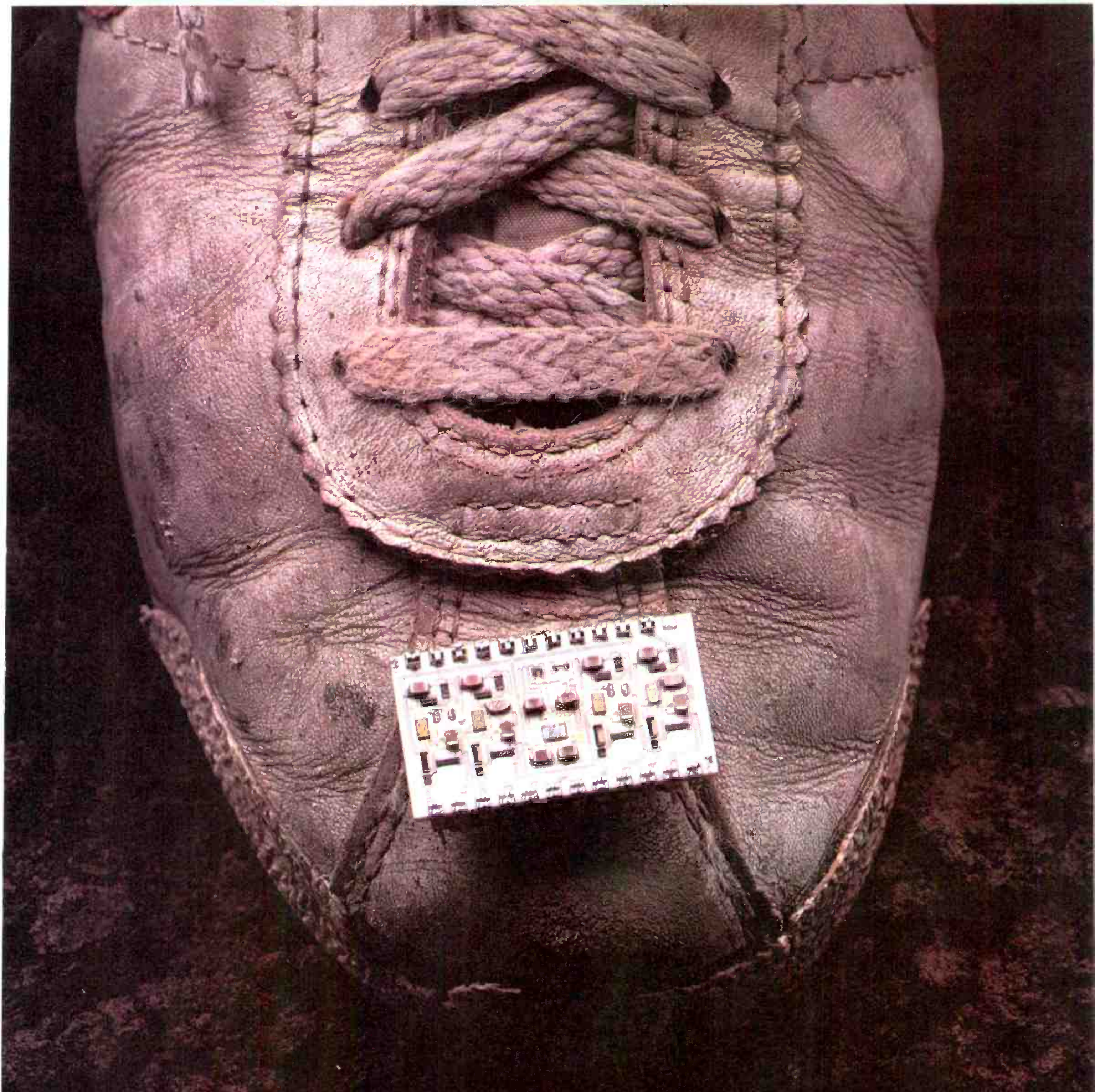

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- System output sampled and demodulated at transmitter antenna output.
- All processing and EQ left in line and adjusted as usual.
- Operating level defined as 0VU or equivalent at console.

Frequency response
Conditions

- AGC voltages switched off, not simply bypassed. Unfortunately, not all processors provide this feature. In such cases, use the *bypass* mode.
- Any convenient modulation level between 50% and 100%.
- Input level as required to maintain reference modulation level.
- Response error expressed as input level deviation required to maintain reference modulation level, compared to the 75μs characteristic for non-Dolby stations or 25μs characteristic with Dolby encoding.

*Superior performance**
- ± 1dB 30-15,000Hz
- ± 0.5dB 50-15,000Hz
- ± 0.2dB 100-10,000Hz

*Excellent performance***
- ± 2dB 30-15,000Hz
- ± 1dB 50-15,000Hz
- ± 0.5dB 100-10,000Hz

*Superior performance is the first proposed **BE** spec representing the maximum performance capability of a state-of-the-art FM stereo facility.
Excellent performance is the second proposed **BE spec. Although it is tighter than the FCC numbers, it is attainable by almost any properly engineered station with typical equipment.

Distortion
Conditions
- AGC switched on, input levels as required to produce specified console levels. De-emphasis in.

Superior performance
at standard operating level
- THD = 0.3%, 30-7500Hz
- IMD = 0.3%, 60Hz & 7kHz, 4:1
  at operating level + 10dB
- THD = 0.5%, 30-7500Hz
- IMD = 0.5%, 60Hz & 7kHz 4:1

Excellent performance
at standard operating level
- THD = 1% 50-7500Hz
- IMD = 1% 60Hz & 7kHz, 4:1
  at operating level + 10dB
- THD = 1.5% 50-7500Hz
- IMD = 2% 60Hz & 7kHz, 4:1

Audio clipping
Conditions

- Same as for distortion tests except that the input level is increased until left/right channel clipping is observed on an oscilloscope at the indicated test frequencies.
- Clipping level is defined as that level above operating level (0VU) required to produce visible clipping as the input level is increased.

Superior performance
- 30-5000Hz + 15dB

Excellent performance
- 50-5000Hz + 10dB

Composite clipping
"A" conditions

- Composite output of the monitor demodulator viewed on an oscilloscope with the transmission system in the stereo mode (and 19kHz pilot on).
- Clipping level is defined as that level above operating level required to produce visible clipping of the *total* waveform.

Superior performance
- 15dB at 1kHz

Excellent performance
- 10dB at 1kHz

"B" conditions

- Switch pilot off, view waveform clipping as defined above.

Superior performance
- 10dB at 7.5kHz
- 5dB at 15kHz

Excellent performance
- 10dB at 7.5kHz

Noise
Conditions

- Measured at each stereo audio channel output with all processing equipment in the line and adjusted for normal operation.
- Noise level is referred to the output level produced by an input signal at 0VU at the console.

Superior performance
- −60dB, 30-15,000Hz unweighted, de-emphasis in.

Excellent performance
- −56dB, 30-15,000Hz unweighted, de-emphasis in.

Separation
Conditions

- Measured at each stereo audio channel output with all processing equipment in the line and adjusted for normal operation.

Superior performance
- 40dB, 400-15,000Hz
- 30dB, 30-400Hz

Excellent performance
- 36dB 400-15,000Hz
- 30dB 50-400Hz

Comments on the BE proof

By Jerry Whitaker, radio editor

In the course of preparing the **BE** proof for publication, the program was submitted to a number of engineers and industry leaders for comments. This feedback helped the **BE** staff and its consultants shape the direction of the program. The review brought up several important items that engineers should consider when examining their audio systems for maximum performance.

Ed Williams, a staff engineer at the National Association of Broadcasters, was one of the people who reviewed the **BE** program. He urged engineers to strive for top performance from equipment in all phases of station operation. Williams made the following observations:

Performance measurements of the transmission system are important, but it is also important to regularly test the rest of the system. The over-the-air sound can be no better than the worst link in the chain. Attention must be given to the *overall* broadcast plant. And, if a station is seriously interested in maintaining a high-quality sound, it is essential that high-quality test gear be obtained, maintained and *properly used* on a *regular* basis. Even old equipment, if properly maintained, can sound very good.

The amount of headroom in the audio chain is another area of system engineering that should not be overlooked. A signal-to-noise ratio of (for example) 65dB, with only 10dB headroom before clipping, will sound significantly worse than a system with a 55dB S/N and 20dB headroom. Special attention must be paid, therefore, to overload levels on turntable preamps, tape recorders and reproducers, microphone preamps, STL systems and all other active audio equipment. Transformers, where they must be used, should be top-quality types, able to take levels of +24dBm.

No matter how technically perfect a station's facility may be, the way audio processing is handled is often out of the hands of the station's engineers—except, of course, to implement the processing. The program director, sales manager, station owner, chief "jock" or a "reference listener" may have more to say about how the station sounds than the engineer. More "punch," more "loudness," more "tinkle" or "sizzle" may be what they want, but if the audio chain is poorly maintained, the processing won't work.

There are perhaps more psychoacoustic effects to processing than performance specs, which can easily be measured. It may be in order for station engineers to understand the mechanics and subjective aspects of human hearing as well as how the processor, console and transmitter work. As a result of this kind of knowledge, some stations sound better than others because their engineers know how to set up and use the processors properly.

The history of audio processing makes an interesting study. At first there was no processing, and stations operated at low average modulation levels, while operators carefully watched the levels. Limiters were added later to prevent over-modulation due to high-level program peaks. This also permitted somewhat higher average modulation levels. Then, as less experienced operators and automatic program switchers became more widespread, audio compressors and sophisticated gain riders were used to balance levels between various sources. Not only were the program peaks gone, but so were the differences between loud and soft passages. As a result, all programming became *equally loud.*

Stations soon discovered the joys of echo, reverb, EQ and multiband limiters (to avoid pumping), thus producing a more distinctive sound for the station. However, as more advanced technology is incorporated into processors—providing almost unlimited flexibility and effects—stations may be expecting too much. Broadcasters cannot hope to satisfy, through processing, the sonic preferences of all listeners using a wide variety of receiving equipment in all environments. Increasing the high and low ends of the audio spectrum to make low-quality radios sound better will show up as too much "boom" and "sizzle" on better receivers. Decreasing dynamic range (through compression/limiting) to compensate for a noisy automobile environment will produce listener fatigue on high-quality home receiving systems.

Excessive processing may "distort" the nature of certain music so much that the listener, perhaps knowing how the original recording sounds, may prefer to listen to the selection on record or tape, rather than a limited dynamic range FM transmission system with modified spectral characteristics. Processing *in moderation* provides the best of all worlds.

BE will present additional comments on the FM proof program in coming issues. We welcome any reader comments.

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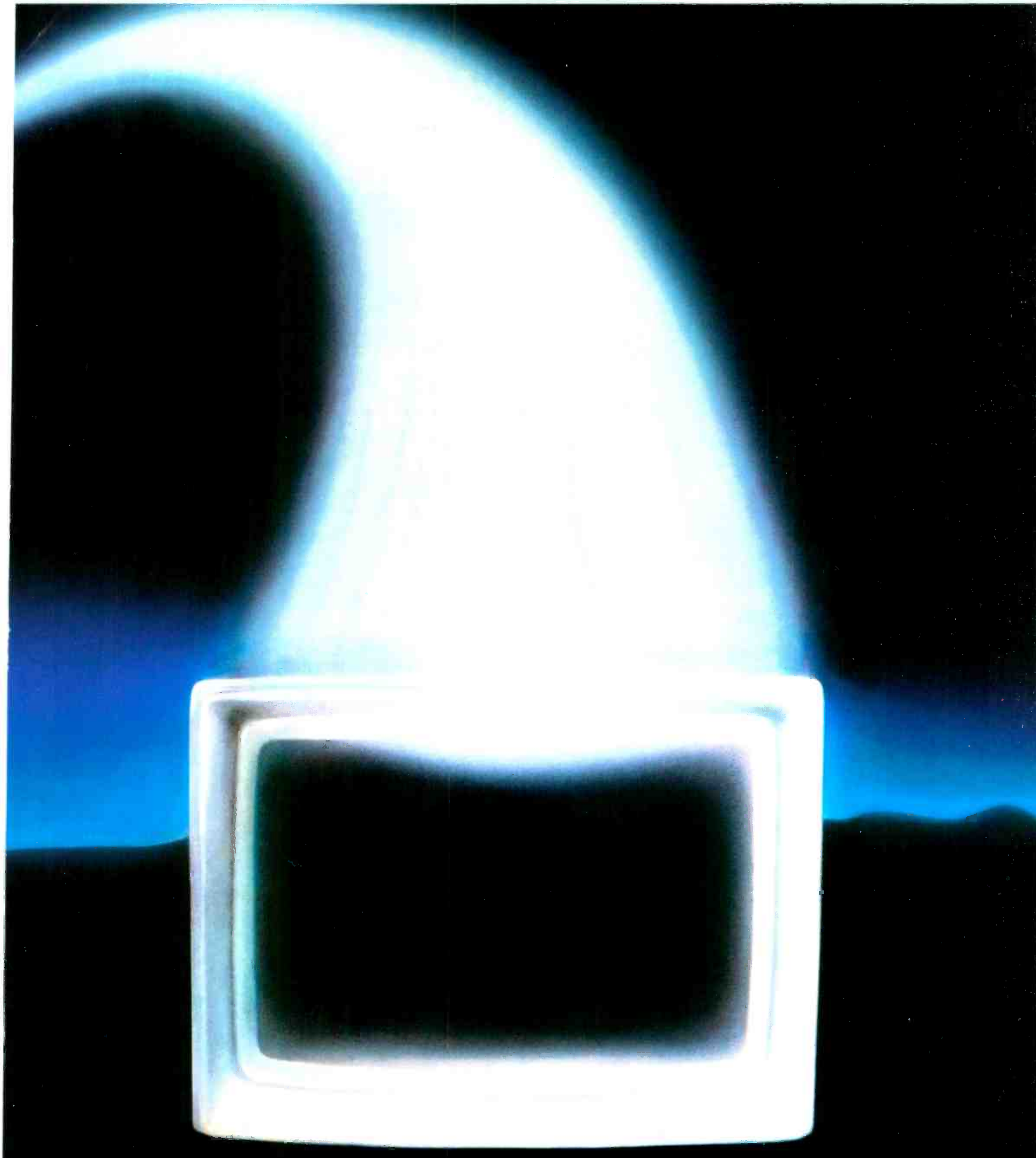

Monitor loudspeaker analysis

Are you aware of all the points to consider when choosing a monitor loudspeaker for your broadcast application?

By John Eargle, JBL, Northridge, CA

The specification of monitor loudspeakers for broadcast use has much in common with the specification of monitors for recording. Without question, the two most important attributes for both applications are reliability and accuracy. In general, broadcast applications favor smaller models, and the monitoring environment itself is not likely to be as carefully controlled as that in the recording studio.

Reliability aspects

A monitor loudspeaker must be both physically and electrically rugged. Whatever the external finish details, the enclosure should be sturdily constructed with particle board of sufficient thickness to inhibit spurious vibrations. The transducers themselves should be built on cast frames—as opposed to stamped metal—for mechanical rigidity during operation at high power levels.

The input power ratings of the system should be conservative, and both steady-state sine wave power input and typical program input ratings should be given. Under proper matching with a power amplifier, it should be virtually impossible to stress a monitor loudspeaker to the breaking point.

Many hi-fi loudspeaker models masquerade as monitors, but they are not to be considered for professional use.

Electrical characteristics

• Sensitivity. This is a measure of sound pressure level (SPL) on-axis for a given electrical input. The standard used today is 1W input measured at a reference distance of 1m. Typical sensitivies of smaller bookshelf monitors used today are in the 89dB-93dB range (1W at 1M).

• Power input rating. Knowing the program input rating, we can calcu-

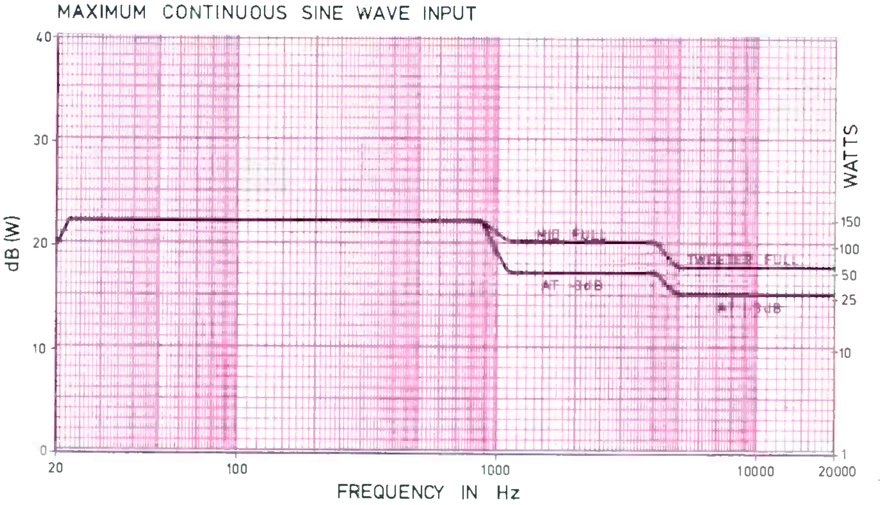

Figure 1. The maximum audio power input (sine wave) as a function of frequency for a typical 3-way loudspeaker system. Note the reduction in power handling capability at the higher audio frequencies.

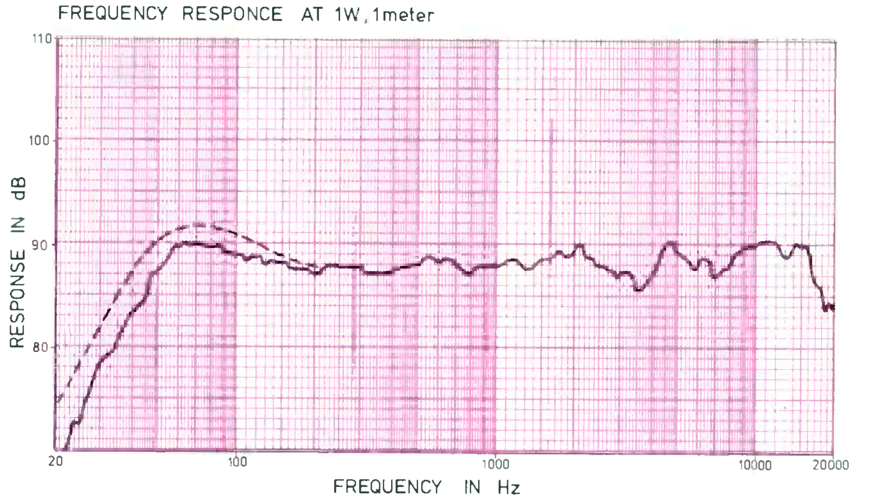

Figure 2. The effects of loudspeaker mounting on frequency response. The solid line shows the response of a free-standing speaker. The broken line shows the response measured when the same speaker is mounted against a solid boundary.

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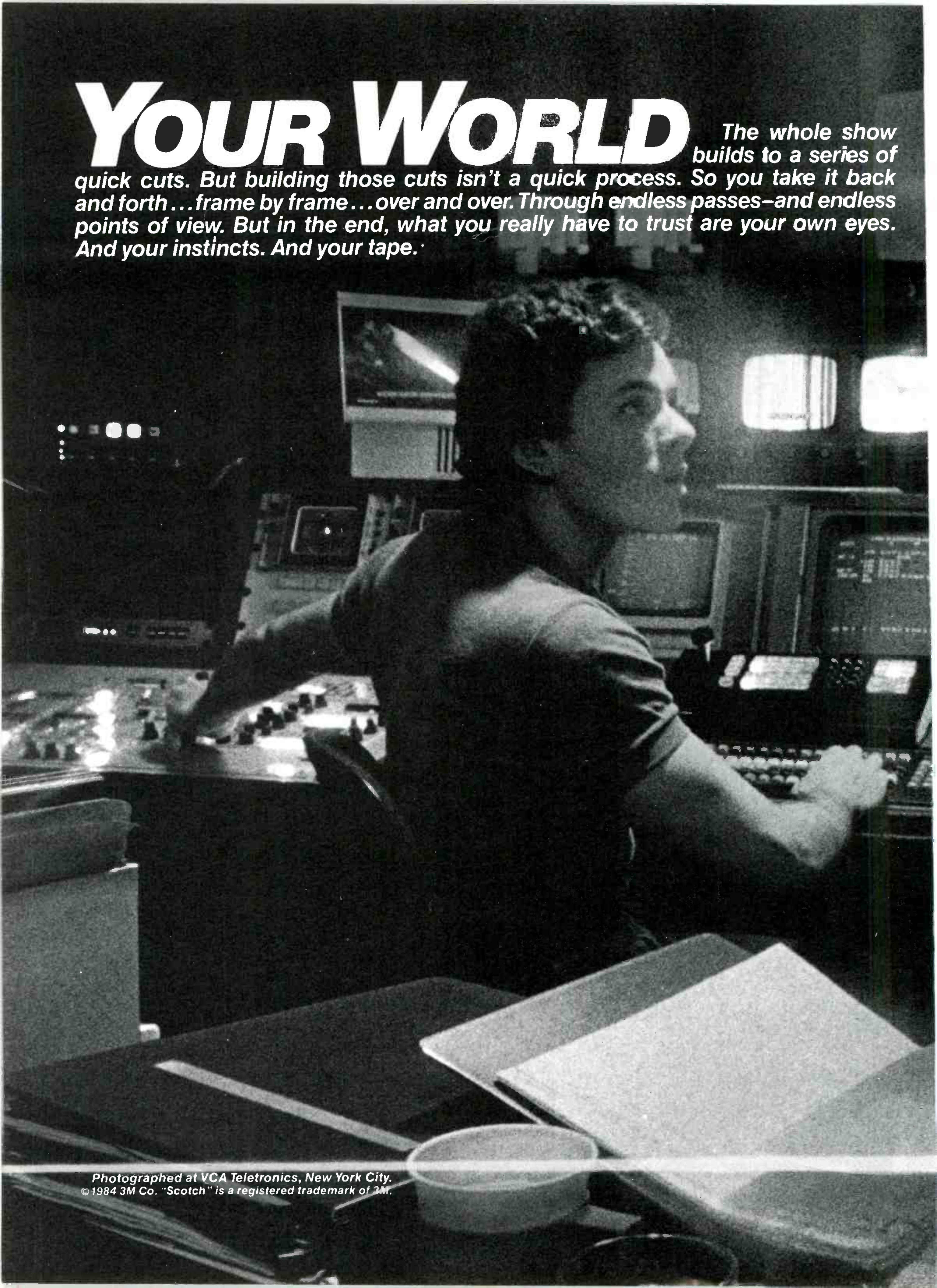
YOUR WORLD
The whole show builds to a series of quick cuts. But building those cuts isn't a quick process. So you take it back and forth...frame by frame...over and over. Through endless passes–and endless points of view. But in the end, what you really have to trust are your own eyes. And your instincts. And your tape.
Photographed at VCA Teletronics, New York City.
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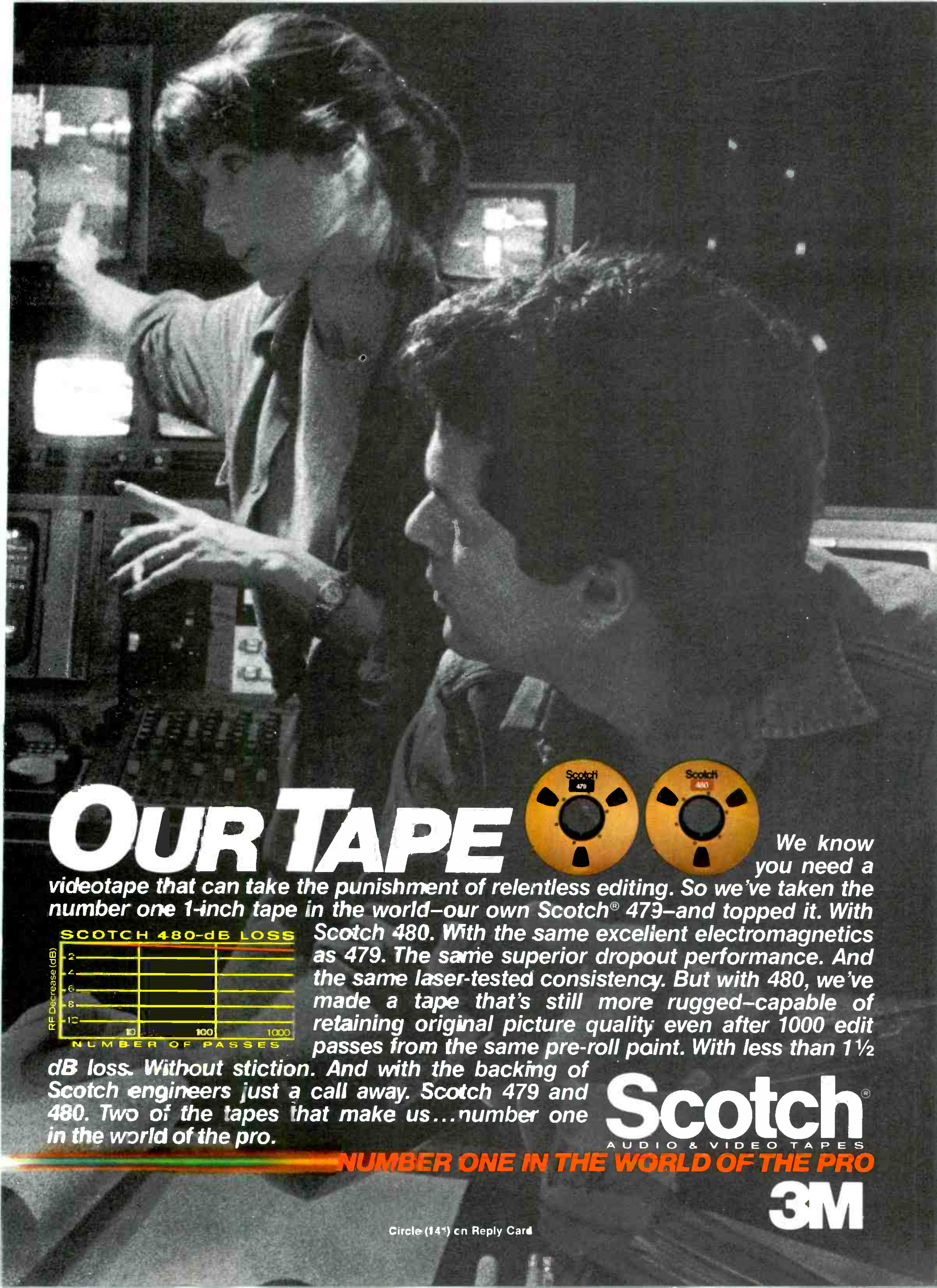

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Distance (meters)	1W	2W	5W	10W	20W
1	90dB	93dB	97dB	100dB	103dB
2	84dB	87dB	91dB	94dB	97dB
3	80dB	83dB	87dB	90dB	93dB
4	78dB	81dB	85dB	88dB	91dB

Table 1: The Sound Pressure Level (SPL) at various distances and power input levels for a loudspeaker with a sensitivity of 90dB SPL (1W at 1m).

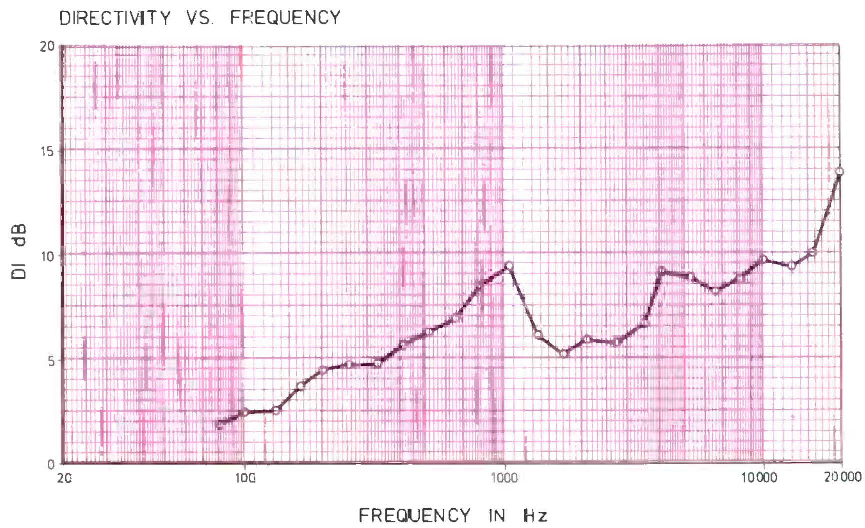

Figure 3. The directivity index (DI) of a test loudspeaker vs. frequency.

late the maximum on-axis SPL that the system can develop. Table I gives values of SPL for a loudspeaker of nominal sensitivity of 90dB (1W at 1m) at various distances and power inputs. Figure 1 shows the maximum electrical power input as a function of frequency for a 3-way monitor system with a 300mm (12 inch) low-frequency driver.

The program power rating for a loudspeaker is usually higher than its sine wave power input rating. The reason for this situation is that the sine wave rating assumes a continuous input, while the program rating assumes an average level, with only occasional peaks. With care, an amplifier capable of delivering power in excess of the loudspeaker's sine wave rating may be used, but it is essential that the amplifier not be driven to full output for extended periods of time. Manufacturer's recommendations should be carefully considered in this regard.

• On-axis frequency response. The on-axis frequency response of a monitor loudspeaker for broadcast work should be reasonably flat from 60Hz to 10kHz. When the listening is done within a distance of approximately one meter (about 3 feet), the listener is

The more you see, the more we hear

Look who's talking about Dubner now.

While we claim no responsibility for the famous line, "Build a better mousetrap and they'll beat a path to your door," we'd like to think it might have been said about the Dubner CBG-2 video graphics/animation system. In any case, we thought you might like to hear what your colleagues are saying about us:

"The CBG-2 is undeniably the most novel and flexible state-of-the-art real-time animation graphics device currently available.

—Mark Bernardo, Chief Graphics Design Engineer, Olympics
ABC Television

"We needed a machine that would allow us to compete effectively in an already competitive market. The CBG-2 gave us the capability to create weather maps and news graphics quickly, it could be operated by department personnel, and it was the best buy on the market."

—Bob Plummer, Director of Engineering, Fisher Broadcasting
KOMO (Radio & Television, Seattle)

"It's a digital computer and animation tool that allows artists to create quality animations independently. The CBG-2 is relatively inexpensive, it works fast and enhances the creative process with real-time imagery."

—Elaine Schwartz, Computer Animator
Atlantic Image (New York animation house)

"The CBG-2 is much faster and less expensive than standard film animation. The real-time animation, clean key capability, expandability and great software support make it one of the best computers around."

—Corinne Sousoulas, Art Director
Motion Picture Laboratories (Memphis post production house)

"The CBG-2 is a valuable tool due to its ability to create effective graphics quickly. It offers three dimensional animation, graphic enhancement, and character generation all in one unit. And these features are difficult to find in any one machine."

—Victoria Henigman, Electronic Graphic Designer
WPBT-TV (Miami PBS Affiliate)

"The Dubner was purchased for its advanced animation capabilities, its ability to be upgraded via software, and its cost effectiveness. We love it!"

—Dan Sokol, Vice President, Engineering
Video Post & Transfer (Dallas post production house)

With all the nice things being said about Dubner, all we can say is thank you. We plan to keep up the good work. You'll keep seeing it and we'll keep hearing about it.

For a free demonstration of the Dubner CBG-2, call (201) 592-6500, or write.

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well within the *direct field,* and reflected sound will be minimal.

Manufacturer's mounting specifications should be carefully noted. Many loudspeakers are designed to be placed adjacent to a hard boundary in order to exhibit flat response. When such a loudspeaker is standing free in a room, the low end will usually exhibit a roll-off. Details of this effect are shown in Figure 2.

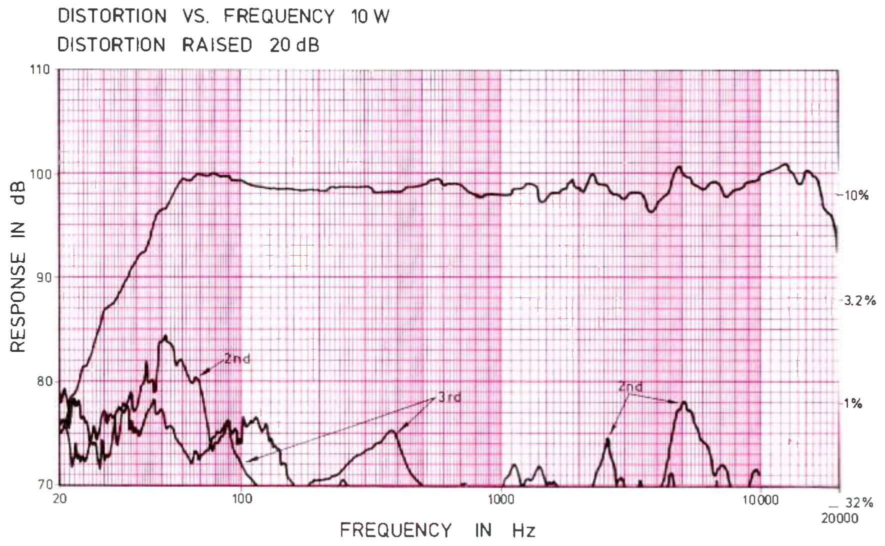


Figure 4. Loudspeaker distortion vs. frequency for a power input level of 10W. The top line on the chart shows on-axis response vs. frequency, using the scale on the left-hand side of the chart. The second and third harmonic distortion components (as shown on the chart) are raised 20dB for presentation purposes. The distortion percentage figures should be read from the scale on the right-hand side of the chart.

• Angular pattern control. When the listener is some distance from the loudspeaker, the reflected sound field in the listening room may become significant. The implication here is that a loudspeaker with erratic angular coverage will create an uneven reflected sound field—even though its on-axis response is quite flat.

The term *power response* is used to describe the total power output of the loudspeaker with respect to frequency. Obviously, a loudspeaker that exhibits both flat on-axis frequency response and smooth angular control over the operating frequency range will, almost by definition, be putting out nearly flat power over the operating bandwidth. The measurement that defines this condition is the *directivity index* (DI) of the loudspeaker. The smoother the DI over the operating frequency range of the loudspeaker, the more likely it is that the on-axis and power responses will track each other. Figure 3 shows the DI for a 3-way bookshelf monitor. Note that from about 400Hz to 16kHz, the DI is contained within a window

What you see above is yet another installment of TV's longest-running horror series: "The Lost Commercial."

The villain is the antiquated 2-inch cart machine—notorious for making valuable commercial air time vanish into thin air. And its appetite for destruction seems endless. Statistics show it's not unusual for a station to squander upwards of $15 million yearly on makegoods alone.

But the nightmare is ending. Because Sony announces the first real advance in cart machine technology in over a decade. The new Betacart™ multicassette system.

THE CART MACHINE VS. THE SMART MACHINE.

What the old cart machine tried to do by mechanical means, the Sony Betacart achieves through superior intelligence.

Microprocessors keep constant track of 40 cassettes. They maintain the alignment of the system's four BVW-11 decks and its elevator. They run self-check diagnostic routines.

And, in the belief that an ounce of prevention is worth many times its weight in makegoods, they solve problems before they occur—such as warning a technician that he's about to remove a cassette that's due to air shortly.

The Betacart is communicative in other ways, too. It's smart enough to guide your technicians through its operation, and will even interface directly with your station's main computer.

MAINTAINING MACHINERY VS. MAINTAINING PROFITS.

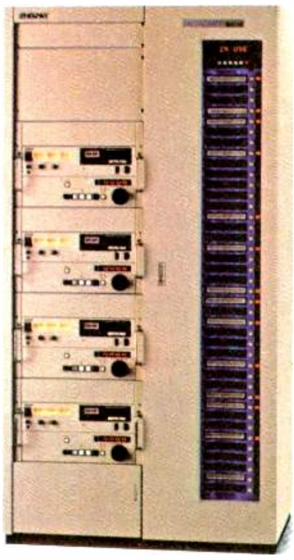
The end result of all this electronic

THE MACHINE INSPIRED BY BILLIONS OF DOLLARS WORTH OF COMMERCIAL FAILURES.

sophistication is the kind of mechanical simplicity that virtually eliminates breakdowns—not to mention the makegoods, excessive downtime and high maintenance costs that are generally part of the package.

And, as its name implies, the Sony Betacart uses Betacam cassettes—which cost less than a third of what 2-inch cartridges cost. Its format also makes the system ideal for ENG use during newscasts—thanks to its compatibility with the Betacam™ camera/recorder, along with its multiple video and audio outputs and freeze/instant-start capabilities.

All these advantages, plus its low initial cost make the Sony Betacart multicassette an investment that will pay for itself quickly. And it will keep paying off in new ways. Its stereo capability, for example, will allow you to capitalize on the coming introduction of stereo TV broadcasting.



For more information, call in New York/New Jersey (201) 833-5350; in the Northeast/Mid-Atlantic (201) 833-5375; in the Midwest (312) 773-6045; in the Southeast (404) 451-7671; in the Southwest (214) 659-3600; in the West (213) 841-8711.

After all, to err may be human. But there's nothing divine about having to forgive a machine.

SONY Broadcast

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Ikegami's new HL-95 Unicam® is the only universal camera system that accepts all professional on-board VCR formats, ¼-inch and ½-inch, and solves your buying puzzle by putting the picture you want into place.

Engineered to offer performance beyond the most rigid expectations, the HL-95 utilizes new ⅔-inch SM diode gun Plumbicons® resulting in a camera with higher sensitivity and S/N ratio, greater resolution, lower operating power requirements and less registra-

size and weight.

The HL-95 is also available as a stand-alone ENG camera, and in systems configurations using Triax or Multi-core cable base stations, or with the ML-95 ENG Microwave Link. Once you examine the HL-95 Unicam® you'll agree that the system flexibility and picture quality puts it in a class all by itself. The standard of excellence continues at Ikegami.

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of ± 2.5dB. Thus, when the system is adjusted for flat on-axis response, the reflected sound field in the room—assuming constant boundary absorption with respect to frequency—will not vary more than ± 2.5dB over that range.

• Distortion. A convenient power input level for presenting distortion data is 10W. Figure 4 shows the second and third harmonic distortion components (raised 20dB) for a 3-way monitor system with a 300mm (12 inch) low-frequency driver. Note that along the right axis of the graph, the distortion is well below 3% for all frequencies, and well below 1% for all frequencies from 150Hz upward. Such a system will exhibit little coloration due to harmonic distortion at normal operating levels.

• Time domain response. Time domain response involves the relative sound delay across the frequency band. Systems with minimal delay effects generally sound "smoother" and "crisper" than those systems with significant delay errors. Fortunately for the broadcast market, most of the 2- and 3-way bookshelf loudspeakers that are employed as monitors have insignificant timing errors. Figure 5 shows the delay characteristics of a 3-way system. Note that below 1kHz the time lag is about 1ms, which is

monitor loudspeakers create accurate stereo phantom images. Phantom images are those that originate in the space between the two loudspeakers. They should be precise and unambiguous.

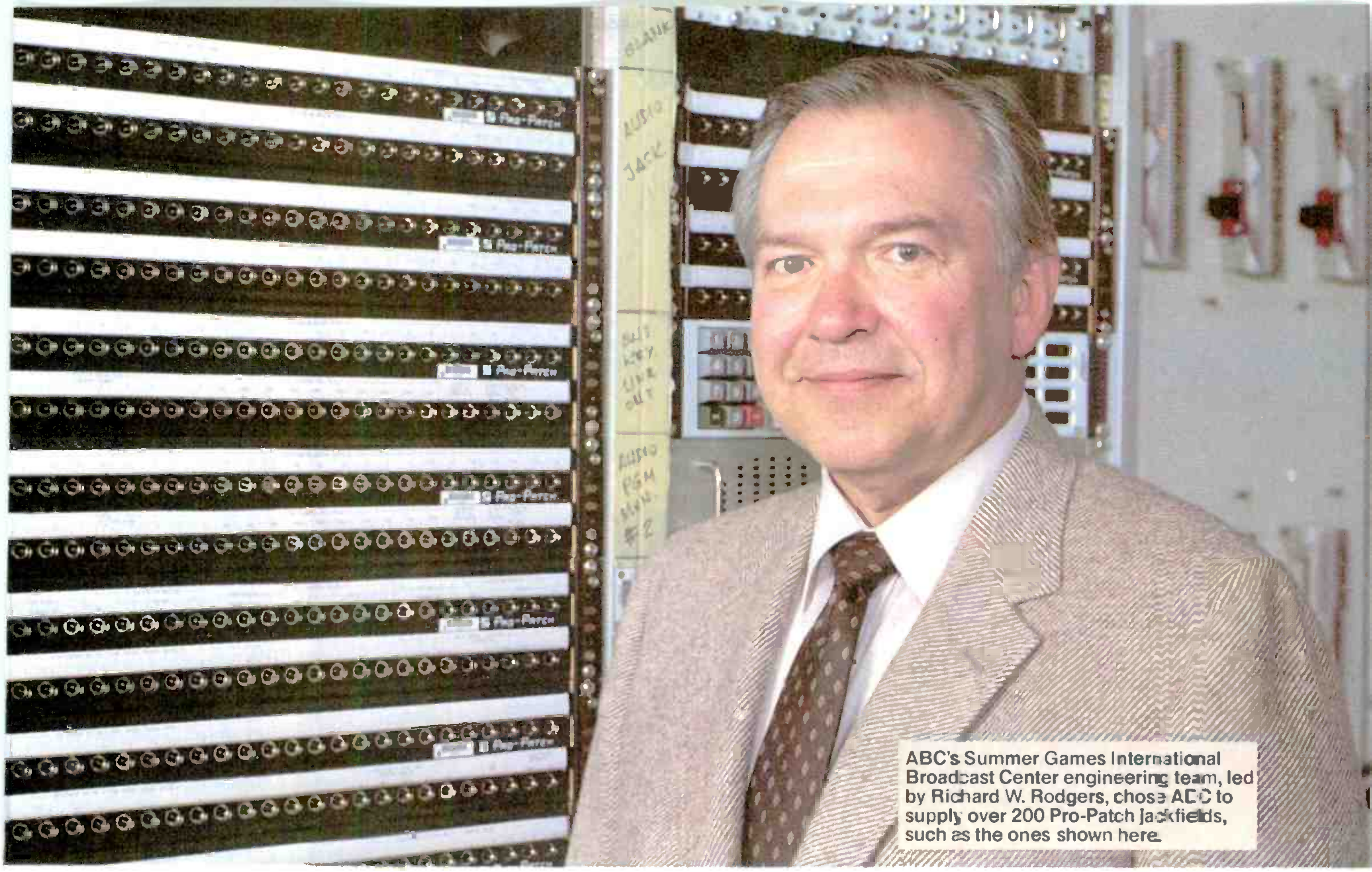
The sure way to arrive at this condition is to use either a vertical in-line component array on the baffle, or use a mirror-imaged baffle layout. Figure 6 shows a view of the JBL 4401 2-way monitor, with its in-line array. This model has an optional mounting cradle and is designed for fairly close-in monitoring applications.

The JBL 4312, shown in Figure 7, reflects recent design trends that make improved linearity and smoothness of response possible.

Figure 6. The JBL 4401 studio monitor loudspeaker, which uses an in-line array on the baffle for optimum stereophonic imaging.

Mounting the loudspeaker

Although a great deal of remote program listening is done via headphones, smaller monitors—2-way systems with 150mm (6-inch) or 200mm (8-inch) woofers—are often useful additions. Such loudspeakers are also ideal for small announcing or editing booths. In every case, the loudspeakers should be permanently mounted and not at the mercy of operators. If mounted in rack space, care should be taken that the loudspeakers



ABC's Summer Games International Broadcast Center engineering team, led by Richard W. Rodgers, chose ADC to supply over 200 Pro-Patch jackfields, such as the ones shown here.

For the biggest broadcast event in history, ABC chose ADC

With over 30,000 pieces of equipment and 660 miles of cable to install, ABC wasn't looking for extra work.

But, as host coordinating broadcaster for a worldwide audience of more than 2 billion, with 188 hours of scheduled coverage for the USA alone, ABC needed reliable jackfields.

The back panels of Pro-Patch jackfields feature ADC's unique split cylinder contact modules. Each contact will terminate up to four solid or stranded wires—22, 24, or 26 AWG—two on each side. ADC's split cylinder contacts make hooking up to the back of a panel almost as easy as plugging in to the front. Just a push on a convenient hand tool bares a wire, locks it into the contact inside an insulated housing, and trims off excess length. Disconnecting wires, if you choose, is just as easy. No unsoldering. No tools.

They needed flexibility, too—with 1300 total hours of competition to cover at 30 locations in just 13 days.

Modularity was another consideration, so the jackfields can be used elsewhere after the Summer Games.

For these reasons, Richard W. Rodgers, head of engineering at ABC's International Broadcast Center, and his staff, chose ADC. They installed our 100% prewired, computer tested Audio Pro-Patch® jackfields exclusively.

Like ABC's busy engineers, your own staff has more important things to do than soldering jackfields. You'll see higher productivity, faster installation and lower up-front costs with ADC's 100% prewired Pro-Patch® jackfields and Ultra-Patch® panels. With our patented split cylinder contacts, they're solderless and hassle-free.

For more information on these state-of-the-art units—or on more than 300 ADC standard audio and video patching components—write to the address below. Or call (612) 893-3000.

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Figure 7. The 4312 studio monitor system for broadcast use. Note the arrangement of the mid- and high-frequency transducers around the woofer speaker.

are properly oriented with respect to the user.

For larger areas, such as master control areas or control rooms where live productions are mixed, it is important that the monitor loudspeakers be suspended from the ceiling or walls, and aimed precisely at the operator's work position. The level settings for the various drivers in the systems should be set permanently by the chief engineer and not readjusted to taste by individual operators. Where possible, a reference acoustical level should be defined, and all monitoring should be done at that setting.

Outlook for the future

Although FM radio in the United States has long been a quality-oriented medium with standards as high as management wishes to maintain, television has only lately become sophisticated with respect to audio handling. The promise of stereo TV is an exciting one, and will undoubtedly lead to massive upgrading of audio equipment in that medium. The impact of well-produced stereo on a good picture has been long established in the motion picture theater, and proper monitoring is an important step along the way to attaining this goal for television.


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FP31 MIXER
SLATE
LO CUT
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PEAK
MIC
LIMITER

Selecting power amplifiers

By William Isenberg*

One of the more important decisions in the design of a large radio or TV monitoring system is what type of power amplifier to use. No matter what size installation is being considered, the choice of units is broad enough to satisfy any requirement. From on-air monitors to cart production or ENG editing rooms, it is important to have enough clean power for the monitor loudspeakers.

Look at the hardware

Check the input connections. They should be tip-ring-sleeve or XLR, as this allows a balanced input. Either a differential or transformer input is acceptable, but an unbalanced input is an open invitation to hum and buzz. With video monitors around, buzz can be a real problem. Output connectors will most likely be the dual binding posts often seen on test equipment.

*Isenberg is circuit design consultant to **Sound & Video Contractor** magazine (an Intertec publication). He operates an independent consulting firm in La Canada, CA.

Some things are more fundamental than wiring details. Inspect the mechanical construction and heat sink area. Removal of heat in a crowded rack is not easy. Count the number of output transistors and make sure they are in metal cases, instead of plastic. All of these things contribute to the unit's reliability. A conservative unit may cost more at the beginning, but broadcast applications demand many years of continuous service without unexpected problems. Any failure that requires removal of the unit from the rack is one too many. The object is to remain productive.

Take the lid off and check the components inside. Amplifier circuits operate by making a high-power copy of the incoming signal. The entire unit is a servo system, which duplicates incoming commands as best it can. No amplifier can deliver more than its power supply can provide. An amplifier with a lightweight power supply will suffer from what amounts to a fuel starvation. Look for a good-sized power transformer and filter capacitors of at least 10,000Mf per channel.

Check the specifications

There are several ways to estimate the reserve capacity available from a power amplifier unit. A comparison of the 4Ω power output rating to the 8Ω rating is one method. If the unit is conservative, the 4Ω figure will be almost double the 8Ω value. The current capacity of such a unit is obviously much greater than that of an amplifier where the ratings are almost the same. The current flows from the power supply through the output circuit and into the load. If either one cannot deliver the goods on demand, the system performance will suffer.

Also, examine the 4Ω distortion specification. If it is much higher than that for 8Ω, this is an indication that

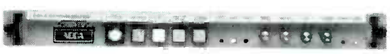
What's going on at ADDA?

We're celebrating our 7th Anniversary as a pioneer in digital video processing by launching the next generation TBC/Synchronizer and Digital Still Store systems . . .extending the benefits of ADDA technology to an even broader range of applications in broadcasting and informational video production with greater flexibility and at lower costs.

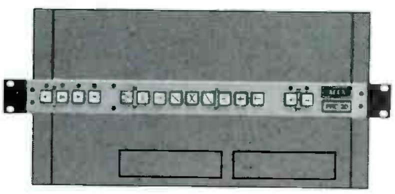
That's what we call "Affordable Excellence."

A SMALLER "INFINITE WINDOW!"

Using new CAD/CAM capabilities,, our engineers developed the VW 3 . . .the smaller, more powerful successor to our popular VW series of TBC/Synchcronizers. (A tough act to follow; almost 2000 VW 1s and VW 2s are still at work throughout broadcasting and video production.) The VW 3 was introduced at the SMPTE Conference in late Summer.



VW 3 TBC/Synchronizer

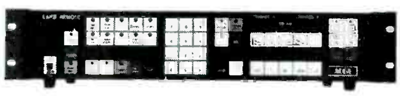


AC 20A *Dual-Channel TBC/Synchronizer with Digital Effects*

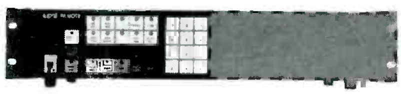
At NAB last Spring, we introduced the AC 20A Dual Channel TBC/Synchronizer with digital effects transitions. . .the practical way to move up to professional A/B roll editing. To date over 1000 units have been shipped.

Also at NAB, we demonstrated the next-generation ADDA still store, the ESP II.

Interfacing with a number of standard disk drives, the dual-channel ESP II combines high signal transparency and modular convenience for cost-conscious graphics generation and conventional still storage and retrieval. . .plus digital effects transitions.



ESP II Dual-Channel Digital Still Store System



ESP II Single-Channel Digital Still Store System

A significant contribution to still store technology, ESP II extended this versatile tool to users with smaller budgets.

CHOICES IN MODULAR STILL STORE

Then, at Video Expo in New York, we introduced the single-channel version of ESP II which takes advantage of smaller disk units and can be upgraded to dual-channel operation with no cost penalty thanks to our unique approach to modular architecture.

Of course, the ADDA ESP-C remains the top-of-the-line still store system for professional applications; over 350 ESP systems form the backbone of still production and storage throughout the industry.

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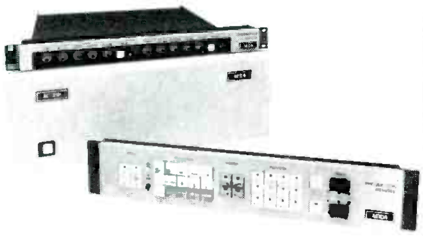
In England at the International Broadcasting Conference, we unveiled our first entry into the world of PAL. . .the AC 21P Dual Channel TBC/Synchronizer with expanded Digital Effects.

Patterned after the AC 20 concept in NTSC, but engineered from the ground up to demanding PAL standards, the AC 21P offers a number of exciting features of interest to international broadcasters.

The AC 21P is manufactured by ADDA IRELAND for European distribution.



AC 21P *Modular PAL Dual-Channel TBC/Synchronizer with Digital Mixing Effects*

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This year Control Video became a part of ADDA, with their complete line of advanced videotape editors . . .such as the Lightfinger series . . .sequencers, time code control and automation systems.

With complementary products, engineering and marketing outlook, ADDA and Control Video will have exciting news in the months to come.

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the published specifications. Distortion will increase somewhat with a 4Ω load.

Take a power reading when the amplifier is on the verge of clipping, and recheck the ac line voltage as you do. If the power supply is up to the job, the power at 4Ω will be about double the 8Ω reading.

If one channel works well, check the total capacity of the power supply by driving both channels at once. Unless the power supply is adequately sized, the 4Ω output will probably be less with both channels driven. Try monitoring the dc voltage on the filter capacitors. Check the ac power line voltage if the dc voltage shows a significant change. Beware of skimpy ac power cords. 18-gauge is probably too small.

To check power bandwidth, increase the frequency at 1dB less than full power. When the distortion reaches 1% (or −40dB) note the frequency and divide it by 20kHz. The result is the IHF *slew factor*. For a power bandwidth of 60kHz, the slew factor will be 3.

Check for interference

Many broadcast locations have a high RF field because the transmitter is on site, and loudspeaker wiring makes a better antenna than you think. RF coming into the output will not be eliminated by using an input transformer. The transformer should remove the hum and buzz, however. The loudspeaker wiring should be shielded as a last resort.

Safety considerations

Most of the foregoing discussion concerns performance and reliability. *Safety* cannot be ignored, and this is where some otherwise excellent units fall flat. Take a look at the rear panel for a sticker indicating UL or LA city labs safety approval. (In Canada, it is CSA.) To ignore this seemingly trivial point is asking for trouble. If there is a fire, all sorts of people who know nothing about broadcasting or sound systems will show up wanting money or blood. Perhaps both. Play it safe. No matter what anyone tells you about approvals they would like to have, or what they have applied for, look for the stickers. No stickers, no sale.

Having uncertified equipment on the premises means that employees are being asked to perform their duties in an unsafe workplace. OSHA will not be amused, so don't take chances.

Editor's note.
Additional information on audio power amplifier systems can be found in the March 1984 issue of **Broadcast Engineering.** See the articles, "Multiway Audio Amplification," by William C. Cheney, and "Selecting a Monitor Amplifier," by Bruce Bartlett.

Stereo TV is the one to watch.

Flash. *Stereo TV is the hot topic at the 1984 Consumer Electronics Show in Chicago.*

Flash. *Every major TV set manufacturer plans to put multichannel units on the street by 1985.*

Flash. *NBC announces The Tonight Show and Friday Night Videos will soon be recorded in stereo.*

Flash. *ABC tests bilingual broadcasts of The Fall Guy in Spanish markets; ratings soar.*

Flash. *NEC introduces VHF and UHF transmitters with full stereo sound.*

In 1977.

We signed on seven years ago.

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And since then, we've installed more than 100 stereo TV transmitters in Japan and Australia. With the same proven technology found in more than 1,400 NEC transmitters around the world.

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Tested. Tenured. And fine-tuned.

Stereo TV Transmitters. Right now. From NEC.

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You see, we're the one to watch in stereo television. Because we already have been for seven years.

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WHILE EVERYONE ELSE HAS BEEN PROMOTING A FORMAT, SONY HAS BEEN PERFECTING A SYSTEM.

Over the last three years, Sony's rivals in the combination camera/recorder arena have spent considerable time inventing wonderful things to say about their new formats. But apparently, they've overlooked inventing many wonderful new products to go along with these formats.

Sony has taken a different course.

In 1982, Sony introduced Betacam™ and the BVW-10 playback unit. An evolutionary system that didn't force stations to abandon their existing ¾" and 1" equipment.

Then, in 1983, Sony expanded the system with the three-tube Betacam, the BVW-40 edit/recorder, and the world's first battery-operated ½" field playback unit.

And this year at NAB, Sony announced a major breakthrough in cart machine technology with Betacart.™ A system

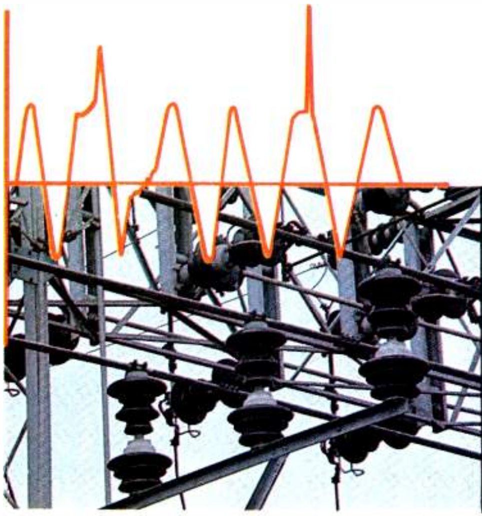
that demonstrated the Betacam format's strength beyond the newsroom, beyond the studio, and beyond field production.

At the same time, Sony also unveiled the world's lightest camera/recorder, the BVW-2 Newsmaker.™ And a prototype coder/decoder system that will make it possible for Betacam to be transmitted by microwave.

Each of these products is the result of Sony's dedication to the needs of the ENG and EFP industry. Work which has earned the Betacam format widespread acceptance by television stations and production companies around the world.

Which only makes sense. After all, in this business you don't win sales on the merits of your arguments. You win them on the merits of your products.

SONY® Broadcast



The effects of ac line disturbances

Part 2

By Jerry Whitaker, radio editor

This article is the second in a series dealing with the effects of ac power disturbances on broadcast equipment. Engineers at radio and TV stations are faced today with a situation in which the equipment they are using is becoming increasingly sensitive to transient overvoltages, while the quality of the utility company ac feed (in most areas of the country) is declining. This series of articles seeks to give engineers the information they need to identify areas of the broadcast plant that need protection, and define in general terms the types of protection equipment currently available.

Part 1 of this series, in the September ***BE,*** *discussed the scope of the problem. This month's article looks at the causes of transient disturbances. Next month's article will deal with the effects of transient overvoltages on discrete components commonly used in broadcast systems.*

Transient overvoltages come in a wide variety of forms, from a wide variety of sources. They can, however, be broken down into two basic categories: those generated through natural occurrences and those generated through the use of equipment, either on-site or elsewhere.

Natural phenomenon consists mainly of lighting and wind storms, including tornados. The *lightning effect* can be compared to that of a capacitor (Figure 1). A charged cloud above the earth will create an oppositely charged area below it of about the same size and shape. When the voltage difference is sufficient to break down the dielectric (air), the two "plates" of the "capacitor" will arc over and neutralize their respective charges. If the dielectric spacing is reduced, as in the case of a conductive steel structure (such as a transmitting tower), the arc-over will occur at a lower than "normal" potential, and will then travel through the conductive structure.

A typical lightning strike consists of a stepped leader that progresses toward the ground at a velocity that may exceed 50m/μs. When sufficient potential difference between the cloud and the ground exists, arcs move from the ground to the leader column, completing the ionized column from cloud to ground. A fast and bright return stroke will then move upward along the leader column at about one-third the speed of light. Peak currents from such a lightning strike can exceed 100 kiloamps, with a total charge as high as 100 coulomb. (A coulomb, abbreviated as C, is the unit of electrical charge that is transferred each second by an electric current of one ampere. It is approximately equal to 6.24 x 10^{18} electrons.)

The lightning effect can also occur between charged clouds, with current movement between clouds creating a corresponding *earth current.* This earth current can induce significant voltages in conductors buried in-line with the charge movement. The *wind storm effect* can induce voltages in above or below ground conductors due to the rapid changes in the electrical potential of the atmosphere that are present during such occurrences.

It is, thus, unnecessary for atmospheric charge energy to actually strike a conductor of concern, such as a transmitting tower or utility company pole. In many cases, significant

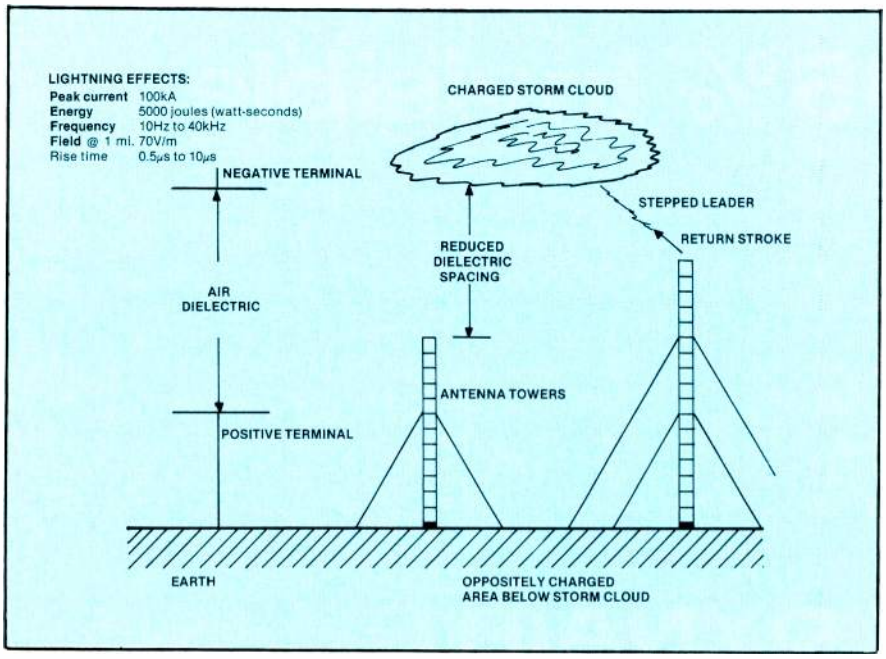


Figure 1. The lightning effect and how it can be compared to a more familiar mechanism, such as the capacitor principle. Shown also are the parameters of a typical lightning strike.

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voltage transients can be generated solely by induction.

Cloud-to-cloud charge movements will generate horizontally polarized radiation and cloud-to-ground discharges will generate vertically polarized radiation. Field strengths exceeding 70V/m can be induced in conductors a mile or so from a large strike.

The major induced man-made transient is *electromagnetic pulse radiation*. Radiation from high-power broadcast transmitters will induce voltages into nearby lines and structures, but these are insignificant when compared to the radiation resulting from an electromagnetic pulse (EMP). Further, because of the constant nature of broadcast radiation, it does not fit the transient definition.

An EMP is the result of an intense release of electromagnetic waves that follows a nuclear explosion (Figure 2). The amount of damaging energy is a function of the altitude of detonation and size of the device. A low altitude or surface burst would generate a strong EMP covering a few thousand square kilometers.

However, the effects of this radiation would be meaningless, because the blast would have already destroyed most structures in the area. A high-altitude burst, on the other hand, presents a real threat to all types of communication systems. Such an explosion would generate an EMP with a radius of more than 1000 kilometers—a large fraction of the United States.

The amplitude and polarization of the field produced by a high-altitude detonation would depend on the altitude of the burst, the yield of the device and the orientation of the burst with respect to the receiving point. This EMP field creates a short but intense broadband radio frequency pulse with significant energy up to 100MHz. The electric field of this pulse can be greater than 50,000 V/m, with a rise time measured in the tens of nanoseconds.

Lightning and other natural occurrences cause problems many times, not because they strike the broadcasting site, but because they strike part of the utility company system and are brought into the station via the power lines. Likewise, damage that could result from EMP radiation would be most severe to equipment connected to the primary power source, because it is generally the most exposed part of the transmitting system.

The utility power distribution system can couple transient overvoltages into a customer's load through induction or direct charge injection. As stated earlier, a lighting strike a mile away from a 12kV line can create an electromagnetic field with a strength of as much as 70V/m. Given a sufficiently long line, substantial voltages can be coupled to the primary power system without a direct hit. Likewise, the field created by EMP radiation can be coupled to the primary power line, but in this case at a much higher voltage (50kV/m).

Given the layout of many parts of the utility company power system—long exposed lines over mountain tops and the like—the possibility of a direct lightning strike to one or more legs of the system is a distinct possibility. Lightning is a point charge-injection process, with pulses moving away from the point of injection.

The amount of total energy (voltage and current) and the rise and decay times of that energy seen at the load as a result of a lighting strike is a function of the distance between the strike and the load and the physical characteristics of the power distribu-

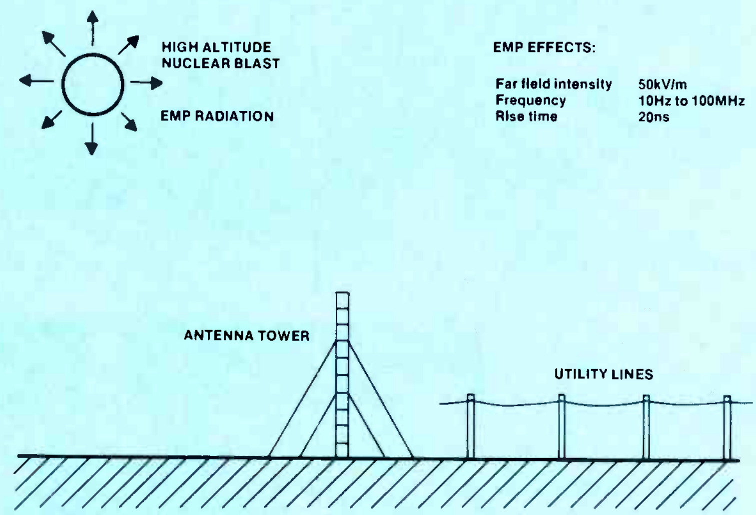

Figure 2

Figure 2. The EMP effect and how it can induce damaging voltages onto utility company lines and antenna structures. The expected parameters of an EMP are also shown.

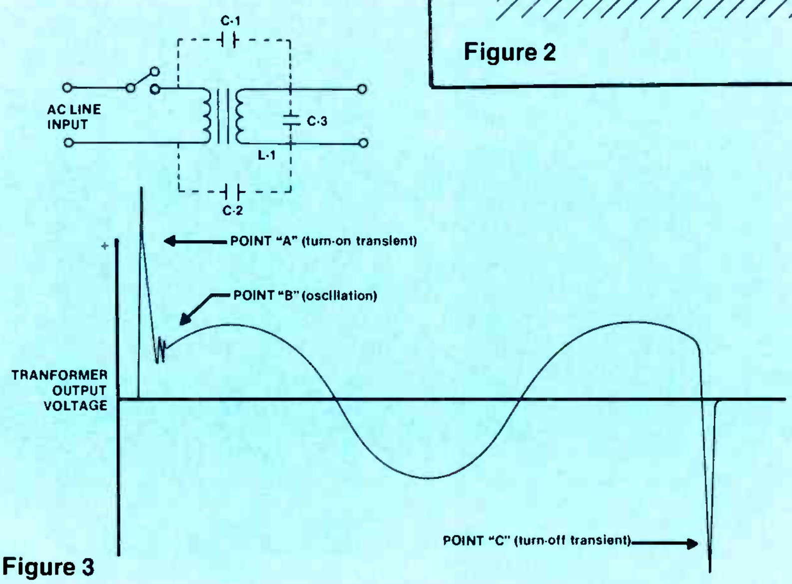

Figure 3

Figure 3. The causes of inductor turn-on and turn-off spikes. The waveforms are exaggerated to illustrate the transient effects. C-1, C-2 and C-3 are stray capacitances that form a divider network between the primary and secondary, causing the turn-on spike shown at point A. The oscillation shown at point B is caused by the interaction of the inductance of the secondary (L-1) and C-3. The spike shown at point C is the result of power interruption to the transformer primary, which causes the collapsing lines of flux to couple a high-voltage transient into the secondary circuit.

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tion system (wire size, number and sharpness of bends, types of transformers, types of insulators, lighting suppressors). Any direct hit on a 12kV feeder line will generate a damaging spike to any unprotected load.

Equipment-caused occurrences

Transients in the utility power system are the result of the basic nature of alternating current. A sudden change in an electrical circuit will cause a transient voltage to be generated due to the stored energy contained in the circuit inductances (L) and capacitances (C). The size and duration of the transient is dependent on the values of L and C and the waveform applied.

A large step-down transformer, the building block of a power system, makes an effective transient waveform generator when energized or de-energized. As illustrated in Figure 3, the stray capacitances and inductances of the secondary can generate a brief oscillating transient of up to twice the peak secondary voltage when the transformer is energized. The length of this oscillation is determined by the values of L and C in the circuit.

The second problem encountered when energizing a step-down transformer is that the load is looking into a capacitive divider from the secondary into the primary. If the inter-winding capacitance is high and the load capacitance is low, a spike of as much as the full primary voltage can be induced onto the secondary, and thus the load. This spike does not carry much energy, because of its short duration, but sensitive equipment on the load side could be damaged upon re-application of power to a utility company pole transformer, for example, as would occur after a power outage.

De-energizing a large power transformer can also cause high voltage spikes to be generated. Unless switched off at or near the zero-crossing, interrupting the current to the primary windings of a transformer will cause the collapsing magnetic lines of flux in the core to couple a high voltage transient into the secondary circuit. If a low impedance discharge path is not present, this spike will be impressed upon the load.

Transients in excess of 10 times the normal secondary voltage have been observed when this type of switching occurs. Such spikes can have damaging results to equipment on-line. For example, the transient produced by interrupting the magnetizing current to a 150kVA transformer can measure 9 joules (watts-seconds).

Whether these turn-on, turn-off transients would cause any damage depends on the size of the transformer involved and the sensitivity of the equipment connected to the transformer output.

Various utility fault conditions can also result in the generation of potentially damaging overvoltage transients. For example, the occurrence of a fault somewhere in the utility company local power distribution system will cause a substantial increase in current in the step-down transformer at the local area distribution substation. When a fuse located near the fault opens the circuit, the excess stored energy in the magnetic lines of flux of the transformer will cause a large oscillating spike to be injected into the system.

Routine load switching by the utility will have a similar effect. These transient voltages can be quite frequent and, in some instances, damaging to equipment rectifier stacks, capacitors and transformers. Figure 4 shows that utility company switching transients are independent of power system voltage ratings.

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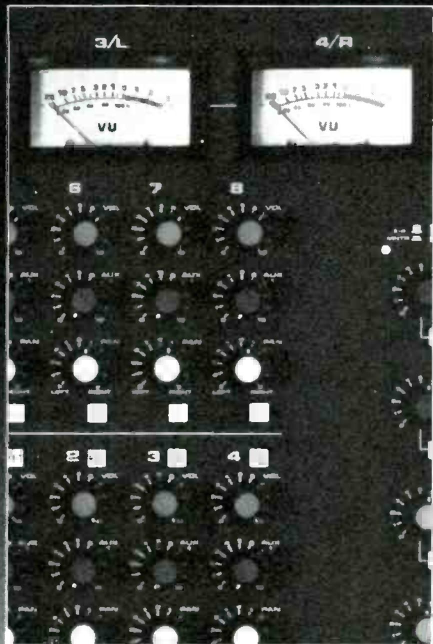
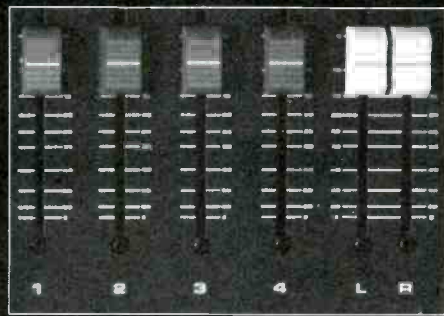
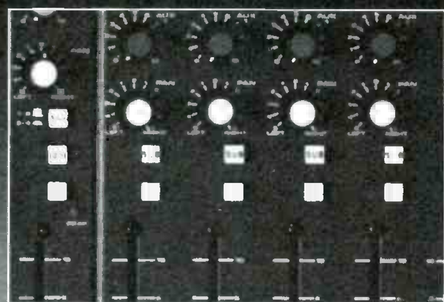


Tape returns 1-8



Long throw faders



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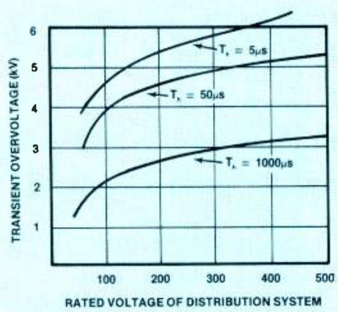


Figure 4

Figure 4. The relationship (computed and measured) between utility company system voltage and switching transient peaks. The switching transients are plotted as a function of normal operating voltage for three values of the transient tail time to half-potential. It can be seen that there is no direct linear increase in spike amplitude as the system voltage is increased. (Data based on Switzerland power quality study by L. Regez, Landis & Gyr., Zug, Switzerland.)

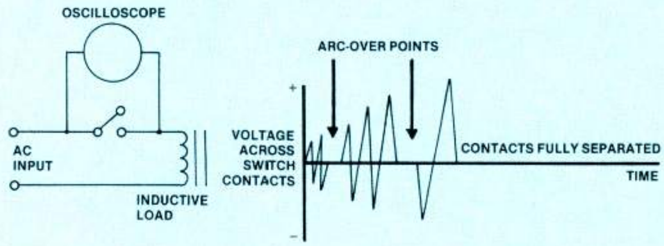


Figure 5

Figure 5. The mechanics of contact bounce. The waveforms are exaggerated to illustrate the transient effects. The modulating effect of the ac line voltage is not shown for clarity.

These principles are the basis for several other commonly experienced disturbances such as switch arcing and relay transients.

Spikes generated by contact bounce occur not only because of physical bouncing upon closing or opening, but also because of arcing between contacts resulting from transients generated by de-energizing an inductive load. The principle is illustrated in Figure 5. When current is interrupted to an inductor, the magnetic lines of flux will try to maintain themselves by charging stray capacitances. The current will oscillate in the inductance and capacitance at a high frequency and if sufficiently high voltages are generated, an arc will jump the contacts after they have opened, clearing the oscillating current.

As the contacts separate further, the process is repeated until the voltage generated by the collapsing lines of flux is no longer sufficient to jump the widening gap of the contacts. This voltage may then look for another discharge path, such as inter-winding arcing (unlikely) or other components in parallel with the inductor.

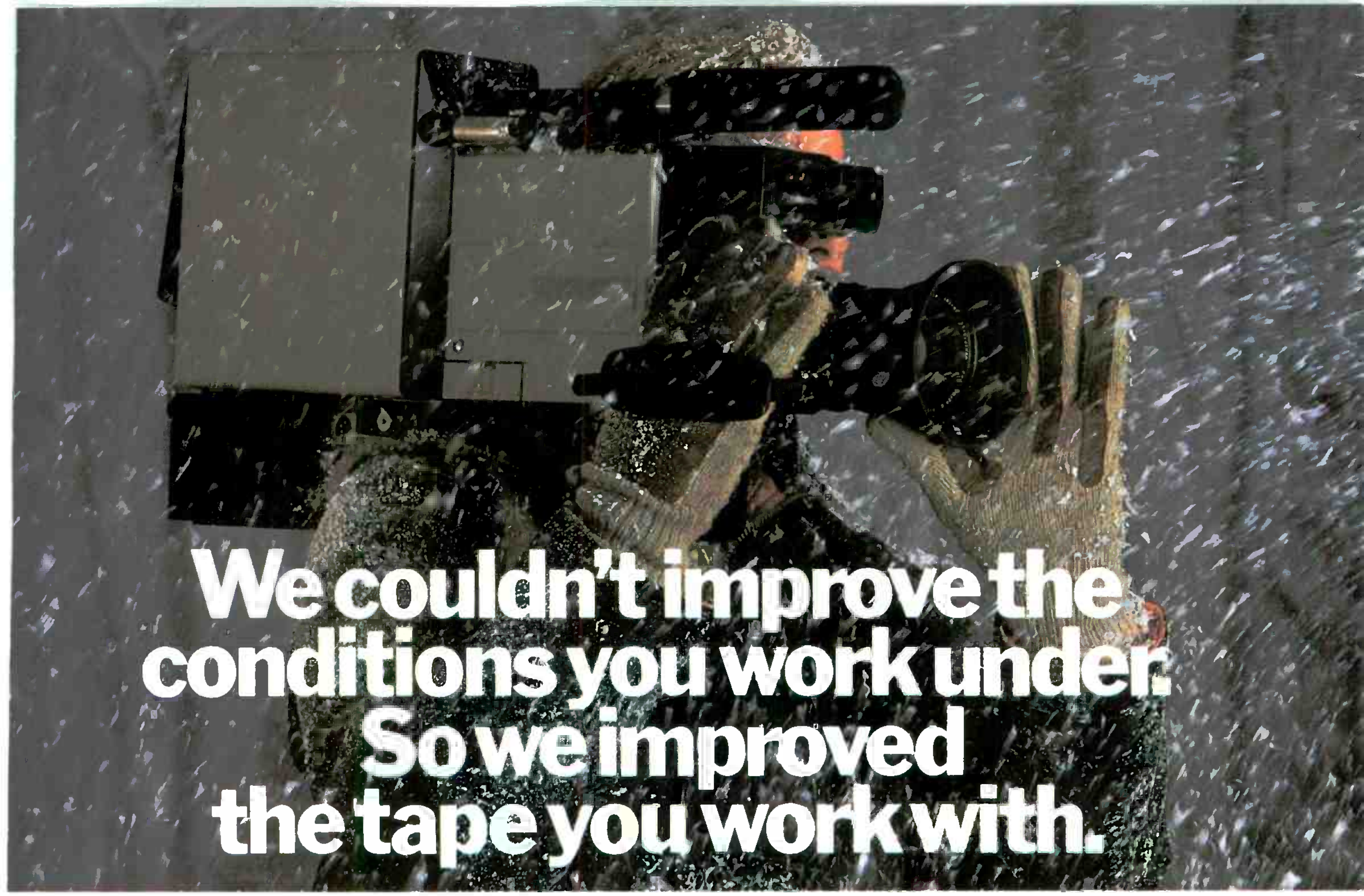
Contact arcing can also occur when an inductor is switched on, if the contacts bounce open after first closing.

Telephone system transients

Overvoltages on telephone loops and data lines can generally be traced to the 60Hz power system and lighting. Faults, crossed lines and bad grounding can cause energy to be injected into or coupled onto telco circuits from utility company power lines when the cables share common poles or routing paths. Direct lightning hits to telco lines will generate huge spikes on the low level audio or data circuits.

Buried phone company cables are also subject to damaging transients, because charge movements in the earth resulting from lightning discharges and cloud-to-cloud activity can induce voltages in the shield material, and thus to the lines themselves. EMP radiation can penetrate a buried telco line in a similar manner.

Lightning or other transient currents usually travel along a telephone cable shield until dissipated, either through ground connections (in the case of pole-mounted cables) or through cable-to-earth arc-overs (in the case of buried cables). This activity usually does not cause damage to the shield material itself, but it can induce transient voltages on the internal conductors of the cable, which may be harmful to central office equipment or



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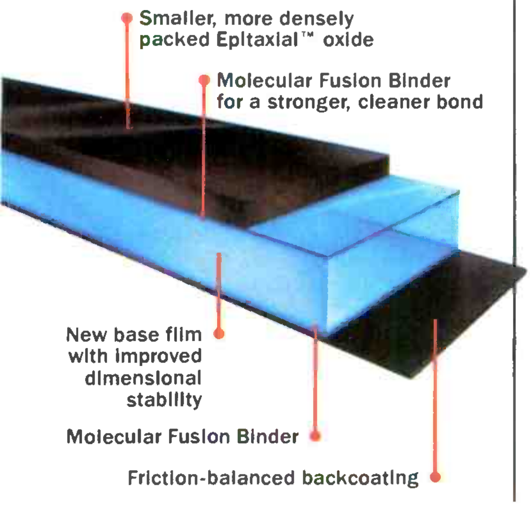

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The characteristics of the spike that can appear at the end of a telco cable is dependent on the distance from the disturbance to the measuring point, the type of cable used (including the jacket thickness, shielding material and thickness, and internal conductor wire size) and the amplitude and waveform of the lightning current in the cable shield. The current-generated potential along the cable shield is capacitively coupled to the internal cable pairs, and so the waveform of the transient voltage observed at the measuring point will closely resemble the waveform of the lightning current. The induced spike will propogate as a traveling wave in both directions along the cable from the point of injection or region of induction.

The oldest and most common protection component used in telephone company systems is the carbon block spark-gap device. This component, however, can often exhibit a wide variation in spark-over voltage potential and can have a relatively short product life. For this reason, secondary protection for user equipment is suggested, particularly in the case of data or control loops.

Carrier storage

Although the carrier storage phenomenon is rarely a source of serious transient disturbances, its effects should be considered in any critical equipment.

When a silicon diode switches from the forward conduction mode to the reverse blocking state, the presence of stored carriers at the device junction can prevent an immediate cessation of current flow. These stored carriers have the effect of permitting current to flow in the reverse direction during a brief portion of the ac cycle.

The carrier storage current is limited only by the external voltage and circuit design. This current flow is brief in duration, as carriers are rapidly removed from the junction, both by internal recombination and the sweeping effects of the reverse current. This removal of carriers causes the diode to revert to its blocking condition, and the sudden cessation of what can be a large reverse current may cause damaging voltage transients in the circuit if there is appreciable system inductance and if spike suppression has not been included.

The reverse current due to carrier storage is usually not excessive in normal operation of power rectifier circuits, and does not in itself constitute a hazard, especially at ac power line frequencies. The carrier storage effect can, however, lead to complications in certain switching arrangements.

For example, current will tend to "free-wheel" through the diodes after the supply voltage has been removed in an inductive circuit until the stored energy has been dissipated. If the supply voltage should be reapplied while this free-wheeling process is under way, some of the diodes in the circuit will be required to conduct in a forward direction, but others will be required to block.

While the latter diodes are recovering from the carrier storage freewheeling current, a short-circuit effect will be seen by the source, causing potentially damaging surge currents to flow.

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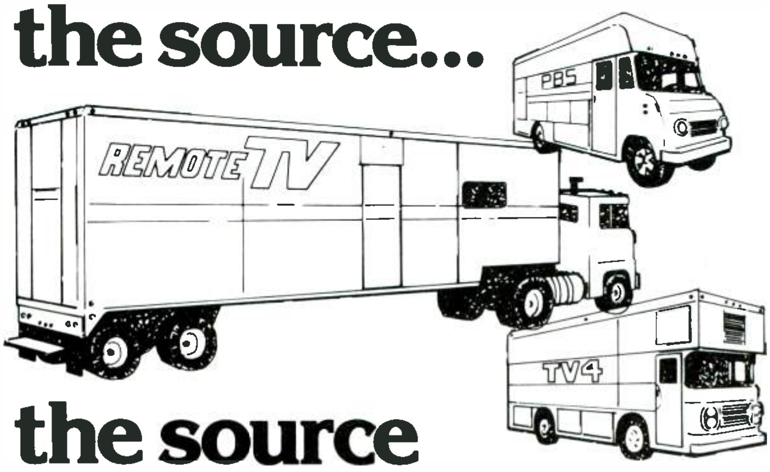


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Continued from page 94

Today's applications of imaging will be considered during the Friday morning session with information regarding the 1984 Olympic Games, the political conventions, the space shuttle and IMAX in outer space. During the afternoon, a panel discussion will forecast "Future Applications of Electronic Technology."

Luncheon/banquet

The schedule calls for the annual Awards Luncheon to be held at the Sheraton Centre on Tuesday, Oct. 30. Those desiring to attend the annual banquet will need to be at the Hilton on Wednesday evening, Oct. 31. Tickets for both functions may be arranged in advance or at the registration area, which will be at the Hilton. Regular registration will begin at noon Sunday, Oct. 28, and will continue until 5 pm.

Spaces for 126th SMPTE Technical Conference and Equipment Exhibit were sold out by Aug. 14, leaving a waiting list of manufacturers.

The following list includes exhibitors as of Aug. 31. The hotel where the company is exhibiting, either the New York Hilton (H) or the Sheraton Centre (S), is designated.

Using the reader service numbers will provide information from the companies on the products they will exhibit. For information on Cinema Products, contact the company directly at 2037 Granville Ave., Los Angeles, CA 90025.

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Sound Technology (S) . . . . . . (431)
Soundcraft Electronics (S) . . . (432)
Stage Lighting Distributors (S) . . . . (433)
Steenbeck (H) . . . . (434)
Strand Century (S) . . . . (435)
Studer Revox America (S) . . . (436)
Swintek Enterprises (H) . . . . . (437)
Sylvania Lighting (H) . . . . (438)
Tektronix (H) . . . . (439)
Telescript (S) . . . . (440)
Television Eqpt. Associates (H) . . . . (441)
Tentel (H) . . . . (442)
Thomson-CSF (S) . . . . (443)
Tiffen Manufacturing (H) . . . . (444)
Union Connector (H) . . . . (445)
URSA MAJOR (S) . . . . (446)
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Winsted (S) . . . . (448)
Zellan Enterprises (H) . . . . (449)

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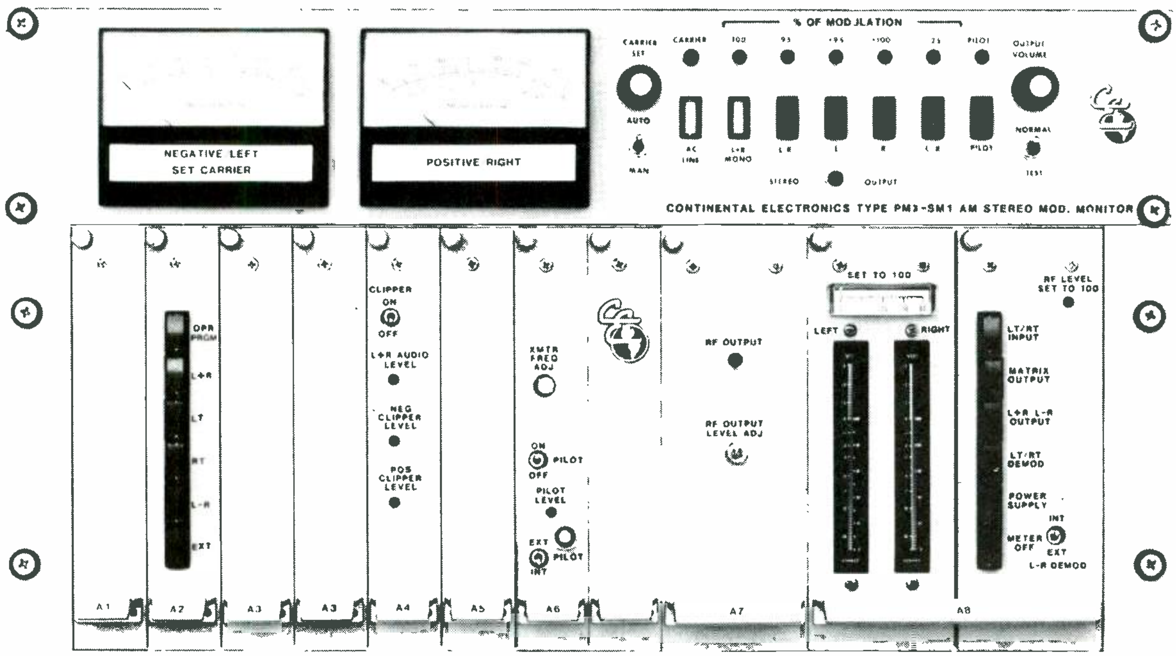

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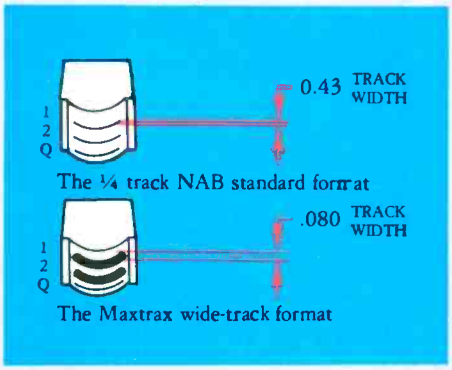

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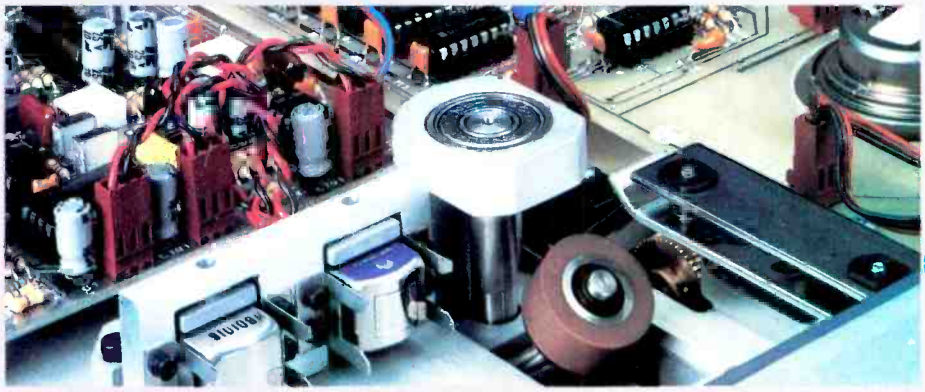

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Field report: Islatron transient suppressor

By Jerry Whitaker, radio editor*

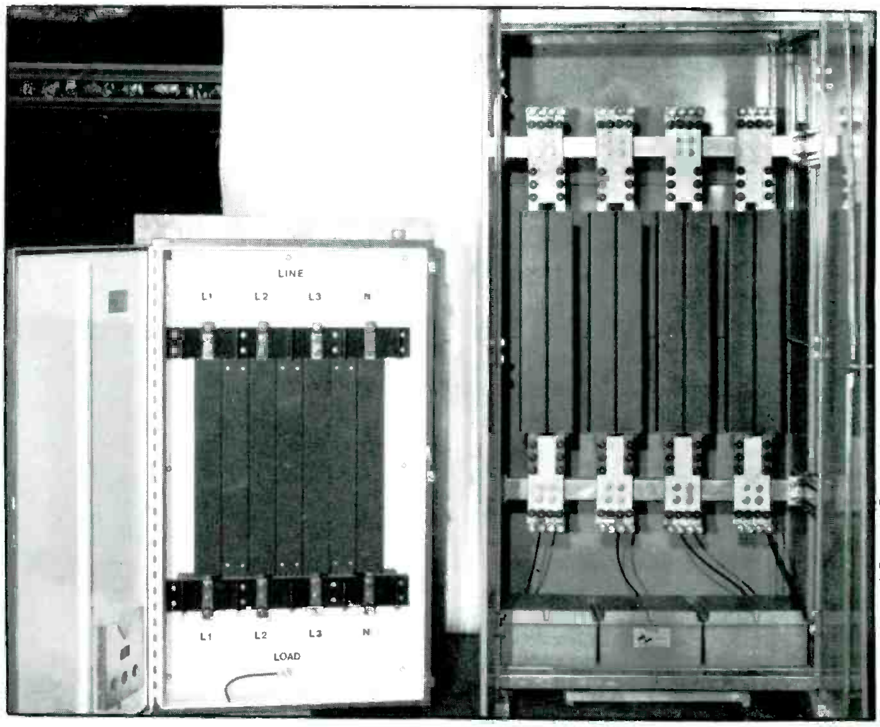


Photo courtesy of Control Concepts.

Figure 1. The Islatron is available in a wide range of voltage and current ratings. Shown are a 400A, 3-phase model (left) and a 1200A, 3-phase unit.

A variety of methods are available to broadcasters wishing to eliminate the threat posed by transient overvoltage conditions. Protection may be in the form of discrete devices, such as the varistor, or ac processing equipment, available from several sources. The discrete device method of surge suppression is much less expensive than the *systems* approach, but the level of protection is lower as well.

One of the more impressive transient elimination systems available to broadcasters today is the Islatron, manufactured by Control Concepts, Binghamton, NY. The Islatron, pictured in Figure 1, is available in standard current ratings up to a maximum of 2000A and voltage ratings from 120V to 480V. The system comes in single, split-phase and 3-phase models.

System operation

The Islatron is an active filter device that "tracks" the input power line voltage and then "triggers" itself into action when a deviation of more than ± 2V from an ideal sine wave is detected. The response time is essentially instantaneous—less than 10ns. The device, because of its tracking feature, prevents ringing at the output regardless of the transient present at the input to the unit. This stability is maintained from zero load through full load. Specifications for the Islatron are shown in Figure 2.

Although the patented design of the Islatron is closely guarded, Figure 3 shows the basic idea of the system. A solid-state sensing circuit monitors the incoming ac voltage and, if no deviations greater than ± 2V from an ideal sine wave are detected, the protection system is inactive. The reference signal for this function is ob-

***Note:**
This article was written while Whitaker was chief engineer at KRED-AM and KPDJ-FM, Eureka, CA.

Specifications

General Description:
A solid state, active tracking voltage suppressor which protects against lightning induced voltages, transients, spikes, short-term outages and noise on incoming AC lines to functional equipment.

Standard Voltage Inputs:
105-130V RMS
208-240V RMS
440-480V RMS

Load Current:
Single and three phase thru 2000A.

Power Line Frequency:
50-60 Hz.
(May be modified to other frequencies, currents and voltages, to your specifications.)

Preset Switch Level: ±2V

Response Time:
Continuous monitoring for faster than 10 nanosecond response.

Suppression Performance:
Destructive or spurious transients, present at any point on the input sine wave of the AC power line, are clamped to within several volts, both above and below the instantaneous value of a filtered input sinusoid. For example, a six joules 5000V spike (peak-to-peak) is suppressed to 10V (peak-to-peak). The above is accompanied with minimal power line loss.

Transient Reduction:
Minimum of 40 db, from the midband audio range through 50 MHz. The active filter improves the quality of the input line. Attenuation is greater than 50 db to IEEE surge withstand capability test No. 472-1974 and IEEE 587-80.

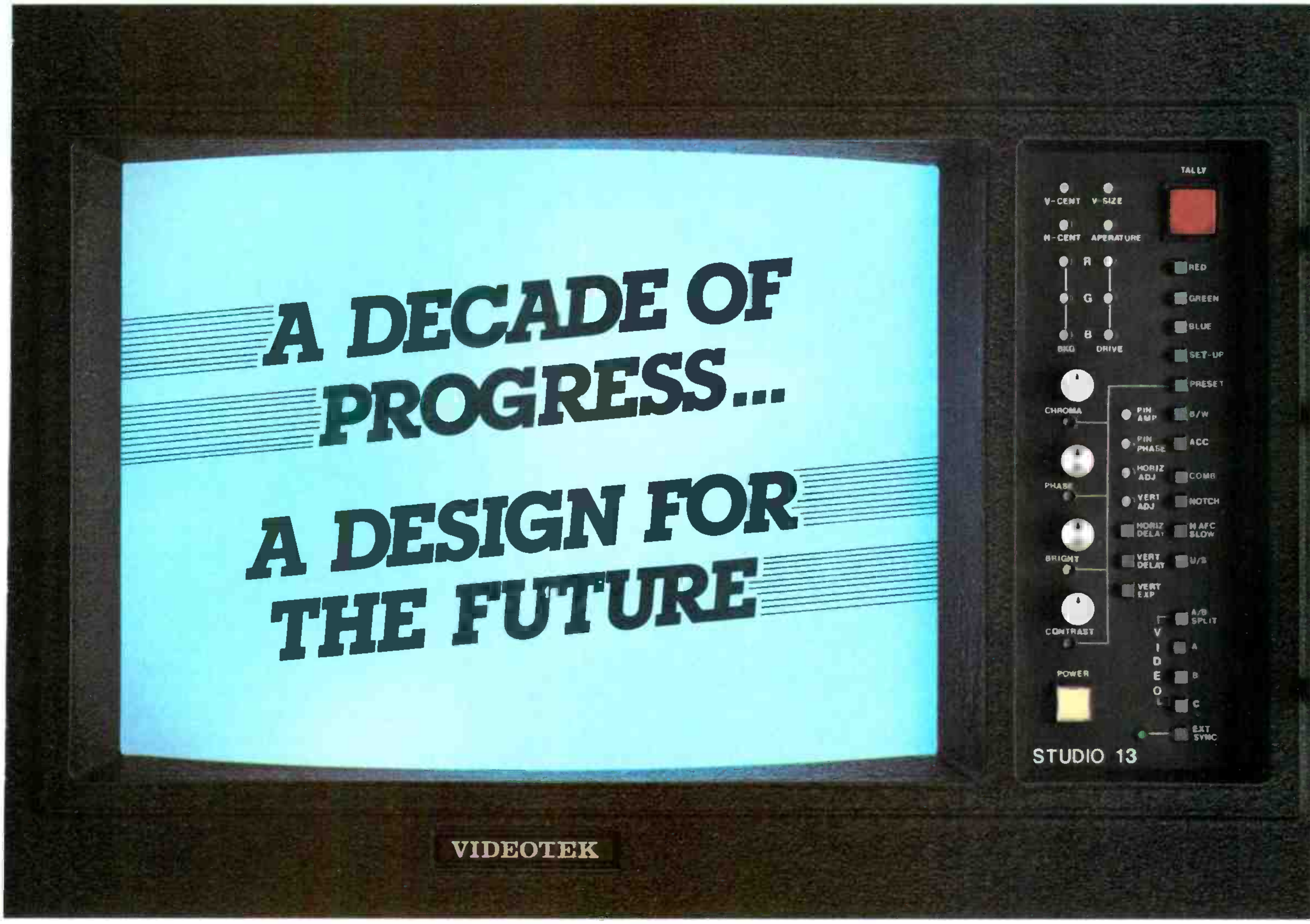
Regulation:
Better than 1% from no load through full load.

Leakage:
Leakage to case less than 50 microamperes. Voltage isolation to case 5000V RMS.

Operating Temperature Range:
—40° to 85°C

Reliability/Test Criteria:
Each ISLATRON unit is 300% tested at an input energy level of one joule for approximately 1000 strikes, superimposed at the peak of the input sinusoid at main power line distribution impedance.

Figure 2. The basic Islatron transient suppressor system specifications.



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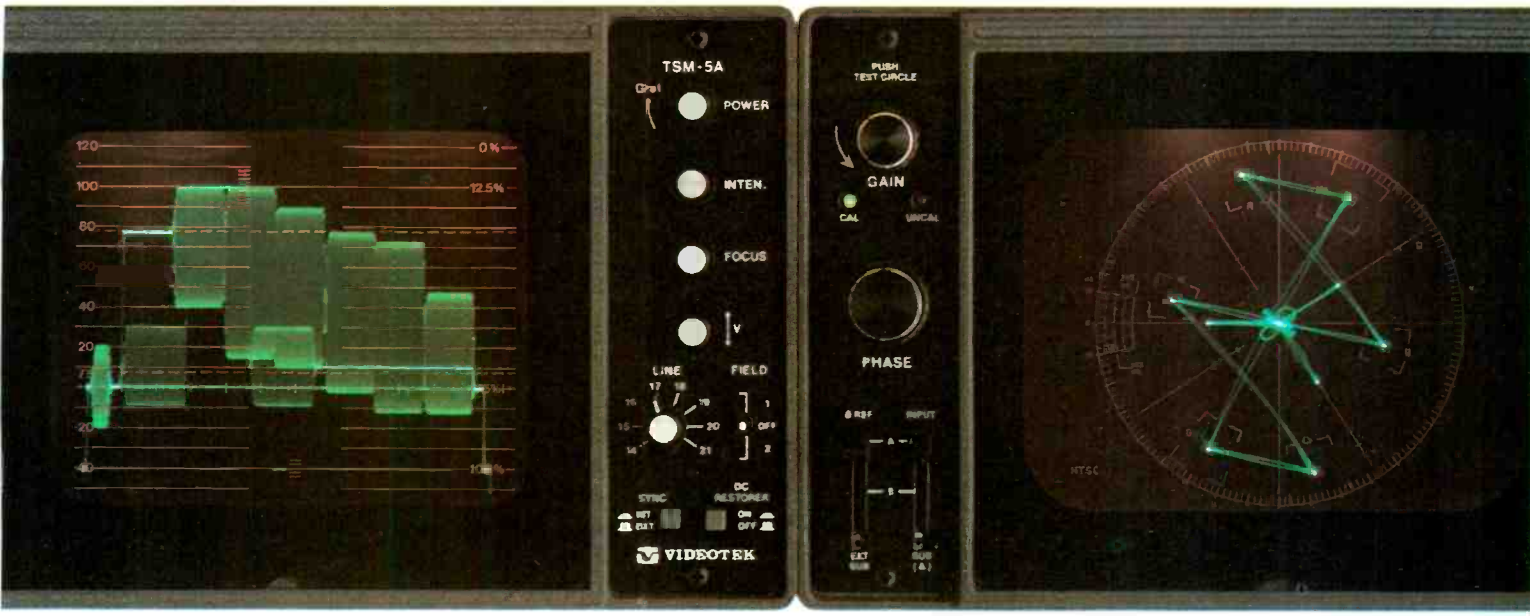

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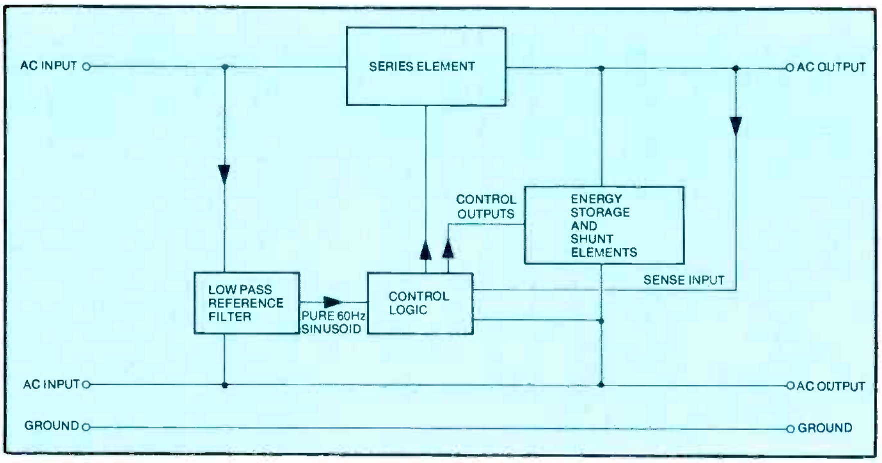

Figure 3. The Islatron system block diagram, showing the major component/function sections.

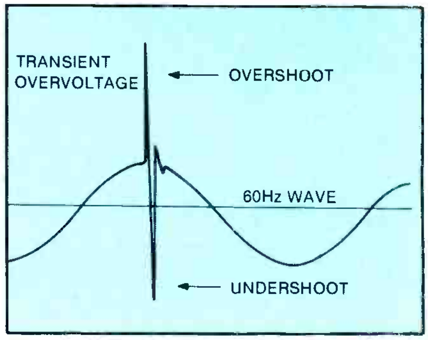

Figure 4. The *iceberg* effect of many transient disturbances.

tained through a lowpass filter that analyzes the incoming sine wave to produce a high-quality 60Hz sinusoid for reference. Upon detection of an out-of-tolerance disturbance, the series *reactance* increases in value and the *shunt element* decreases in reactance as needed to attenuate the transient. The *storage element* of the Islatron restores the sinusoid "notch" caused by many surges. This "iceberg" effect is illustrated in Figure 4.

Incoming spikes (or noise) can occur at any point on the sine wave and these disturbances typically occur both above and below the sinusoid trace. For the sake of simplicity, we will refer to these excursions as *overshoot* and *undershoot*. The overshoot portion of the transient is absorbed through the use of the series and shunt elements described above. The undershoot, on the other hand, corresponds to a brief outage that can be, in some instances, as damaging to on-line equipment as the overshoot. The storage element in the Islatron provides energy to fill in this hole in the sine wave. Protection against overshoot or undershoot is equally effective at any point in the ac wave.

Because of the tracking ability of the Islatron, the absolute magnitude of the ac line voltage is not critical to the performance of the system. Three standard voltage ranges are used when specifying a unit. For example, the 208Vac to 240Vac model will accept voltages anywhere within a wide window from 180Vac to 270Vac with no degradation in performance.

Occasionally at a broadcast plant installation, protection is needed not only from the utility company ac feed, but from in-house electrical equipment as well. In such cases, the Islatron can be installed in reverse to protect the ac power distribution system in the plant from noise or transients that may be coming from a particular piece of machinery or equipment. Such noise-generating devices

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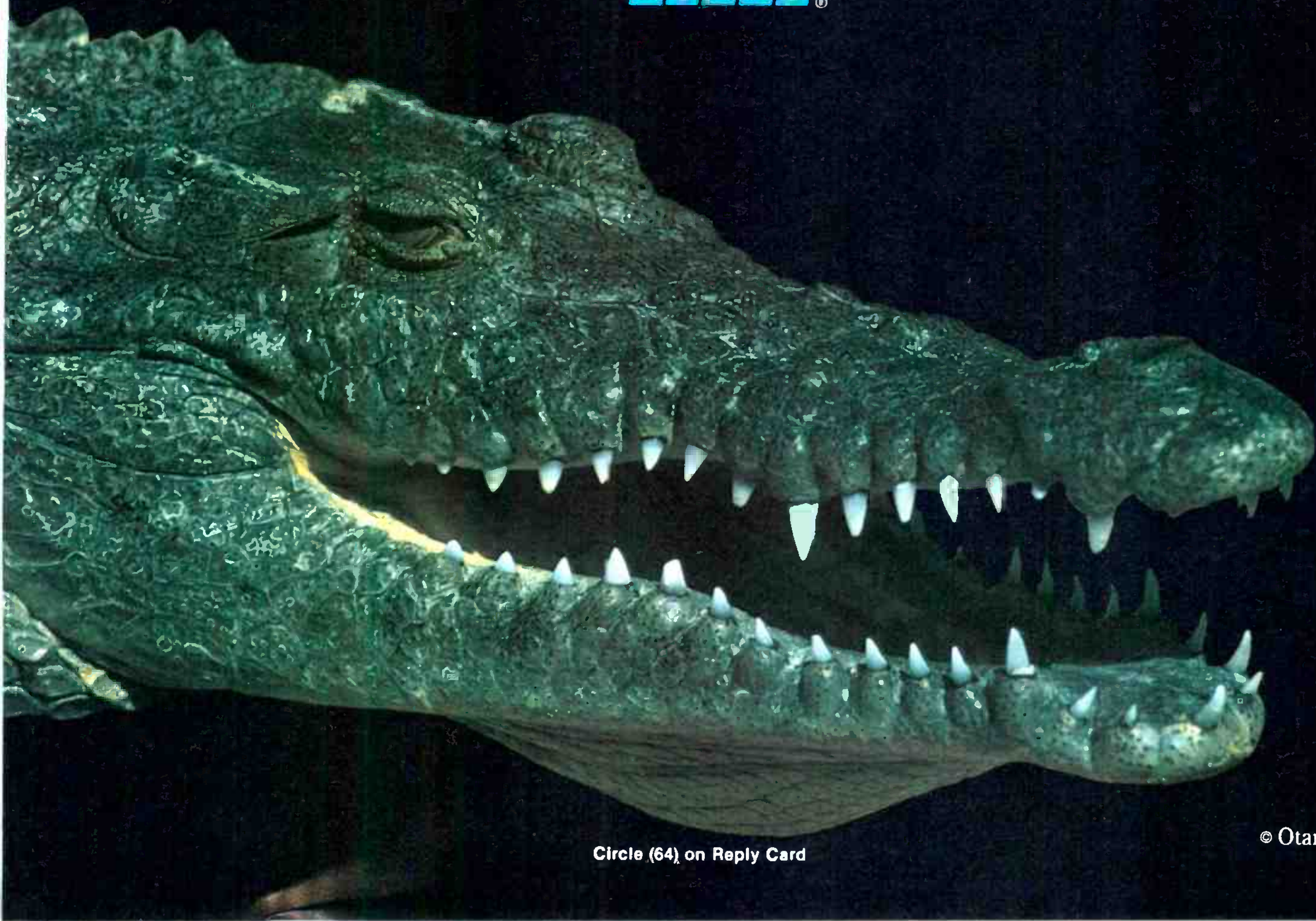

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could be heating or cooling systems, or large motors used for elevators or other functions.

For maximum protection from transient overvoltages, suppression equipment should be installed physically as close as possible to the equipment requiring protection. Figure 5 shows a typical installation. The main suppressor on the ac service entrance protects all of the studio and transmitting equipment, but because the business computer is located some distance away from the 3-phase protection device, a second, dedicated unit, is installed between the local ac outlet and the computer.

Low-current Islatron units are encased in sealed, high-strength phenolic boxes. High-current or multiphase systems are contained in NEMA-12 or NEMA-4 hinged enclosures. Special mounting arrangements can be ordered, if needed, for unique or existing switch gear.

Performance testing

One of the problems with any surge suppression device or system is the difficulty faced by the user in testing its performance on-site with realistic waveforms. Transients are virtually impossible to predict, and equally difficult to see on a standard oscilloscope.

One solution to this problem is the Islatron Transient Generator unit, the TS-III. The TS-III provides a simple method of generating periodic spikes that can be used to evaluate the effectiveness of transient and noise-suppression filters. The unit can also be used to feed transients into the power distribution system at line impedance for observation. (During a test such as this, all transient-sensitive equipment on the line would, naturally, be disconnected.)

Figure 6 shows a typical spike generated by the TS-III. It is approximately 800V peak-to-peak and 30μs wide. This pulse is designed to be similar in nature to transients typically generated by SCR controllers, contractor load switching and large motor mode changes.

The TS-III pulse is superimposed on the ac incoming power line and synchronized to it, thus allowing easy observation on an oscilloscope. The pulse can be positioned at the 90° point on the sine wave, as shown in Figure 6, or at a lower potential at 135° into the cycle, as shown in Figure 7. The TS-III has a switchable protection function, which will prevent transients generated by the unit

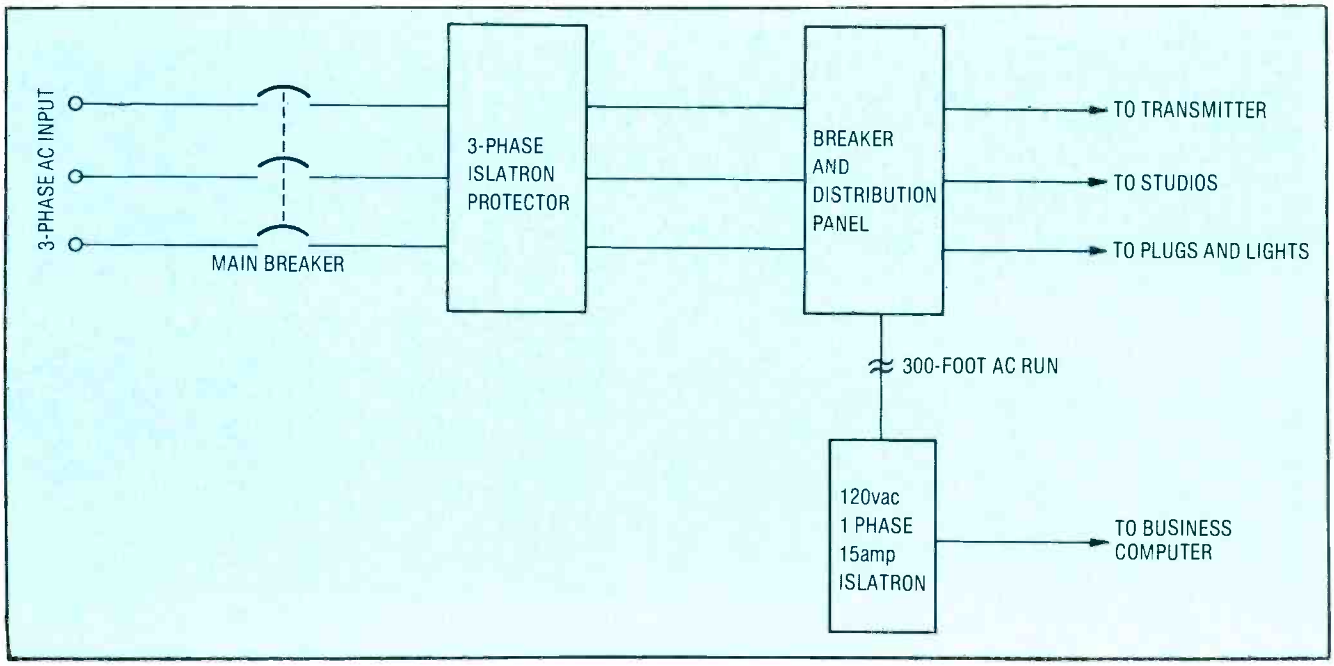


Figure 5. Installation considerations for surge-suppression equipment. Sensitive load equipment separated from a service entrance protector may require a dedicated suppressor.

Note: Except where specified, the oscilloscope photo scale = 135V per division. One cycle of 60Hz ac is shown. The 60Hz applied voltage = 120 V RMS (339V P-P).

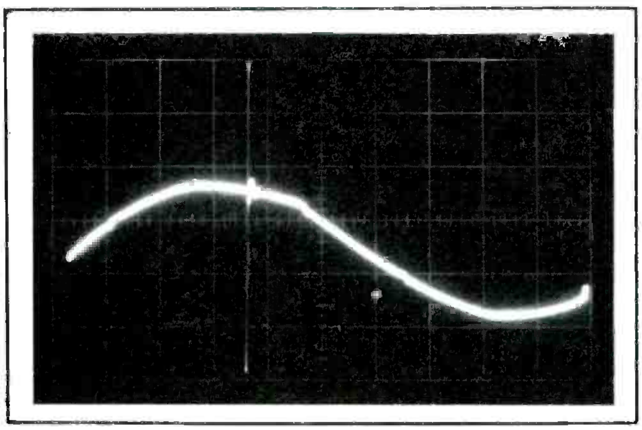


Figure 6. The output waveform of the TS-III test set. The spike is approximately 800V P-P and is positioned just past the 90° point in the ac wave.

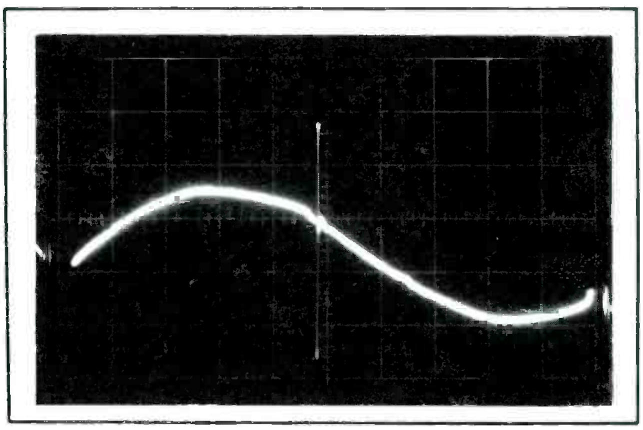


Figure 7. An optional output waveform from the TS-III generator. The spike is about 575V P-P and is positioned at the 135° point in the sine wave.

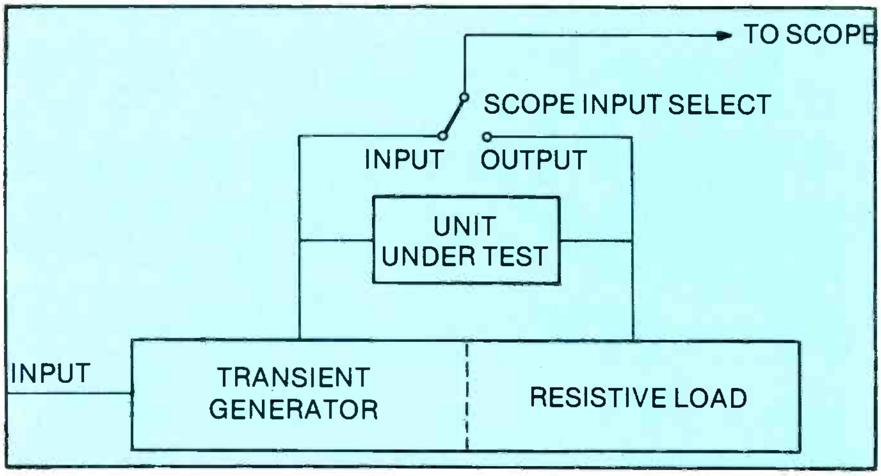


Figure 8. Block diagram of the TS-III transient generator test unit.

from entering the ac power line and possibly damaging sensitive equipment nearby. For tests of transient suppression at actual line impedance, the protection function is switched out and the performance of suppression circuits is viewed on an oscilloscope under real-world conditions. Again, this mode must be used with care, because unprotected on-line equipment can be damaged by the high-voltage spikes generated by the TS-III.

An output post on the transient generator is used for connection to the input of an oscilloscope. This terminal is switchable between the *input* and *output*, as shown in Figure 8.

Islatron performance

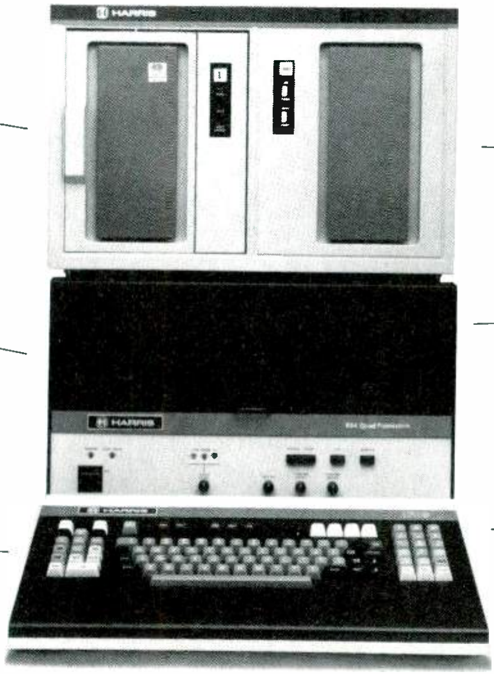
I have long had an interest in transient suppression equipment, and Control Concepts last year gave me the opportunity to run a 15A Islatron and TS-III generator through their paces at KRED-AM and KPDJ-FM.

The test setup used for the evaluation is shown in Figure 9. A Variac was placed between the transient generator output and the Islatron suppressor input in order to check the unit's capability of tracking input voltages within its rated range of 105Vac to 130Vac. The oscilloscope input was arranged to be switchable, as shown, for before-after comparisons. A switchable inductive load was used to check operation of the unit with a light or heavy load. The test setup was metered as shown in the diagram.

The test results are compiled in Figure 10. Voltages were increased in 5V steps from the low-rated value to the high-limit. At each voltage, Islatron performance was checked with both a light and heavy load.

The test results were impressive. As shown in Figure 10, the unit tracked the input voltage tightly with no degradation in transient suppression performance over the rated input range.

The current draw of the load had no



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appreciable effect on the transient suppression ability of the Islatron, with no output waveform changes detected between the high current load (10A) and the low current load (1mA). Because the Islatron incorporates a series element as part of the spike removal circuit, I checked for voltage drop across the unit with the 10A load connected. A loss of less than 0.5V was measured, small enough to be insignificant in most applications.

Dumping a large inductive load onto the output of the Islatron caused no noticeable downward bounce at the ac output voltage. Removal of the same load from the unit occurred without any upward bounce of the output voltage.

Figure 11 shows the output waveform of the Islatron. Deviations from an ideal sine wave are within 12V P-P, despite the 800V P-P input spike. Figure 12 shows the waveform expanded to provide a better look at the output. Note that there is virtually no overshoot or ringing on the trace. The two bumps in the waveform at about 45° and 135° are not the result of the Islatron or spike generator unit. They are, instead, present on the ac line in the KRED-KPDJ engineering shop. Figure 13 shows the unprocessed ac waveform at the test bench, and the deviation from an ideal waveform can be seen.

Comparison tests

To determine how the Islatron compares with other commonly used methods of transient suppression, I checked four different types of devices with the TS-III transient generator. Figure 14 shows the 800V input spike applied to a common isolation transformer. As the scope photo shows, the output transient is greater than the input transient. One of the new high-performance isolation transformers specifically designed to remove noise and spikes from the ac line would have certainly performed better than the general purpose device used in this test—one not intended for transient or noise-suppression applications. On the basis of this measurement, however, engineers should be cautioned against using just any transformer for isolation if transient suppression of some sort is not provided on the primary *and* secondary of the device.

Figure 15 shows the TS-III 800V input spike applied to a general-purpose RFI filter assembly. As the scope photo shows, there is almost no attenuation of the pulse. The RFI filter may have performed better if the input spike rise time had been different, but because the transient generator test set gives only a single output rise time, this was not examined.


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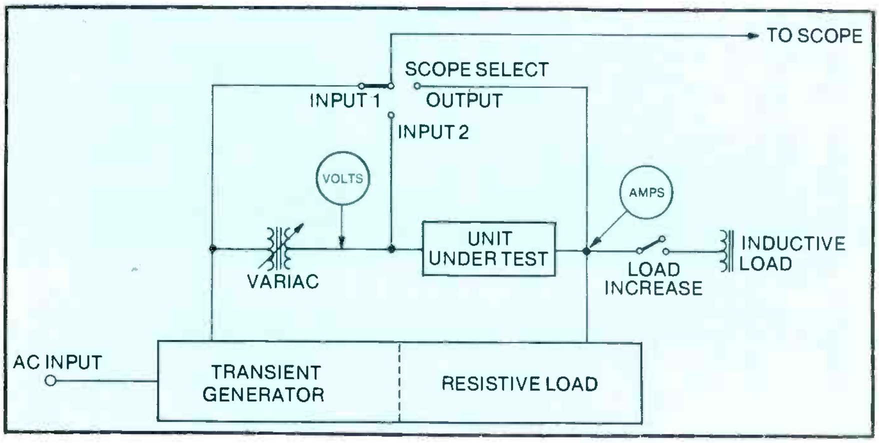

Figure 9. The test setup used for Islatron performance measurements.

		High current = 10A	Low current = 1ma		
VOLTAGE	**CURRENT**	**INPUT**	**OUTPUT**	**SCOPE PIX**	**NOTES**
105	LOW	800V P-P	12V P-P	11	
	HIGH	800V P-P	12V P-P	11	
110	LOW	800V P-P	12V P-P	11	
	HIGH	800V P-P	12V P-P	11	
115	LOW	800V P-P	12V P-P	11	
	HIGH	800V P-P	12V P-P	11	
120	LOW	800V P-P	12V P-P	11	
	HIGH	800V P-P	12V P-P	11	
125	LOW	800V P-P	12V P-P	11	
	HIGH	800V P-P	12V P-P	11	
130	LOW	800V P-P	12V P-P	11	
	HIGH	800V P-P	12V P-P	11	

THE INPUT COLUMN REFERS TO THE AMPLITUDE OF THE INPUT TRANSIENT.
THE OUTPUT COLUMN REFERS TO THE AMPLITUDE OF THE TRANSIENT AFTER PROCESSING BY THE ISLATRON. TEST RESULTS ARE FOR A 120Vac, 15A ISLATRON UNIT.

Figure 10. The test results on the Islatron transient suppressor.

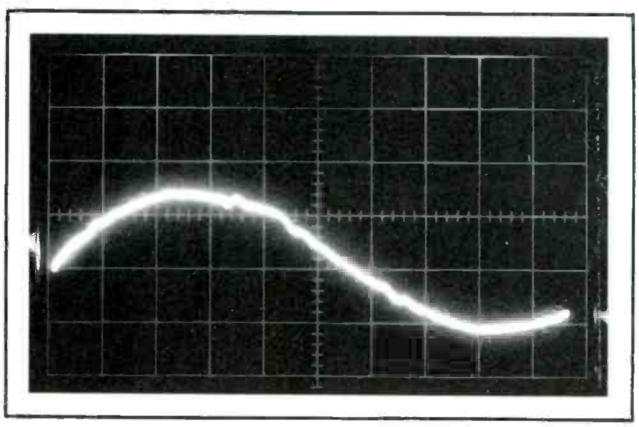

Figure 11. The output waveform of the Islatron under the application of an 800V P-P input spike. Note that the transient disturbance is virtually impossible to detect.

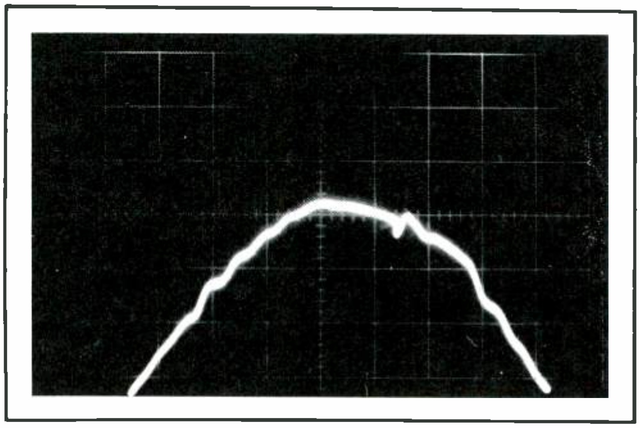

Figure 12. An expanded view of the output waveform of the Islatron under the application of the 800V P-P test spike. Note the freedom from ringing, overshoot or undershoot. (Scale = 50V/division.)

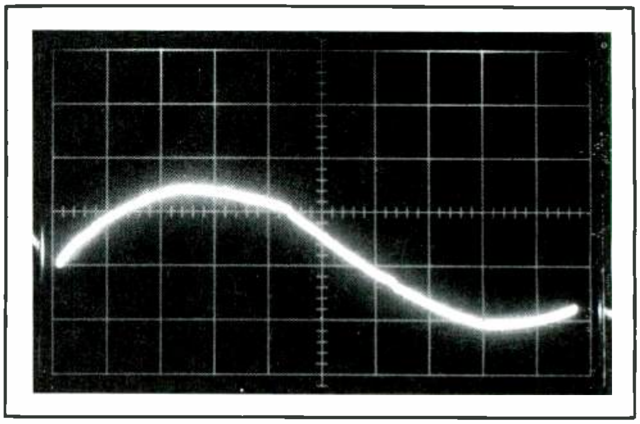

Figure 13. The unprocessed ac line voltage at the KRED-KPDJ engineering shop test bench.

The most promising of the four discrete devices checked in the comparison tests was a General Electric MOV varistor. Figure 16 shows the performance of the varistor under the application of an 800V P-P transient. The device clips the level at about 200% of the applied steady-state voltage. Although this level of protection may not be sufficient to prevent disallowed states in logic equipment or overloads in sensitive systems, it would probably prevent damage to equipment on-line if a moderate-level transient occurred. This conclusion assumes that most power supplies in broadcast equipment are designed for long-term operation at about 50% of their maximum capability.

Although the MOV varistor performs well by many standards, note the undershoot that occurs in the waveform. Varistors clip on maximum amplitude, without regard to the position of the spike on the sinusoid.

Low-value (0.1μF or so) capacitors are sometimes used for transient protection in broadcast equipment, generally across the power input terminals. Figure 17 shows the attenuation gained with a 0.25μF capacitor

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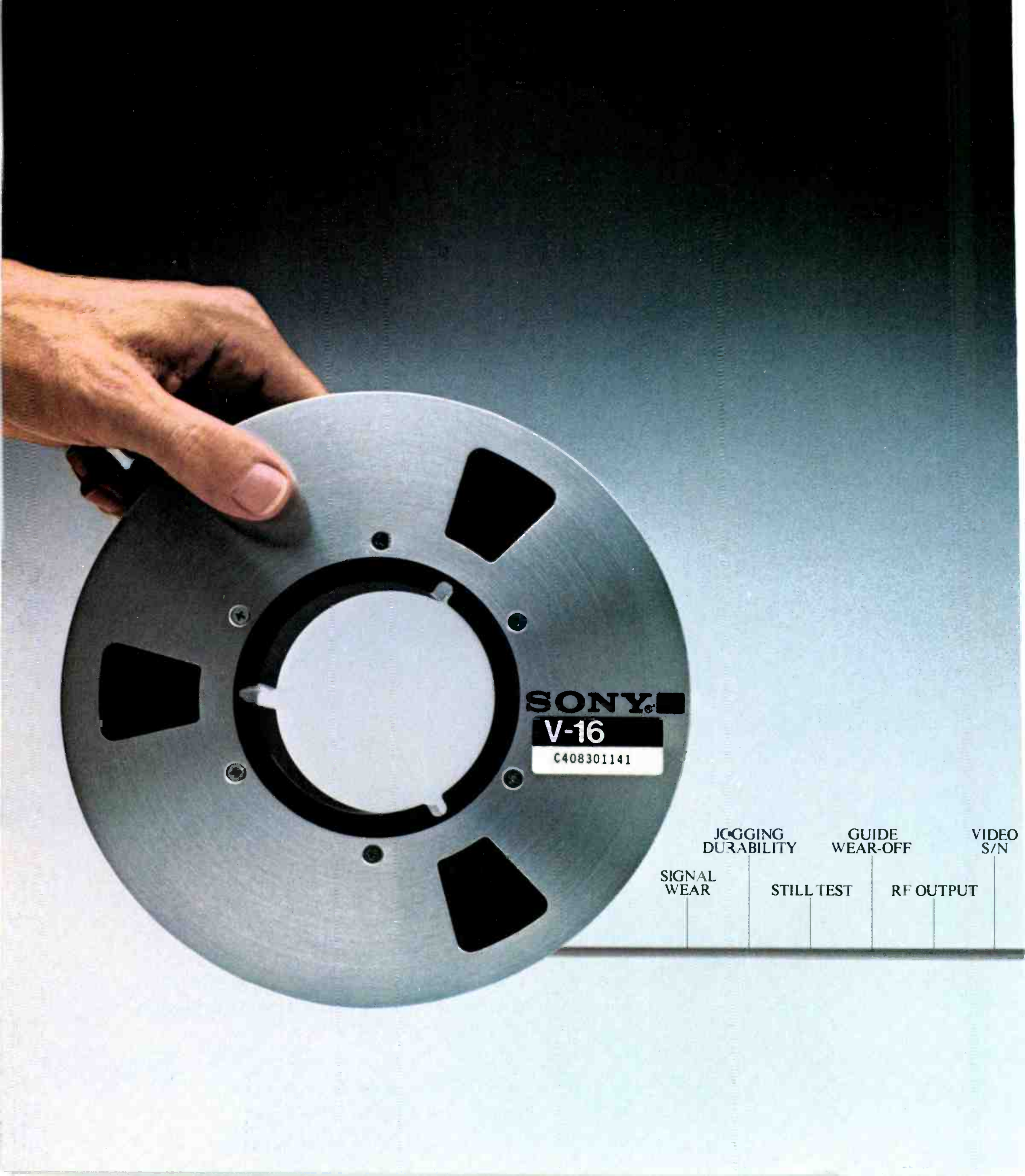

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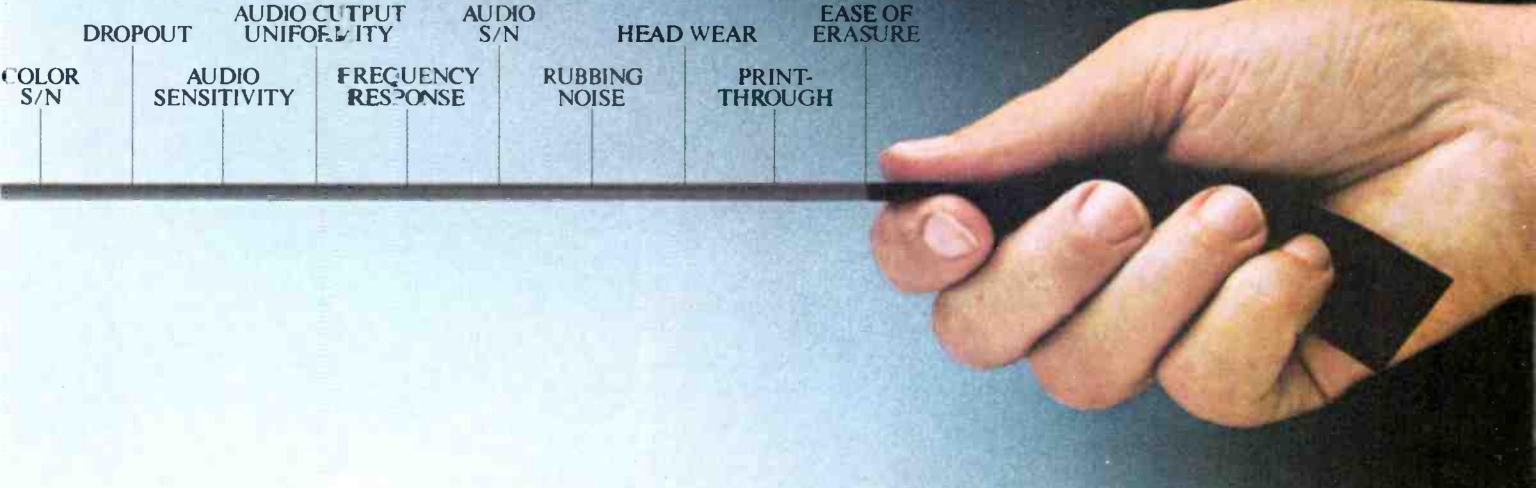


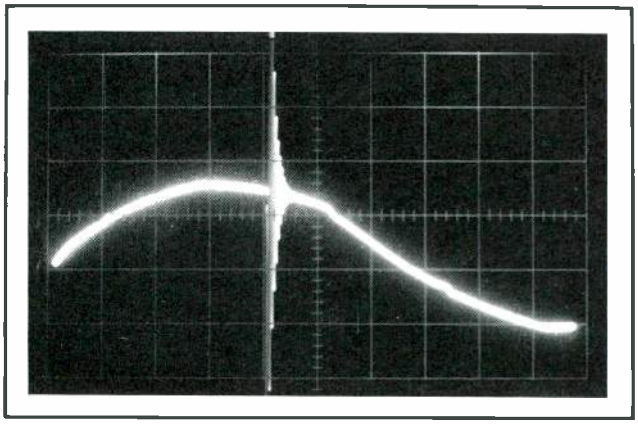


Figure 14. The effect of a transient spike on a common isolation transformer.

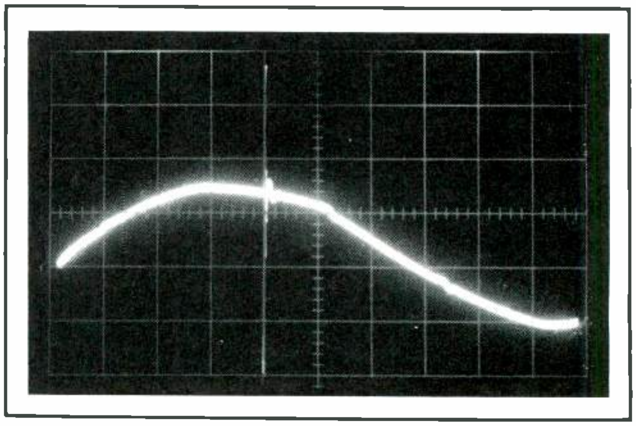


Figure 15. The effect of the test transient on a commonly-used RFI filter assembly.

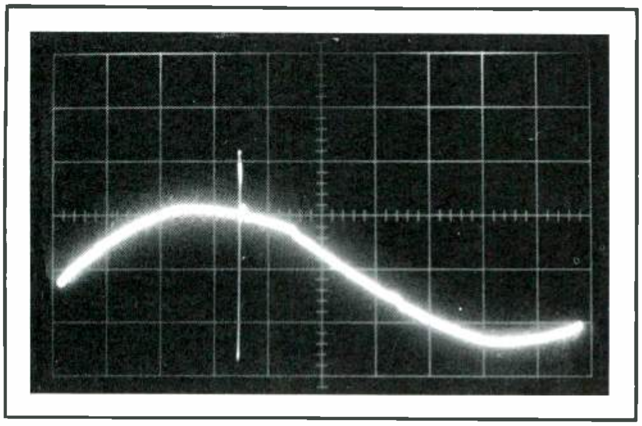


Figure 16. The transient suppression performance of a GE MOV Varistor.

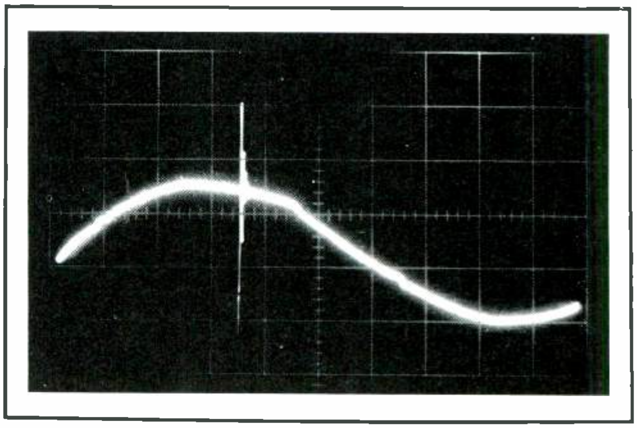


Figure 17. The transient suppression performance of a 0.25μF capacitor. Note the brief period of oscillation following the spike.

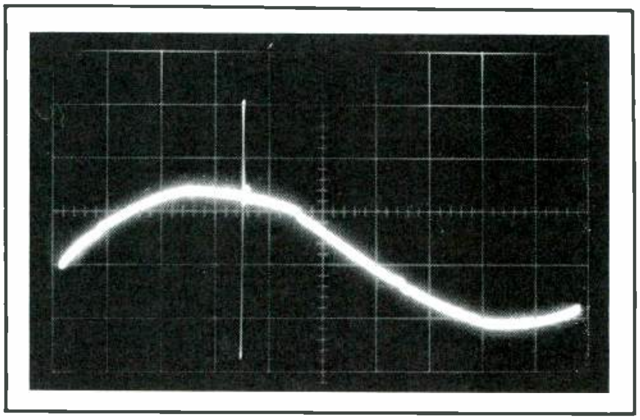


Figure 18. The transient suppression performance of the 0.25μF capacitor shown in Figure 17 with a series resistance of 100Ω.

placed across the 800V P-P spike. The cap reduces the transient by half, centered on the sine wave. This is contrasted with the varistor, which clips on maximum amplitude, positive and negative.

An examination of Figure 17 also shows a brief oscillation following the transient, caused by the interaction of the capacitor and the inductance in the circuit. Placing a series resistance of 100Ω reduces the oscillation to a negligible amount, as shown in Figure 18. It also, however, reduces the effectiveness of the capacitor in snubbing the transient. A good rule of thumb for the series resistance in an RC snubber is to allow about 1Ω for each volt of the applied potential.

In conclusion

The output level of the TS-III transient generator, while being a substantial value (800V P-P) is far from the maximum that may be experienced in the typical broadcast plant. Examination of these test results indicates a need for transient suppression of some sort on all vital equipment at a broadcast installation. Experience at KRED and KPDJ has shown the Islatron to be an excellent device for this purpose.

Editor's note:

The field report is an exclusive **BE** feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting firm. The intent is to have the equipment tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

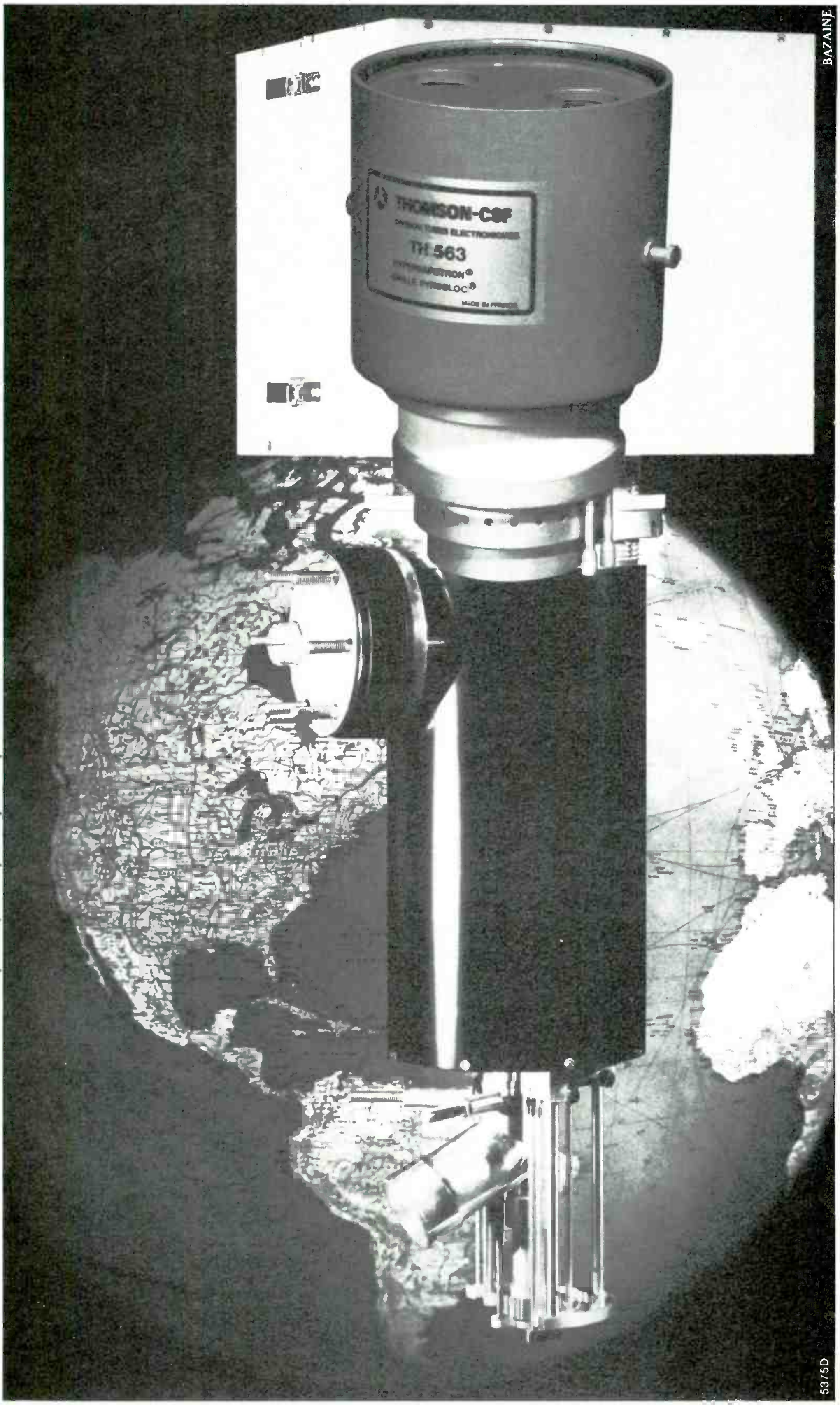
In each field report, the author discusses the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations—if any.

In essence, these field reports are prepared by the industry and for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author, if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement by **Broadcast Engineering** for or against a product.

For more information on the Islatron, contact Control Concepts, 328 Waters St., Binghamton, NY 13902.

Please note that the TS-III transient generator is used for in-house and specialized testing by Control Concepts, and is not part of the company's regular product line.



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Radio Television News Directors Association
1735 De Sales St., NW
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1-202-737-8657

RTNDA regional awards announced

The Radio-Television News Directors Association annual regional awards for excellence in electronic news have been announced by association president Ed Godfrey, WAVE-TV, Louisville, KY. Competition is judged in four U.S. regions.

The Edward R. Murrow Award for overall excellence in radio coverage was presented to WHDH, Boston; KRLD, Dallas; WCXI, Detroit; and KIRO, Seattle. TV stations receiving the Murrow award were WBZ-TV, Boston; WSMV-TV, Nashville; WCCO-TV, Minneapolis; and KRON-TV, San Francisco.

Regional awards for TV spot news went to WOKR-TV, Rochester, NY; WDSU-TV, New Orleans; WMAQ-TV, Chicago; and KCST-TV, San Diego. TV winners in investigative reporting were KYW-TV, Philadelphia; KPRC-TV, Houston; WBBM-TV, Chicago; and KCBS-TV, Los Angeles. TV awards for continuing coverage were won by WABC-TV, New York; WAVY-TV, Norfolk, VA; WCCO-TV, Minneapolis; and KSL-TV, Salt Lake City.

Radio spot news awards were presented to WCKY, Cincinnati; WRAL, Raleigh, NC; WJBC, Bloomington, IL; and KBOI, Boise, ID. Regional awards for investigative radio reporting went to WVLV, Lebanon, PA, tied with WNRE, Circleville, OH, in northeastern regional competition; WGST, Atlanta; WCCO, Minneapolis; and KNX, Los Angeles. Continuing coverage radio award winners were WHDH, Boston, tied with WWVA, Wheeling, WV, in northeastern regional competition; KPRC, Houston; KMOX, St. Louis; and KOMO, Seattle.

Winners of regional awards are automatically entered in the RTNDA international awards competition. International winners will be announced at the 39th annual RTNDA convention in San Antonio, Dec. 5-7.

National Association of Broadcasters
1771 N Street, NW
Washington, DC 20036
1-202-293-3570

FCC's fairness doctrine a 'treacherous concept'

The National Association of Broadcasters has termed the fairness doctrine "a treacherous concept that is premised on logical quicksand and that accomplishes what it sets out to avoid." NAB said it chills the free exercise of speech by the broadcast press in plain violation of the Constitution's First Amendment.

The association submitted its comments to the Federal Communications Commission in response to the agency's announcement that it is re-examining the validity of the doctrine.

NAB said the fairness doctrine "is as moribund as a matter of policy as it is a matter of constitutional interpretation" and based its position on these points:

- The doctrine has failed in its stated aim of increasing First Amendment diversity.
- With today's abundance of media voices, a government-imposed fairness doctrine is totally unnecessary to the achievement of the First Amendment goal of the "widest possible dissemination of information

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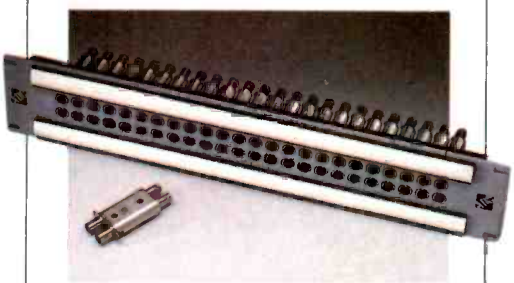

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from diverse and antagonistic sources."

- There are no meaningful distinctions between the broadcast and print media that can support the imposition of the doctrine on broadcasters.
- The doctrine distorts the process and theory embodied in the First Amendment for achieving a marketplace of ideas.
- It interferes with the critical role of the press intended by the First Amendment.

NAB said the doctrine diminishes the discussion of controversial ideas and minority viewpoints, inhibits editorializing and endorsements of political candidates and reduces the diversity and intensity of debate in the millions of homes that depend on radio and television for information and opinions.

NAB challenges Sanyo receiver decision

The NAB has asked the Federal Communications Commission to reconsider its June 15, 1984, decision authorizing the Sanyo Manufacturing Corporation to market a TV receiver capable of receiving only one, or possibly two, TV channel frequencies.

In its petition the association said that the commission's decision was "unsound," not in the public interest and impermissible under the Congress' All-Channel Receiver Act of 1962, which requires that "any apparatus designed to receive TV pictures broadcast simultaneously with sound be capable of adequately receiving all frequencies allocated by the commission to TV broadcasting...."

Also, the association cited the irreparable damage that such a limited receiver could have on UHF TV stations, including noncommercial operations and new low-power TV stations.

Court asked to reject challenge to FCC's TV must-carry rules

The NAB and six other broadcast groups have filed a brief asking an appellate court to uphold the Federal Communications Commission's decision not to commence a proceeding looking toward deletion of its must-carry rules for cable TV systems.

The other organizations are: Association of Independent Television Stations; Association of Maximum Service Telecasters; McGraw-Hill Broadcasting Company; Metromedia; National Broadcasting Company; and Taft Television and Radio Company.

Turner Broadcasting System petitioned the commission to repeal or


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modify the rules and, when denied, asked the U.S. Court of Appeals for the District of Columbia circuit to order the FCC to initiate a rulemaking proceeding.

NAB said that as the expert agency, the FCC was correct in its decision and that the rules are consistent with the First Amendment standard governing agency regulations. Without the rules, NAB stated, those subscribing to cable could be deprived of access to local television. More importantly, the majority of the public that does not subscribe to cable could be deprived of the free local TV service upon which it depends.

NAB committee chairmen announced

NAB President Edward O. Fritts and Joint Board Chairman Gert H. W. Schmidt, senior vice president, Broadcasting and Entertainment, Harte-Hanks Communications, Jacksonville, FL, have announced the chairmen of NAB committees for 1984-85.

Ad Hoc Representatives Advisory—James L. Greenwald, chief executive officer, Katz Communications, New York. **Alcohol and Drug Abuse Task Force**—Andrew M. Ockershausen, executive vice president, WMAL, Washington, DC. **Bylaws**—Clyde W. Price, president and general manager, WACT, Tuscaloosa, AL. **Children's Television**—Crawford P. Rice, executive vice president, Gaylord Broadcasting, Dallas. **Convention**—William F. Turner (co-chairman), president and general manager, KCAU-TV, Sioux City, IA, and Edward Giller (co-chairman), president and general manager, WFBG AM/FM, Altoona, PA.

Copyright—Thomas J. Dougherty, vice president, Regulatory Affairs, and associate general counsel, Metromedia, Washington, DC. **Engineering Advisory**—Warren P. Happel, vice president, Engineering, Scripps-Howard Broadcasting, Cleveland. **Engineering Conference**—Russell B. Pope, director of engineering, Golden Empire Broadcasting, Chico, CA. **First Amendment**—Bev E. Brown, owner/manager, KGAS, Carthage, TX. **Hundred Plus Markets TV**—Bill Bengtson, vice president and general manager, KOAM-TV, Pittsburg, KS.

International—Arch L. Madsen, president, Bonneville International, Salt Lake City. **Legislative Liaison**—William M. Dunaway (co-chairman), vice president and general manager, WTHR-TV, Indianapolis, and Walter E. May (co-chairman), president, WPKE/WDHR, Pikeville, KY. **Local Carriage Task Force**—Wallace J. Jorgenson, president, Jefferson Pilot Broadcasting, Charlotte, NC. **Medium Market Radio**—Kenneth H. MacDonald Sr., chairman and chief executive officer, The McDonald Broadcasting Company, Saginaw, MI. **Membership**—Paul W. Olson, president and general manager, KLEM/KZZL, Le Mars, IA.

Metro Market Radio—Richard Harris, president, Radio Station Group, Westinghouse Broadcasting and Cable, New York. **Minority Executive Council**—Glenn R. Mahone, president, Sheridan Broadcasting Network, Pittsburgh. **Program Transmission Charges and Services Task Force**—Robert Wells, vice president, Harris Enterprises, Garden City, KS. **Radio Allocations Task Force**—Ernest D. Fears, vice president and general manager, WRQX-FM, Washington, DC. **Regulatory Review Committee**—Clark W. Davis, executive vice president, Great Trails Broadcasting, Dayton, OH.

Research—Peter A. Kizer, executive vice president, Evening News Association, Detroit. **Small Market Radio**—Lee R. Shoblom, president, KFWJ/KBBC, Lake Havasu City, AZ. **Television Information**—Kathryn F. Broman, Long Meadow, MA. **UHF Television**—George DeVault, president and general manager, WKPT-TV, Kingsport, TN. [BE]


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Measuring audio

By Richard Cabot, P.E.*

Fundamental to most audio specifications is the measurement of level. The most common level measurements are *frequency response, gain/loss, harmonic distortion, SMPTE intermodulation distortion, noise level, signal-to-noise ratio* and *transient response.*

Level is measured either in *absolute* or *relative* terms. Power output is an example of an absolute level measurement; it does not require any reference. Signal-to-noise ratio and gain/loss are examples of relative measurements, because they are expressed as a ratio of two measurements.

The simplest description of a level measurement is the ac voltage at a particular place in a system. This measurement can be made with several types of meters currently on the market.

Tektronix model SG 505/AA 501 test set, an example of the new generation of audio test equipment available today.

*This article was written while Cabot was senior engineer of the Instrument Systems Integration Unit of Tektronix, Vancouver, WA.

Meters

The most obvious difference between various audio voltmeters is the type of display: analog or digital. Exact measurements are difficult to accomplish with analog meters because of the multiple scales and the need to interpolate numbers from the printed scale. In contrast, digital meters give a direct readout of the value to several digits, enabling precise measurement of gain and output power to be made with little chance of error.

The digital meter, however, is only suited for measuring relatively stable signals. When monitoring program level to determine system operating levels under actual use, it is difficult to extract a single number from the mass of flashing LEDs. The analog meter doesn't pose this problem. Another appropriate application for analog meters is monitoring the results of an adjustment for a peak or null. Some manufacturers have put both analog and digital displays on the same instrument to enable the best of both worlds. Typically, the analog scale does not have fine graduations and is intended only for approximate measurements of rapidly changing signals.

Most meters of the recent past have been the average responding/rms calibrated type. The ac signal is rectified and averaged to develop the drive for the meter. The reading is adjusted to make the display give the rms value for a sine wave input. For other signals, the response is somewhat hard to define.

Newer meters actually measure the rms value of the waveform using integrated circuits. This allows accurate measurements of voltage for all signals—not just sine wave. The rms measurements accurately reflect the heating power of the waveform in a resistor or loudspeaker, which is critical to correct specification of amplifier power. Many noise specifications were developed in the days of average responding meters, and verification of these requires an average responding unit. Some new units allow selection between these two responses, giving compatibility with old and new techniques.

Meter accuracy

A voltmeter's bandwidth can have a significant effect on accuracy. Consider the signal in Figure 1. It is a distorted sine wave being measured by two meters with different bandwidths. The meter with the narrower bandwidth does not respond to all of the harmonics, giving a lower reading. This effect can be especially severe when measuring wideband noise. Most audio requirements are adequately served by a meter with a 300kHz bandwidth. This allows accurate measurement of signals to about 100kHz.

Accuracy measurements define how well a meter measures a signal at a midband frequency (usually 1kHz). This sets a basic limit on the meter performance when establishing the absolute amplitude of a signal. It is important to look at the *flatness specifi-*

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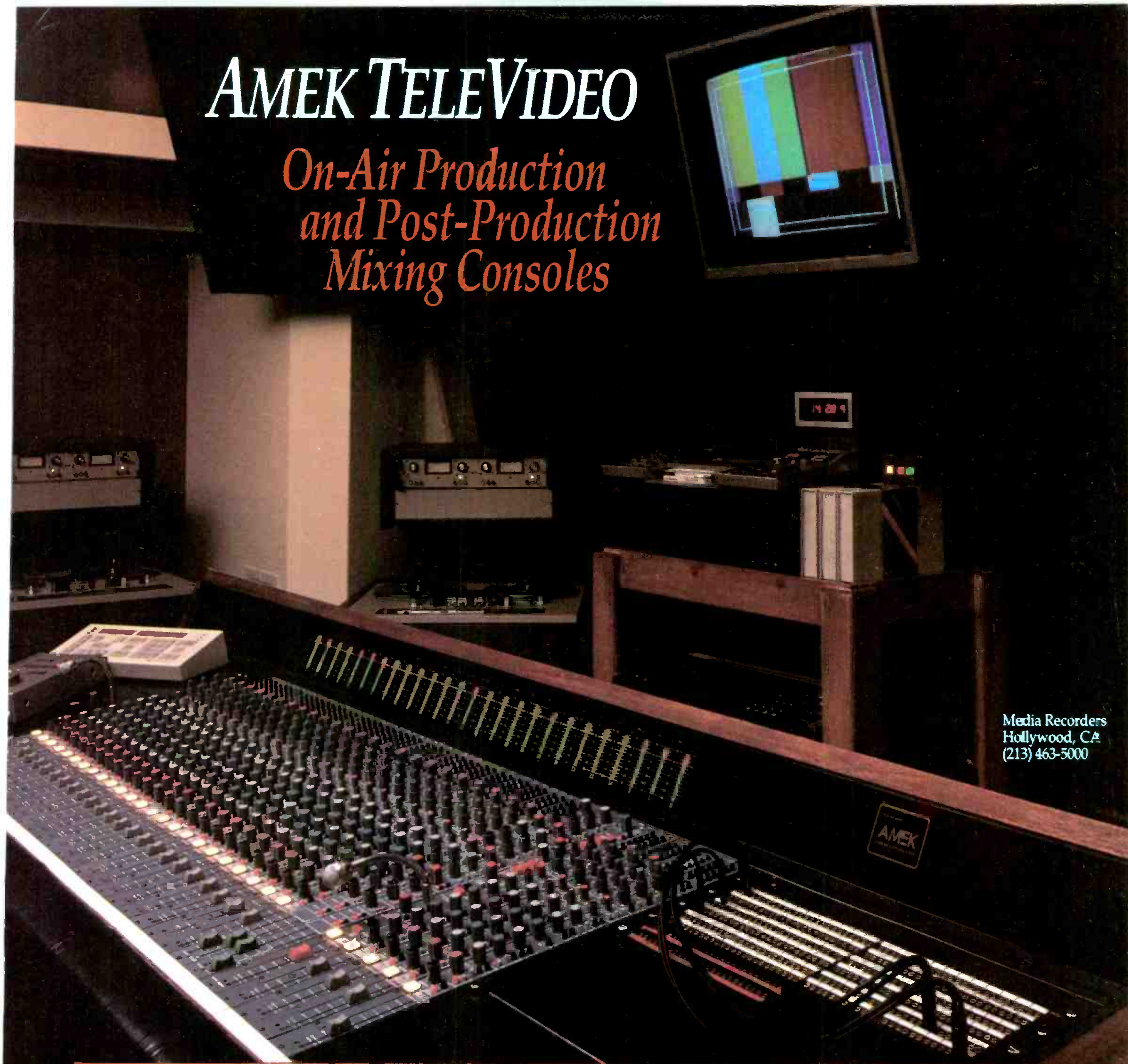

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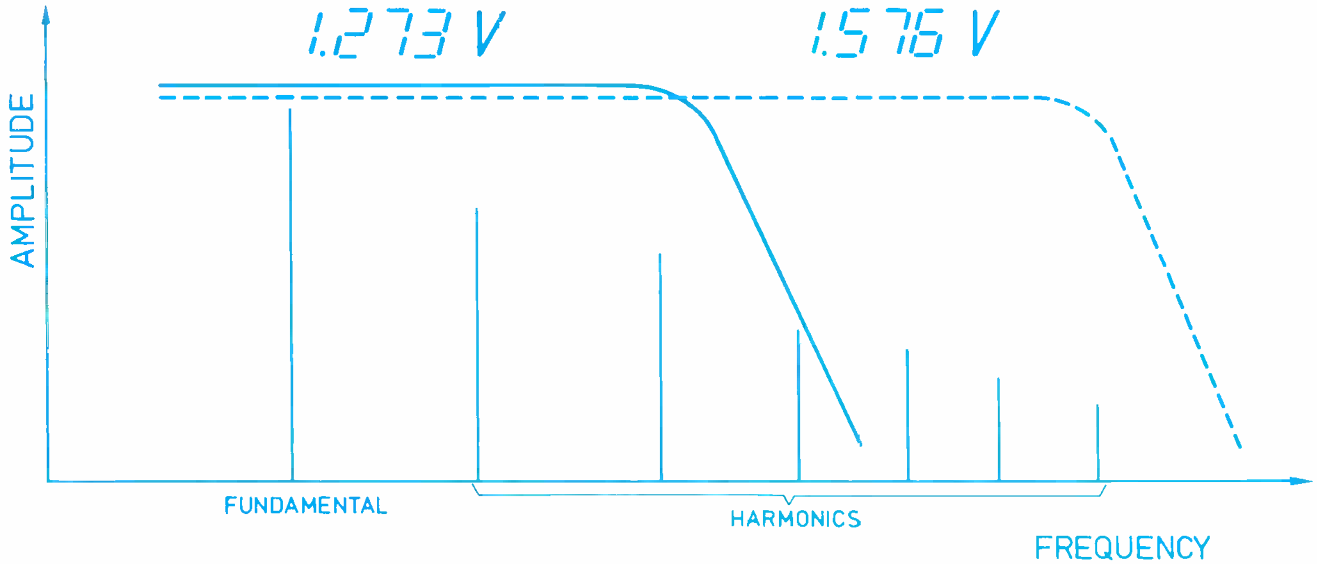

Figure 1. The effect of bandwidth on audio level measurements.

cation to see how well it is maintained with changes in frequency. The flatness specification describes how well the measurements at any other frequency will track those at 1kHz. If a meter has an accuracy of 1% at 1kHz and a flatness of 1dB (10%) from 20Hz to 20kHz, the accuracy could be as bad as 11% at 20kHz.

Meters often have an accuracy specification for each voltage range, being most accurate only in the range in which they were calibrated. A meter with a 1% accuracy rating on the 2V range and a 1%-per-step accuracy spec would be 3% accurate on the 200V scale. Using the flatness specification given earlier, the overall accuracy for a 100V, 20kHz sine wave would be 13%.

The accuracy specification is not normally as important as the flatness. In frequency response or gain measurements, the results are relative and are not affected by the absolute voltage used. However, when measuring gain, the attenuator accuracy of the instrument is a direct error source.

dB measurements

Audio measurements are often expressed in decibels, which can be defined as the logarithmic ratio of two power measurements, or, if the impedances are equal, as the ratio of two voltages. The defining equations are given in Figure 2 for both power and voltage measurements. There is no difference between decibel values from power measurement or from voltage measurements if the circuit is loaded to the reference impedance. An example of this is given in Figure 3.

The reference for decibel measurements may be predefined, as in decibels referenced to one milliwatt (dBm), or it may be the result of another measurement, as in gain or frequency response. When measuring dBm, the *reference impedance* must be specified, normally at 600Ω or 150Ω. The equations assume that the circuit being measured is terminated in the reference impedance used in the calculation.

However, most voltmeters are high-impedance devices and are calibrated in decibels relative to the voltage required to reach 1mW at the reference

$$dB = 20 \text{ Log } \frac{\text{Voltage \#1*}}{\text{Voltage \#2}}$$

$$dB = 10 \text{ Log } \frac{\text{Power \#1}}{\text{Power \#2}}$$

*Only when load impedances are equal
#1 is usually measured
#2 is usually a stated reference

Figure 2. The defining equations for dB.

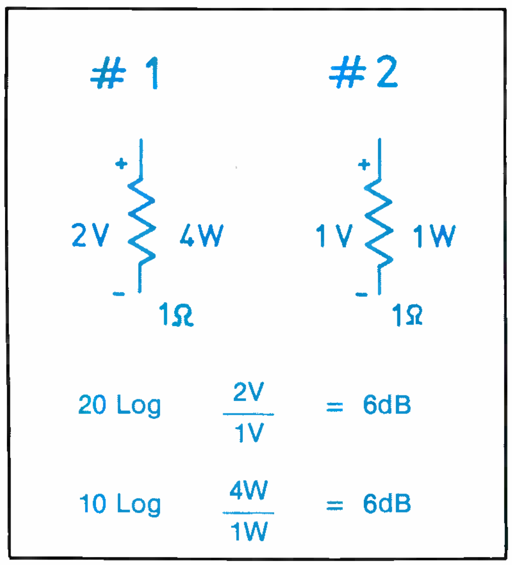

Figure 3. A comparison of two dB measurements.

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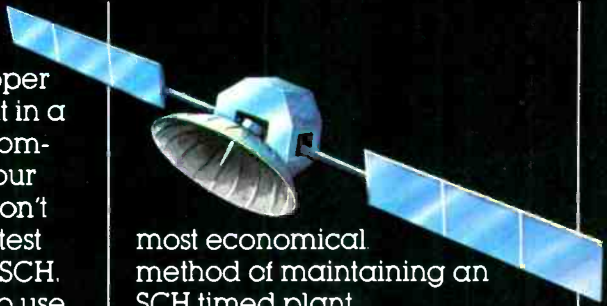

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At Beyer, we maintain the singular notion that a condenser mic *can* combine typical precision and sensitivity with a smooth, natural sound. Beyer Condenser Microphones give you the accuracy and higher output of a condenser without a "hyped," larger-than-life sound. Beyer condensers offer the high-performance specs required by digital recording without reinforcing the occasionally clinical aspect of this process.

More Options – More Versatility

The Beyer MCM Condenser System's comprehensive selection of interchangeable mic capsules means total applications versatility in the most logical and cost-effective format. A choice of mics with cardioid, lobe, omni or figure-8 patterns and the option of integral shock-mounting is instantly available for use in the studio *and* out in the field.

New Super High Performance Mics

The ongoing technical evolution of Beyer condensers has produced several newly designed mics offering matchless performance and long-term reliability. The new MC 737 long shotgun (lobe pattern) and MC 736 short shotgun (cardioid/lobe) utilize a built-in switchable bass rolloff to effectively suppress low end noise and rumble below 200 Hz and provide increased intelligibility for optimum speech and music recording. A 12 dB attenuator prevents high sound pressure levels from overloading the mic's internal electronics without coloration. These mics also feature an extended frequency

The Dynamic Decision

without typical condenser sound.

response of 40 Hz to 20 kHz (± 2.5 dB) and an excellent signal-to-noise ratio of 74 dB.

The new MC 734 is the only "studio" condenser mic that delivers the highest standards of performance in *any* recording or live concert situation. An extremely flat frequency response from 20 Hz to 18 kHz (± 2.5 dB) insures total accuracy while a 3-step filter compensates for proximity effect in close-miking situations. To maximize the MC 734's performance onstage, a unique stage resonance filter which reduces rumble and extraneous noise is combined with the mic's ability to withstand sound pressure levels of 138 dB (1 kHz ≦ 0.5% THD).

Condenser System Accessories

For added back-up flexibility, the Beyer Condenser System includes a full complement of accessories including windscreens, power supplies, pistol grips, suspension mounts and our one-of-a-kind MZA 716 telescoping "fishpole" boom with an adjustable tilt variable from 0 to 360°.

Beyer Dynamic has firmly established itself as a leading force in moving-coil and ribbon microphone technology, but don't let our name mislead you. Instead, consider the uniquely natural sound, applications versatility and wide variety of accessories that make up the Beyer Condenser System.

Visit one of our select professional dealers for a complete demonstration. To obtain a Beyer Condenser Dealer List, please write to: Beyer Dynamic, Inc., 5-05 Burns Avenue, Hicksville, New York 11801 or call us at (516) 935-8000.

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impedance. This voltage is 0.775V in the 600Ω case. Termination of the line to 600Ω is left up to the user. If this is not done, it is not correct to speak of a dBm measurement. The case of decibels in an unloaded line is referred to as dBu (or sometimes dBv) to denote that it is referenced to a 0.775V level. This should not be confused with dBV, which is an unterminated voltage-based decibel measurement.

Noise measurements

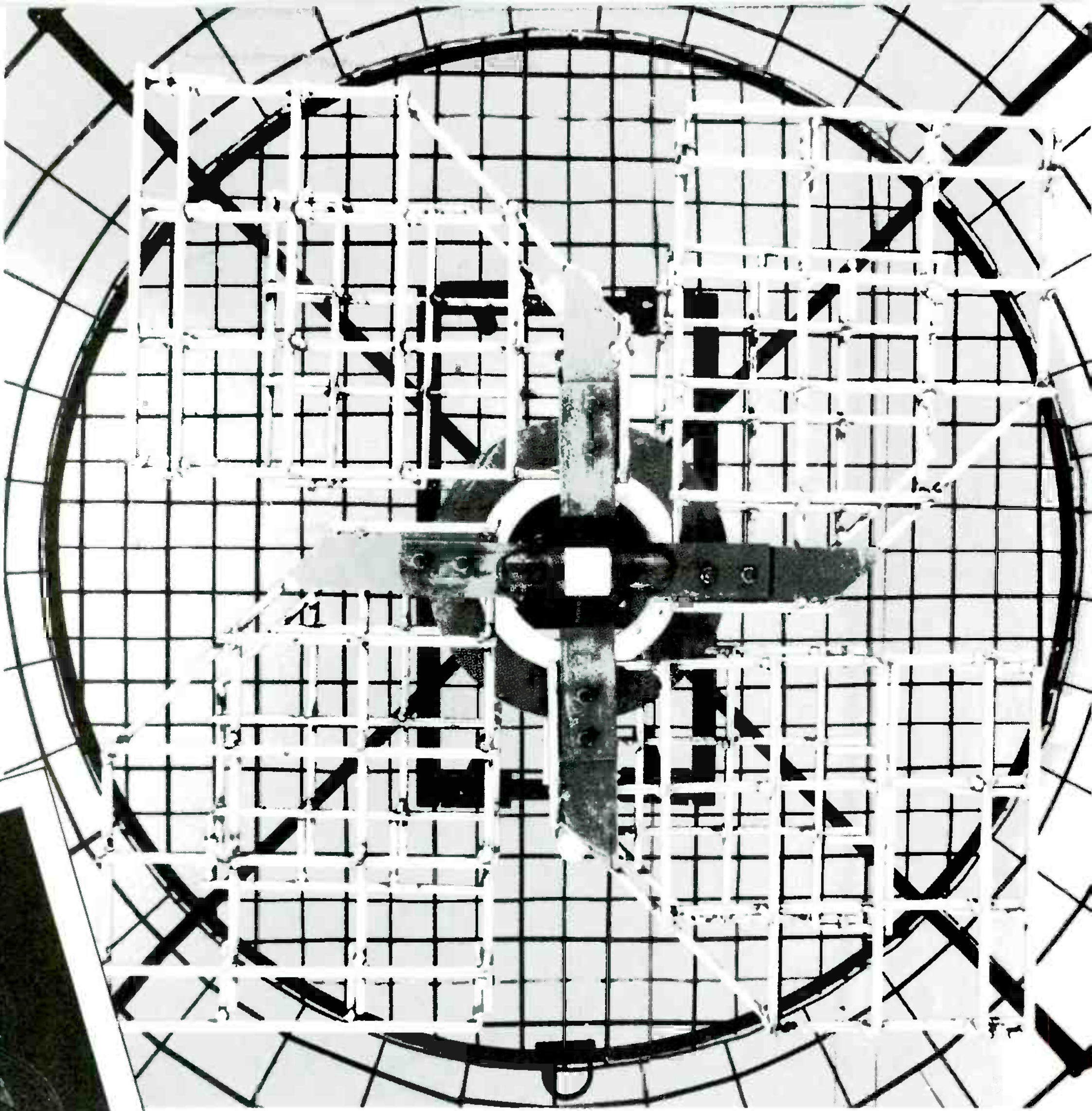
Noise readings are a special case of voltage measurement. The ear's sensitivity to low-level signals varies with frequency; it is most sensitive in the region of 2kHz, with roll-offs above and below this.

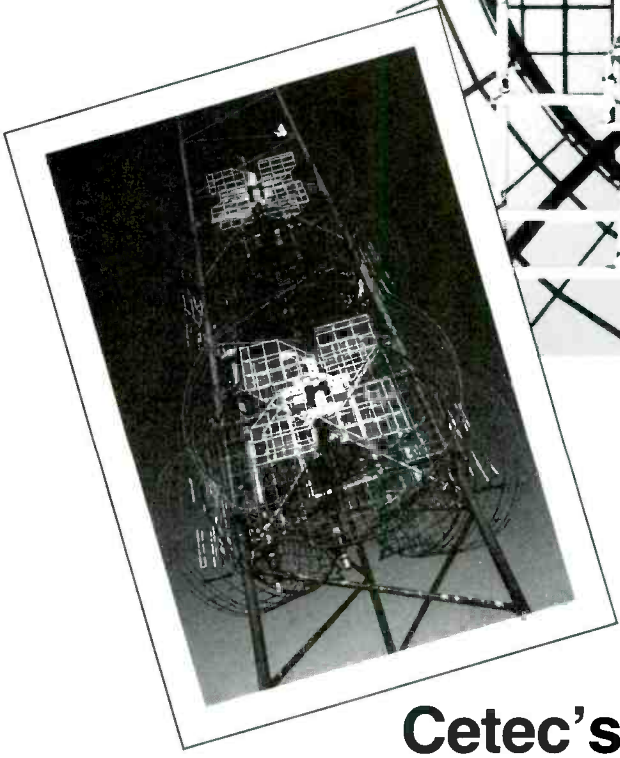
To predict how noisy something will sound on a loudspeaker, it is necessary to use a filter that duplicates this non-flat behavior electrically. Various attempts have been made to do this, resulting in several standards for noise measurement. Some of these weighting filter curves are shown in Figure 4.

The most common filter is the A-weighting curve. This filter is placed in front of a high-sensitivity voltmeter, and the amplitude of the noise is measured. An average responding meter is normally used for A-weighted noise measurements, though rms is beginning to be seen. Some manufacturers specify noise with a 20Hz to 20kHz bandwidth filter and a rms responding meter. European equipment is usually specified with a CGIR filter and a special ac/dc converter called a quasi-peak detector. This is supposed to correlate better with the subjective level of the noise than A-weighted average response measurements do.

Noise may be expressed as an absolute level (usually in dBm and dBu) by simply measuring the weighted voltage at the desired point in the system. However, this means little. A 1mV noise spec at the output of a power amplifier may be quite good, but a 1mV noise spec at the output of a microphone would render it useless for anything but recording jet planes. A better way to express noise performance is the signal-to-noise ratio (S/N).

S/N is a decibel measurement of the noise voltage using the signal level measured at the same point for a reference. This makes numbers at different points in the system directly comparable. Any degradation in S/N at later points in the system is due to limitations of the equipment that follows.





Understanding distortion

Distortion is a measure of signal impurity. It is usually expressed as a percentage or a decibel ratio of the undesired components to the desired components. The distortion of a device is measured by feeding it one or more sine waves of various amplitudes and frequencies. Any frequencies at the output that were not present at the input are termed distortion.

Let's take the case of *harmonic* distortion measurement. The transfer characteristic of a typical device is shown in Figure 5. This transfer function represents the output voltage at any point in the signal waveform for a given input voltage—ideally, it is a straight line. A change in the input produces a proportional change in the output. Because the actual transfer characteristic is nonlinear, a distorted version of the input waveshape appears at the output.

Harmonic distortion measurements excite the device being tested with a sine wave and measure spectrum of the output. The spectrum of the distorted signal is shown in Figure 6. The harmonic amplitudes are proportional to the amount of measured distortion.

A distortion analyzer removes the fundamental of the signal to be investigated and measures the remainder. A block diagram of a harmonic distortion analyzer is shown in Figure 7. The fundamental is removed with a notch filter; its output is then displayed on an ac voltmeter. Additional circuitry (not shown) is required to enable setting of the correct input level for calibrated measurements. Because of the notch filter response, any signal other than the fundamental will influence the results—not just harmonics. Any practical signal contains some hum and noise, and the distortion analyzer will include these in the reading. The correct term for this measurement is thus *total harmonic distortion and noise (THD + N)*.

Intermodulation distortion

Another measurement of distortion is the intermodulation of two or more signals passing through a device simultaneously. The most common of these is SMPTE IM, which uses a low-frequency tone (60Hz) and a high-frequency tone (7kHz) mixed in a 4:1 amplitude ratio. The amount that the low-frequency tone modulates the high-frequency tone indicates the degree of nonlinearity.

As shown in the Figure 8 example, when this composite signal is applied to the test device, the output waveform is distorted. As the high-frequency tone is moved along the transfer characteristic by the low-frequency tone, its amplitude changes. This results in low-frequency amplitude modulation of the high-frequency tone. This modulation is shown as sidebands around the high-frequency tone, illustrated in the lower part of Figure 6. The power in these sidebands represents the nonlinearity in the device.

The signal is measured by filtering out the low-frequency tone, as shown in Figure 9. The high-frequency tone is then demodulated similar to an AM radio signal and lowpass filtered to remove any remaining high-frequency energy. The resultant signal is the distortion, displayed as a percentage of the high-frequency tone's amplitude.

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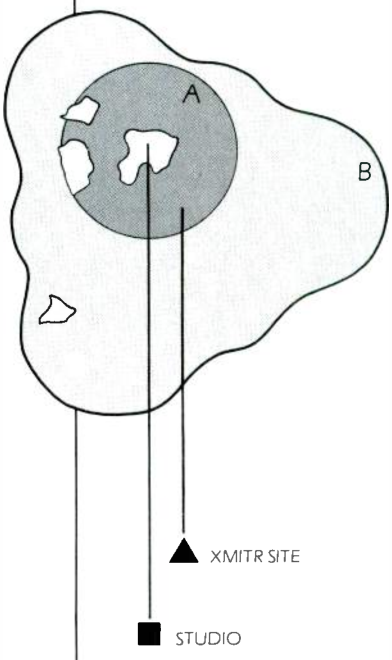
What happens at your station when your FM transmitter goes down? Or your studio transmission link is disrupted? Or a power loss at the transmitter site occurs?



A — Coverage using QEI studio location transmitter

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QEI has an inexpensive solution. Our low-power FM transmitter designed for studio operation can handle all these emergencies and keep you on the air. In many cases you'll retain the majority of your audience simply because your studio is usually located more central to your market than your transmitter site.

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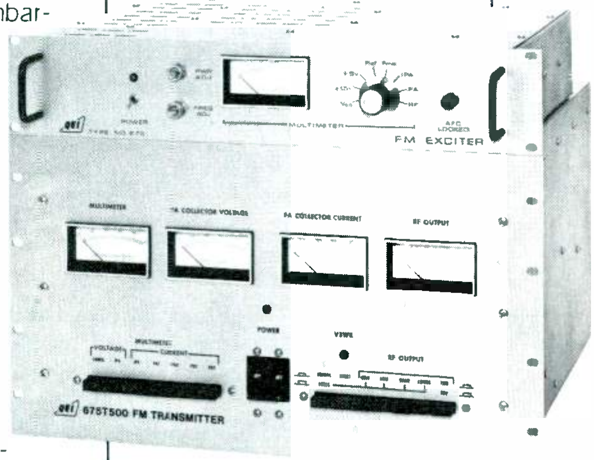

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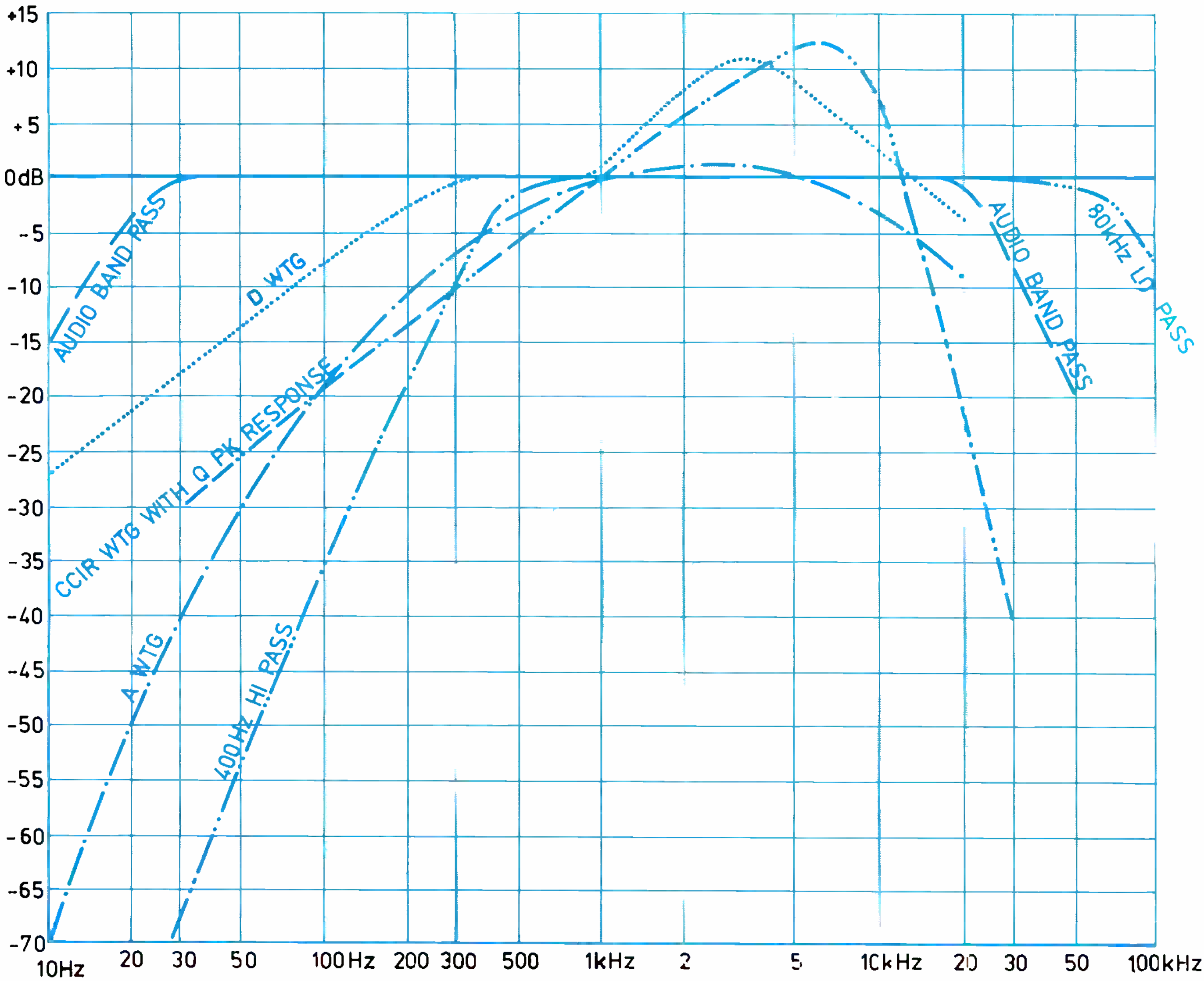

Figure 4. Weighting filter curves commonly used in noise measurements.

Distortion measurements should be performed with an rms responding meter in the distortion analyzer for true accuracy. In most practical distortion measurements, the rms response reads about 2dB higher than the average response.

Residual distortion

The accuracy of most distortion analyzers is specified at 1dB, but this can be misleading because separate specifications are often put on the bandwidth and ranges. A more important specification is the *residual* distortion of the measurement system. Manufacturers often specify the oscillator and the distortion analyzer separately. A system in which the oscillator and analyzer are each specified at 0.002% THD can have a

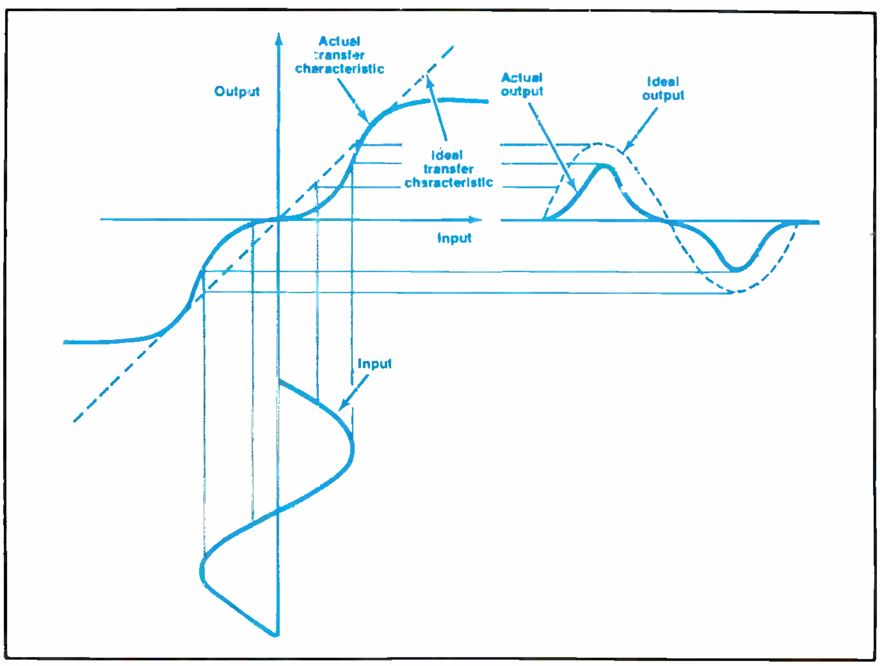

Figure 5. THD test of transfer characteristics.

system residual distortion of 0.004%. If the noise of the analyzer and the oscillator are specified separately, they must be added to the residual specification to find the residual THD+N of the system.

Many commercial units specify the residual distortion at only one input voltage or at the full scale of one range. The performance usually degrades by as much as 10dB when the signal is at the bottom of an input range. Look for a spec on total system residual THD+N that includes all error sources combined and holds for all input voltages and frequencies. Otherwise, you will have a lot of calculator work ahead.

The best distortion analyzers on the market today are fully automatic in both frequency tuning and amplitude setting. This automation makes distortion measurements as easy as pressing one button, whether the generator is 2 inches or 2 miles away.

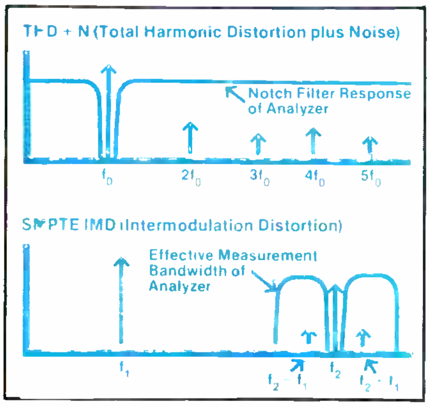

Figure 6. Spectrum of THD and SMPTE IM signals.

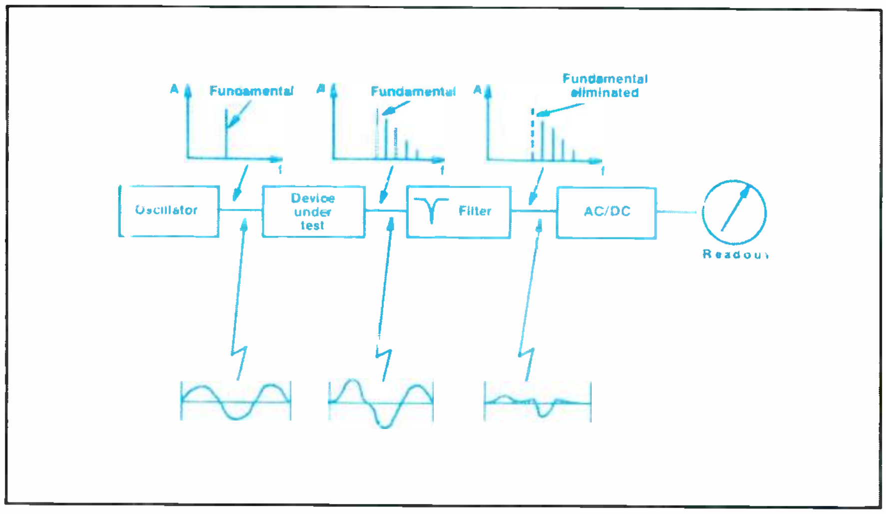

Figure 7. Block diagram of a THD test setup and analyzer.

Signal source effects in measurements

The signal source is an often-overlooked factor in the accuracy of level measurements. Let's consider the measurement of a filter's gain above its −3dB frequency. This is shown in Figure 10 for a 3-pole low-pass filter. If the frequency of the generator is off by 3%, the gain measurement will be off by 1dB. A higher order filter or a less accurate generator will give even more error.

Figure 11 shows the effect of generator distortion on gain measurement of a filter. If the generator's distortion is not sufficiently low, the gain measurement will be inaccurate. This is also true when measuring notch filters in an equalizer, where the distortion will appear as inadequate notch depth. The effect of these errors on distortion measurements is equally severe. The gain introduced by a filter on the harmonics of the generator can make them exceed the distortion of the filter itself.

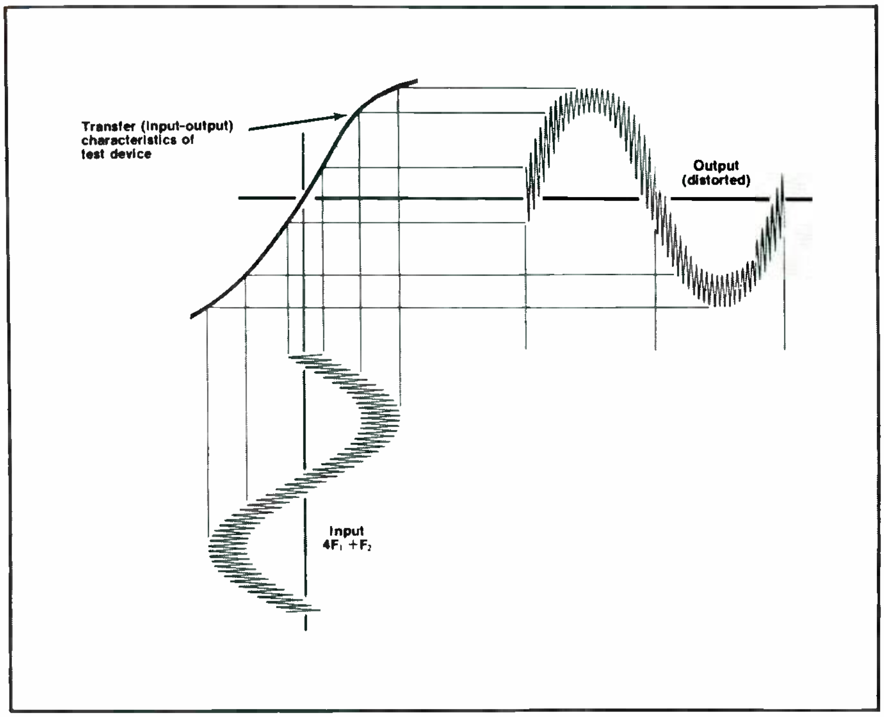

Figure 8. SMPTE IM test of the transfer characteristics of a device under test.

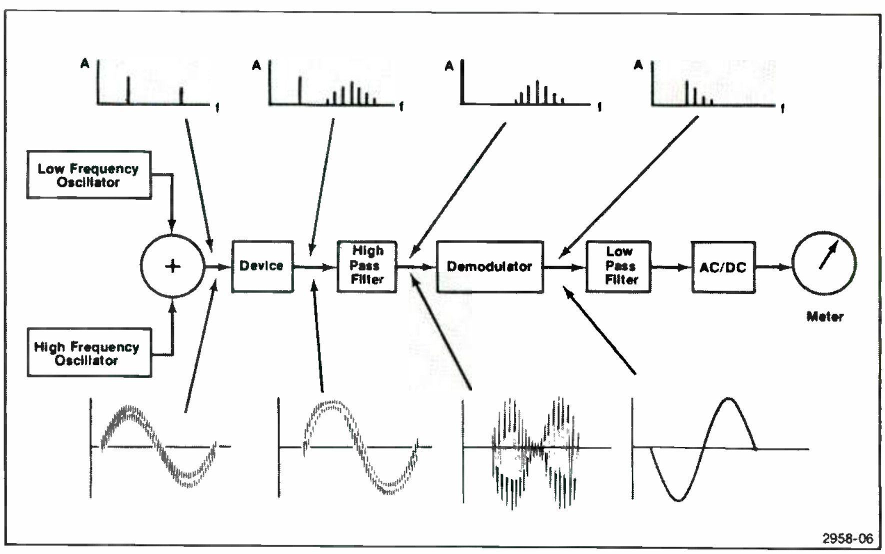

Figure 9. Block diagram of a SMPTE IM analyzer.

Balanced vs. unbalanced I/O

Balanced inputs and outputs are commonly used to eliminate ground loops and reduce interference. It is even more important to maintain balanced operation when connecting broadcast equipment to test instruments. Use of a balanced differential input on a voltmeter or distortion analyzer is essential to produce accurate readings and to verify today's low distortion and noise levels.

Some test equipment manufacturers, in an effort to save money, have produced inputs that can only accept a few volts on the low terminal. They allow reduction of ground loops from unbalanced sources but do not permit connection to balanced lines.

A differential input is also valuable for eliminating hum when measuring unbalanced lines. If an additional ground is created by the connection of an unbalanced meter to the system, it may introduce hum that was not previously there.

Similar concerns about balanced

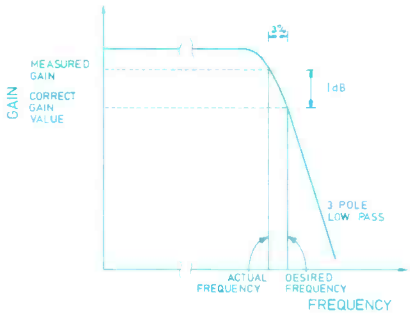

Figure 10. Effect of generator frequency accuracy on low-pass filter gain measurement accuracy.

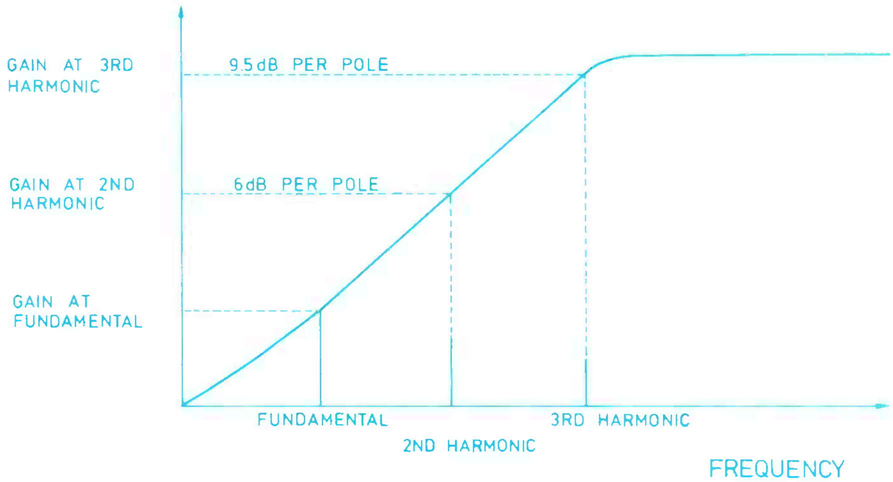

Figure 11. Effect of source distortion on high-pass filter gain measurement.

With a total system capability far beyond the grasp of most synchronizers and a price that's thousands less, the new Sony "Sync Master" synchronizer easily offers you the greatest price and performance in the industry.

It also offers you a much greater range of features than the vast majority of synchronizers. Including an edit list capability of up to 200 edit points.

And it's the only synchronizer developed by both a professional audio/professional video manufacturer.

But the real reason for buying it is that it is upwardly compatible to the proposed SMPTE "Recommended Practices for Digitally Controlled Equipment." Which means the interfacing problems between video, audio and film equipment will be problems of the past. This Sony "Sync Master" synchronizer has a built-in distributed intelligence network that makes it able to talk to an entire universe of diverse machines developed by diverse manufacturers.

So before you invest in a synchronizer that just solves today's problems, perhaps you should first examine the one that will also solve tomorrow's.

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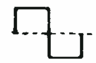
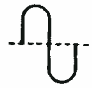
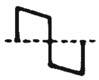
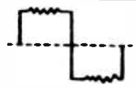
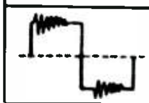
Waveform	LF gain	LF delay	HF gain	HF delay	Damping
	Ideal	Ideal	Ideal	Ideal	Ideal
	Insufficient	Good	Excessive	Good	High
	Excessive	Good	Insufficient	Good	High
	Good	Excessive	Good	Insufficient	High
	Good	Insufficient	Good	Excessive	High
	Excessive	Excessive	Insufficient	Insufficient	High
	Excessive	Insufficient	Insufficient	Excessive	High
	Insufficient	Excessive	Excessive	Insufficient	High
	Good	Good	Excessive	Good	Medium
	Good	Good	Excessive	Good	Low

Figure 12. Squarewave test results (from *Audio Cyclopedia).*

operation apply to the signal source. With an unbalanced generator driving an unbalanced line, it is not possible to separate the extra hum from that inherent in the system.

If measurements are made in a high RFI field, it is essential to maintain balanced operation. Most inexpensive pieces of test equipment will not operate properly in such environments.

Transient response measurements

The most common signals for this purpose are square waves and tonebursts. Square-wave measurements are difficult to extract exact specifications from, but the appearance of the output waveform from the device being tested gives much qualitative information about its behavior. A table of square-wave responses from the *Audio Cyclopedia* is given in Figure 12.

Tonebursts are another technique for evaluating the response of audio devices to transients. A toneburst concentrates the energy of the waveform closer to a particular frequency, enabling evaluation of individual sections of the audio frequency range. Toneburst testing is common with loudspeakers, yielding information on the damping characteristics of the drivers at a glance.

Audio measurements are important for verification of proper system operation. If they are approached with knowledge and the right equipment, they are easy, informative and well worth the time.

The job of getting a job

By Jerry Whitaker, radio editor

Looking for a job in the broadcast industry is not what most people would consider a lot of fun. The process is generally time-consuming, expensive and trying on a person's nerves. An ideal job seldom falls into somebody's lap. A good job, instead, is stalked, often with the patience and skill of a wild game hunter.

People who seem to have landed a great job overnight—with little or no effort—will usually tell you that their move came only after years of planning and work toward a single goal. It's called "paying your dues," and everyone knows how it works.

The process of finding a good job is not a hit-and-miss proposition. It can be directed, timed and controlled. Getting a good job is a job in itself.

The science of job placement has advanced substantially within the last decade. Analysts have been able to distill and package the qualities and approaches that aid an employee in getting ahead in his or her chosen profession. Career planning with a focus toward the future is more important now than ever before in most professions. It is especially important for technically oriented fields, such as radio and TV broadcast engineering.

More skills demanded

The technical sophistication of broadcasting is constantly growing, and the industry, therefore, is demanding higher skilled technicians to maintain the new, advanced tools of the trade. According to Gary Kimball, vice president for engineering of Don Fitzpatrick and Associates—a professional job placement service—the era of the technical generalist is over, at least in the TV industry.

He said, "The equipment in use at TV stations today is becoming so complex that it is increasingly difficult for maintenance engineers to remain knowledgeable about everything in the plant. Stations, therefore, are looking for specialists in various technical areas, such as VTR repair, transmitter maintenance or ENG service."

Kimball also noted that increased equipment sophistication has made field repair of some types of gear difficult, if not impossible.

"The complexity is such that most technicians do not have the necessary skills to work on the gear, and probably never will. Frame synchronizers, digital effects generators and time base correctors—for example—are units that are generally difficult to service in the field," he said.

"Even if the station engineer goes to school and learns troubleshooting techniques for the hardware, the mean-time between failures on such equipment is usually so great that the technician will probably have forgotten much of what he had learned by the time the unit fails. Stations, in-

"We're finding that people will travel and relocate all over the country for the job they want."

stead, are concentrating on the items—usually mechanical—that fail more often."

Equipment specialization has resulted in a number of new opportunities for TV engineering personnel, according to Don Fitzpatrick, president of the San Francisco-based placement company.

He said, "Today we're seeing many more jobs in the TV industry than existed five or six years ago. The approach taken by many stations toward recruiting technical personnel is also changing.

"For example, there was a time when if you were the manager of a station in Spokane, WA, you tried to hire personnel from your immediate area. Now, however, we're finding that people will travel and relocate all over the country for the job they want. We are also seeing that station managers are no longer only looking inside their own geographical areas for new employees."

Fitzpatrick added that his company has seen a change in the length of time engineering personnel spend in a particular job.

"I think the mobility factor has increased, but not nearly to the extent that it has for on-air TV personnel. I think you will see engineering people staying at a station for five to eight years today, where they may have stayed 15 years in the past," he said.

Fitzpatrick added that most of this job shifting is done for reasons of position advancement, that money seems to be a secondary concern.

Getting the job

How does a person go about finding the job he or she wants? Kimball said the first step in the process was to accurately define the desired position.

"The person should focus on his or her area of interest, whether it is out in the field working with ENG equipment, or in the studio working with video switching gear," he said. "After focusing on the desired position, the engineer must go about acquiring the skills necessary for the job, whether through factory or technical school instruction or on-the-job experience."

When approaching prospective employers, Fitzpatrick had some interesting advice.

"Experienced engineers looking for a career advancement should approach the process as a consumer. For example, they should pick a part of the country they want to move into and approach stations in the area on an equal basis. Don't just send a résumé saying please hire me, but instead aggressively go out and ask the stations what opportunities they can offer, and what benefits they can provide. Try to talk to as many stations as possible and put yourself in charge of the situation."

One of the keys to landing the type of position desired is getting in touch with the so-called *hidden job market*—those openings that are filled

"All too often the applicant will say he will do anything around the TV station. Unfortunately, there is no such job description...."

before they are advertised. Fitzpatrick recommended a procedure he called the *friendly pest syndrome.*

The friendly pest is a person who contacts the employer every 6 weeks or two months just to say, "I'm still here and I'm still interested in working for you, so don't forget me."

Fitzpatrick explained the reasons for this approach: "When I was a news manager, the people I always hired were the ones who sent me a résumé—or walked in off the street—and then checked back on a regular basis. They let me know that they were interested in the position.

"In many companies, there is little turnover, but when a job opening does occur, the first people who come to mind are those that persisted in letting the employer know they wanted the job in the first place."

Preparing a résumé should be approached carefully by any engineer trying for a new position. According to Kimball, a maintenance engineer should concentrate on experience—what types of equipment he has worked on—and education. Lengthy résumés should be avoided.

Fitzpatrick added, "There is a tendency sometimes—especially with young people looking for a job right out of technical school or college—to take a shotgun approach, sending out 40 or 50 résumés at a time. Basic psychology says that if you're going to do that, you must do your homework first. Find out the name of the chief engineer or personnel director at the particular station or production house and address the résumé to him or her.

"This requires extra work, but helps to ensure that the résumé will be opened and read. Also, the applicant should specifically say, 'This is what I want to do'—whether it is ENG maintenance or VTR repair or whatever. All too often the applicant says he will do anything around the TV station. Unfortunately, there is no job description for anything around the TV station. Be specific."

Not only is the résumé important, but so is the cover letter that accompanies the résumé. The letter should be well-written, pointing out what the applicant wants to do, and—according to Fitzpatrick—the last paragraph should state that the applicant will be calling within a week to set up an appointment.

Fitzpatrick said, "The reason I suggest that closing line is because a lot of résumés come in with a closing paragraph such as 'I'm looking forward to hearing from you.' What actually happens, however, is the résumé gets shuffled into a file and most likely forgotten.

"But, when somebody says to you, 'I'm going to be calling you next week,' the employer has to start thinking about that person as an individual. And, if he doesn't want to sound uninformed when the applicant calls, he will likely read the résumé."

That's all it takes to land the right job—experience, knowledge, motivation and hard work. Especially hard work.

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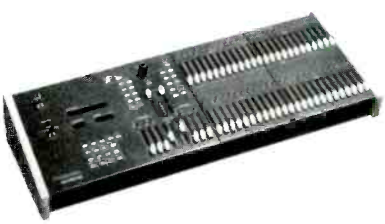
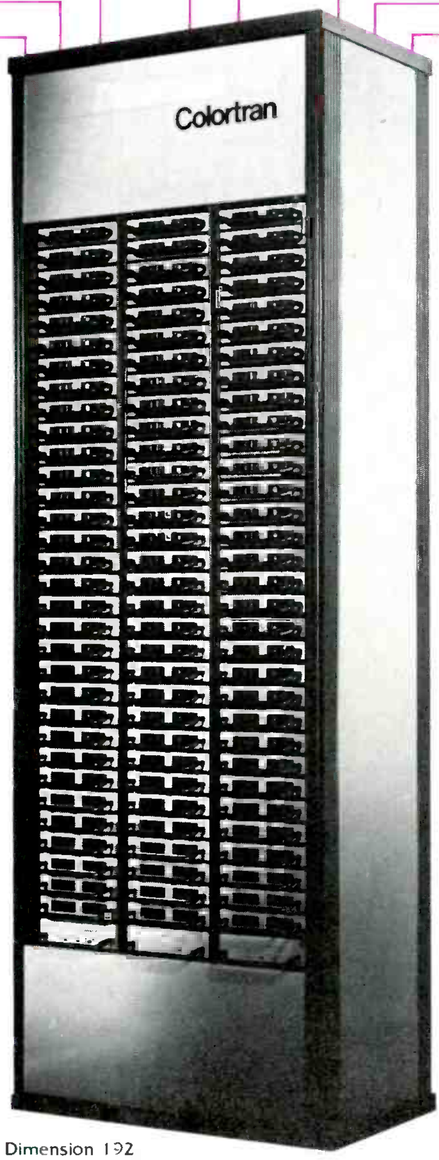
Dimension Five

System Two

Patchman





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The Dimmer . . . maximum density dimming with Dimension 192 — up to 192 2.4kW dimmers in one rack, plug-in electronics as well as plug-in dimmers. Complete security (lock door prevents dimmer and control module removal), Dim/Non-Dim switch selectable, advanced engineering with proven components.

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new products

Noise reduction sytems

Two new models have been introduced into the line of *Micmix Audio Products* noise reduction systems. Model DX-2 is a stereo Dynafex system that incorporates a brilliance control. Model DP-1 is a single-channel Dynafex system that includes the brilliance control plus several other features that allow the user to fine tune the Dynafex circuitry. All Dynafex models provide up to 30dB of noise reduction without the encode/decode process. Both models use XLR connectors located on the rear panel for input/output interface. Inputs are electronically balanced, outputs are unbalanced.

Circle (524) on Reply Card

VP-1 and VP-2 in PAL versions

Chyron Corporation planned to show PAL versions of its high resolution electronic graphics generators at the International Broadcasting Convention show in Brighton Sept. 21-25. The VP-1 and VP-2 are electronic graphics generators targeted for smaller broadcast and cable studios as well as non-broadcast applications including business and corporate users, public display advertising, electronic slide production, education and a variety of other markets. The VP-1 is designed to be used with any personal computer with an RS-232 port and a word processing program. The VP-2 is a stand-alone generator.

Circle (525) on Reply Card

RGB switching

Dynair Electronics introduces solid-state switching for raster scan video systems, which allows the user to select up to 16 sources and distribute them to one display or copy device. Compatible with most display controllers, hard copy and film units, large screen projectors and CRT displays, the unit accommodates all standard scan rates. It can be operated locally and/or remotely by manual push-buttons or host computer via the optional serial control port. Two sizes are available: five inputs/one output in one self-contained rack-mount package, or 16 inputs/one output housed in a 3-unit rack-mount assembly.

Circle (526) on Reply Card

Transient protection unit

EEV has developed a transient protection unit type TPU7A, designed to provide protection of telephone and data lines against the effects of EMP

Continued on page 164

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Circle (106) on Reply Card

Winterizing the ENG operation

By Carl Bentz, TV editor

Winter is coming, and with it will be the usual adverse conditions that make ENG activities difficult. Cold temperatures and moisture can spell even greater problems than summer's heat and humidity. Fortunately, most of today's ENG products really don't need a great deal of attention to provide adequate winter operation. However, a few common sense suggestions may provide more than just adequate operation.

Batteries

Most ENG functions require battery power for cameras, recorders and perhaps lighting equipment. Cold environments, particularly sub-zero conditions, can cause the chemicals inside batteries to react slowly. The result is inadequate power. At the studio, when the cold battery is placed on a quick charger, it has been found that permanent damage may result. If the battery is allowed to warm to a safe temparature, the damage may be avoided.

The condition of the battery is also important. A battery that has been in use for some time may show problems of unequalized charging. Some cells recover their charge better than others. An unequalized battery will appear to fail prematurely. Refer to the September Buyers' Guide for battery charger and conditioning products to keep your systems in top shape for the coldest weather.

Cameras

The worst enemy of a camera in winter is moisture. Temperature could conceivably affect mechanical alignments, but moisture is far more critical. The best means to avoid failures due to moisture is protective coverings. Proper ventilation of the camera is important, but in cold environments, a waterproof covering could create less problems than would snow or rain.

Attention to transportation cases for cameras and other equipment may also prove helpful. Again, should your cases be in questionable repair, consult the Buyers' Guide edition for contacts for new cases or repairs to existing products.

Several weatherized lens systems have been announced over the past years. Generally, weatherizing of the lens is not a retrofit situation, but rather a special form of the product. Check with your favorite lens manufacturer for ways to keep inclement weather from causing you lens headaches.

Recorders

Just as with cameras, moisture in the video recorder will not make the unit work any better than normal. Most recorders designed for less than ideal conditions usually include moisture sensors on the head drum. If a recorder has been exposed to cold temperatures, during a warming process moisture may collect along the tape path that will cause the system to operate unsatisfactorily. Rather than smooth motion, the tape jerks through the machine, making the recorded material unusable. Keeping the machine and tape warm is the best solution. If time is available to allow equipment to warm to the environment, such unstable operation should be avoidable as well.

ENG Vehicles

Getting to the ENG project site means that vehicles need to be winterized as well. Snow tires and chains may be required to get through snow and slush, assuming you have had a competent mechanic make sure the engine is ready for the cold environment. Again, batteries, automotive or otherwise, suffer more stress in winter than any other time of the year. The vehicle's electrical system should be checked, as well as oil and coolant.

Getting ready for winter ENG projects is more common sense than anything else. Fortunately, the few areas that need special consideration can be handled easily ahead of time without too much expense. Waiting until winter hits, however, may result in problems. Plan ahead.

BOSCH FGS 4000

UPDATE

VIDEO GRAPHIC SYSTEM

The FGS-4000 Produces Unsurpassed Video Image Quality

Is it presumptuous for us to suggest that the pencil is passé? The brush a bygone? To the traditional graphics designer, perhaps yes. To the video graphics designer, not really. But regardless of tradition, the designer with the most adequate tools can best implement his imagination. And those tools come from Bosch.

"It gives unlimited capability to design, generate, modify and manipulate two- and three-dimensional objects in three-dimensional space."

Our reason for developing the FGS-4000 was really very simple. We wanted to give the graphics artist more freedom. To give him wings for flights of fancy. To give him a better way to unleash his energy. More than a character generator or electronic paint set, the FGS-4000 is a tool for handling objects in a very real and natural way.

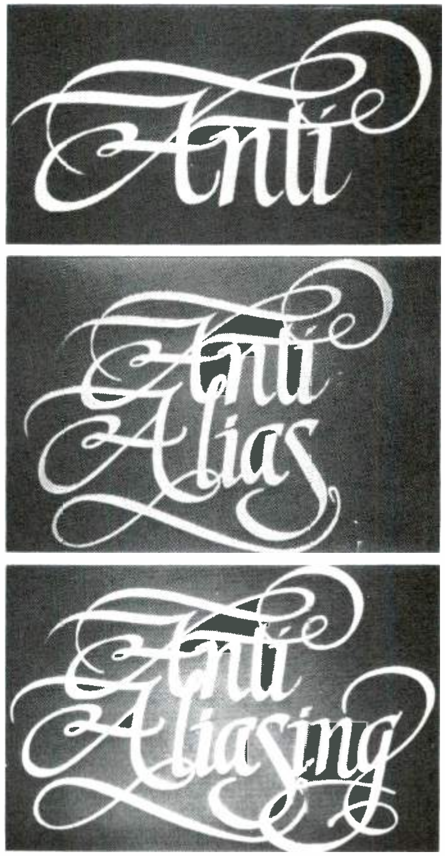
This is not a one-button special effects box. The FGS-4000 is one of many electronic tools that has helped Bosch set or raise industry production standards. But while our products are based on the computer, they are built for the designer. In fact, they do not reach the market until they are tested and proven by artists *for* artists.

Since this is a software-based system, the FGS-4000 comes with a future. As new software applications are developed over time, they will find a home in Bosch hardware. To the graphic designer in the video environment, that means the system will grow with *you* as well as with the industry. It means the system provides an unlimited capability to design, generate, modify and manipulate two- and three-dimensional objects in three-dimensional space.

The FGS-4000's image quality is exceptional. It is characterized by apparent resolution in 10 nanoseconds. There are no stair steps, breaking or tearing of edges when scaling, positioning or rotating objects. Images are completely recreated and anti-aliased at each frame, and appear virtually perfect at beginning and ending frames, and at every one in between. In fact, images produced by the FGS-4000 are indistinguishable from camera-entered graphics.

Bosch will help you get your hands on the FGS-4000 picture. We will train you in our new, fully-equipped facility. We will teach you both fundamental and advanced operating skills to help you free the visual images still locked in your imagination. You will work on a video graphics system so limitless that wonders become realities at your command.

How do you get your hands on the FGS-4000? Call (801) 972-8000. Or write to Video Equipment Division, Robert Bosch Corporation, P. O. Box 31816, Salt Lake City, Utah 84131.



The FGS-4000 creates an image quality comparable to that of a high quality T.V. camera. Special anti-aliasing hardware continuously smooths out the edges, creating, at all times, clean images regardless of size. Seeing is believing.

Robert Bosch Corporation
Video Equipment Division
P.O. Box 31816, Salt Lake City, Utah 84131
(801) 972-8000

BOSCH

New products
Continued from page 160

and lightning. These new TPUs offer the benefits of a spark gap, avalanche diode and filter network, which is capable of clamping any disturbance to a pre-determined value of 7.5V to 170V. This bulkhead mounted, feed-through device isolates exposed cables from the protected environment.

Circle (527) on Reply Card

Mini high voltage relays
Kilovac Corporation is offering an entire family of ceramic vacuum relays. Available in SPST, SPDT, fail-safe and latching configurations, the K40 series of relays includes both 5kV and 10kV rated models, with current carry of 15A at dc and of 3.8A at 32MHz. With operating times as fast as four milliseconds, the K40 series relays are suited for applications in digital antenna couplers, laser systems, medical instruments and numerous industrial high voltage switching requirements.

Circle (500) on Reply Card

Portable camera identifier
A new portable camera identifier that automatically identifies the feed from individual cameras has been introduced by *QSI Systems*. This unit, the PCID-864, clips to the camera operator's belt and, when plugged into a camera, adds an 8-character ID into the vertical interval of the camera video. The unit is powered by a 9V battery.

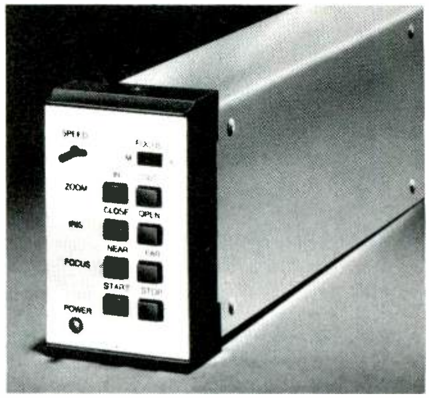
In operation, the PCID-864 can also be used to identify live news feeds from individual helicopters or vans when a station has more than one crew sending to a steerable antenna. The unit instantly labels every EJ camera and VTR in use.

Circle (501) on Reply Card

PC board repair kit
Circuit-Fix from *Datak* is a repair kit with adhesive copper donuts, foil, knife and a patented (pending) combination clamp and cutting guide. The clamp-guide simplifies cutting conductor traces to as thin as 0.012-inch. The tool is opened with one hand while adhesive copper foil is slipped in place. The width is adjusted by hand while checking with a machinist's scale. The clamp-guide securely holds the foil, gives a true straight edge and keeps the blade perfectly vertical during the cut. Repairs are made by pressing the trace onto the PC board, cutting off the excess with a knife and adding donuts (terminal pads) where required.

Circle (503) on Reply Card

Zoom lens control



Vicon Industries has introduced the Auto Focus zoom lens control system, which provides an automatic positive focus without external sensors. Auto Focus relies upon signals within the camera itself, not on information from an offset pickup. Simple push-button operation provides a more efficient method of rendering focus in any lens regardless of focal length or aperture.

Circle (504) on Reply Card

Transmitter combiners for microwave TV
Series 4630(4) quadraplexers from *Microwave Filter* combine the four channels in any ITFS group: groups A through H (2500 to 2700MHz). Loss per channel is less than 1dB, power handling is 100W per channel and mutual channel isolation is 25dB. Connectors are 50Ω type N. Height is 18¼ inches above the 17" x 17" mounting plate and weight is only 40 pounds and 8 ounces. The 4630(4) may be wall-, floor- or panel-mounted.

Circle (505) on Reply Card

Tilt head
Vinten's new Cormorant 90 EFP pan and tilt head from *Listec Television Equipment Corporation* is automatically self-limiting, compensating the degrees of tilt to accommodate nearly any camera/lens combination. The Cormorant has a balance tilt range of 180 degrees. If a camera/lens combination has a 125mm (about 5 inches) vertical center of gravity, the unit balances to accept loads from 10kg to 33kg (about 22 pounds to 72.5 pounds). The load capacity can then be extended to 40 kg and the balancing mechanism will automatically limit the tilt angle to 120 degrees.

Circle (518) on Reply Card

Satellite TV receiver
Marconi Communication Systems offers a compact satellite TV receiver

The ingredients of Varian's new S-Tube bring super-high efficiency.

Varian's new "S-Tube" klystron operates at super-high efficiency—translating to significant savings in electric utility costs for UHF-TV broadcasters. The new S-Series, 5-cavity klystron provides significant improvement in operating efficiency through a unique configuration of tuning and cavity loading.

Efficiency-tuned for 10% improvement.

The new S-Series klystrons are tuned to maximize efficiency while maintaining useful gain. The Q of the second cavity is reduced by external loading and the output cavity is optimized by use of a variable visual coupler. These tubes will provide efficiency improvement of up to 10 percentage points over current high efficiency types when used under equivalent conditions.

Interchangeable with Varian H-tubes.

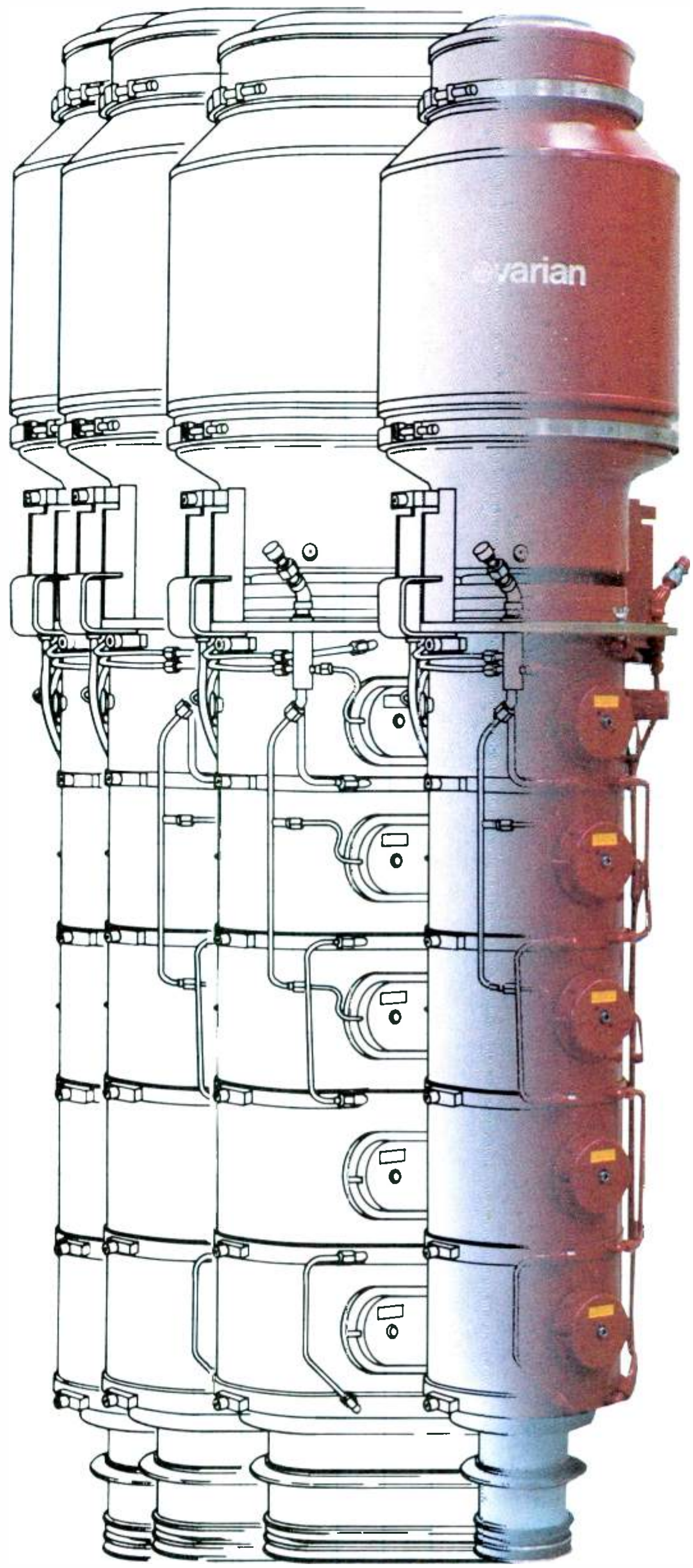
The most practical aspect of the new S-Series tubes is the complete interchangeability with the Varian VA-953H-Series tubes, providing broadcasters maximum flexibility in planning new equipment acquisitions.

More information on Varian's new S-Tube is available from Varian Microwave Tube Division, or any Electron Device Group worldwide sales organization.

Varian Microwave Tube Division
611 Hansen Way
Palo Alto, California 94303
Telephone: 415•424-5675

Varian AG
Steinhauserstrasse
CH-6300 Zug, Switzerland
Telephone: 042•23 25 75

varian



Circle (117) on Reply Card

that is only 44.5mm thick. Model P3400 has been designed for high quality, cost-effective reception of the new European satellite TV transmissions beamed from satellites, such as the ECS and Intelsat series. Primary users are likely to be cable system operators and telecommunication organizations, but the receiver is also intended for other professional users, such as broadcasting organizations, hotels and conference centers, language teaching institutes, military bases and offshore installations.

Circle (519) on Reply Card

Accu-weather forecasts from The Source

Weather forecasts from *Accu-Weather*, are now available on The Source. These reports detail the upcoming weather for the country as a whole, for specific regions of the country, and for the 15 largest metropolitan areas in the United States. Also, more than 100 specific city forecasts will be provided giving high and low temperatures and weather conditions for the three days ahead. Weather information is also available for more than 40 cities around the world. From November through March, Accu-Weather will provide on The Source detailed forecasts of weather-related hazards on major U.S. highways. Accu-Weather reports will be updated twice daily or more often if necessary.

Circle (520) on Reply Card

VCR/monitor system

Panasonic Industrial Company has introduced a compact, self-contained VCR/monitor TV combination unit designed for high-quality video presentations. The CT-130V comes equipped with a 10-function wired remote control keypad. Operational modes include noise-free still playback, 8-hour recording/playback capability and editing functions. The monitor has a bright, clear 13-inch diagonal screen. Panabrite control and picture sharpness control allow the user to fine-tune image quality.

Circle (521) on Reply Card

Disappearing tape

One of our biggest problems with tape, it seems, is that it disappears just when we need it most. A new tape from *Arlon Products* is water soluble, is highly conformable and is durable. The tape can be dipped in solder and washed off in hot water, protecting desired areas without problem. The tape is also static-free and leaves no residue to impair the protected surfaces.

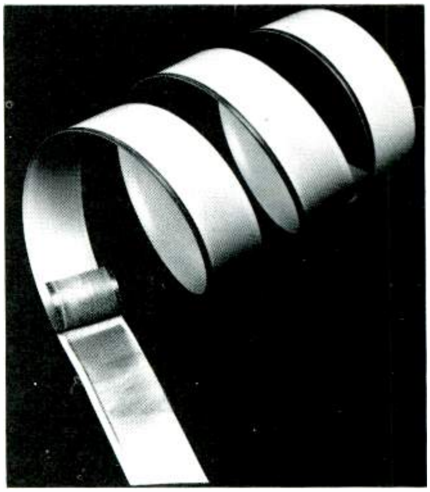
Circle (523) on Reply Card

3½ Digit DMM

The DM-8010 rotary switch 3½ digit DMM, by A.W. Sperry, has a built-in tilt stand, instant continuity buzzer, auto zero, auto polarity, overload protection on all ranges, 500V ac/dc protection on all resistance ranges, diode test function low power ohms for in-circuit resistance measurement, recessed safety designed input jacks and basic dc accuracy of 0.25% reading.

Circle (502) on Reply Card

Peelable ground plane cable



Belden Electronic Wire and Cable is offering a peelable ground plane cable which assures easy termination by eliminating the need for special equipment to separate the mesh from the insulation. This controlled impedance cable aids in reducing crosstalk and may be used as an interface cable on personal computers and peripheral equipment. The temperature rating of the cable is 105°C; its insulation resistance is 10^3 MΩ (10-foot sample); it passes the UL VW-1 vertical flame test.

Circle (512) on Reply Card

Modular time code

Amtel Systems, the U.S. distributor for Evertz Microsystems time code products, announces the EV Bloc System, a versatile modular time code and control system. By selecting only the necessary modules, a user can create a *custom* time code/control system from our off-the-shelf modules. On-board intelligence in each microprocessor-based module allows them to operate independently or as an integrated system.

Circle (514) on Reply Card

Cable reels

Canare Cable has introduced a line of cable reels, which are constructed of extremely durable tubular steel, with an E-shaped brace, and which include heavy-duty, permanently lubricated bearings. These reels are further tested with sustained vibration

New Schneider TV Lenses
Continuing the tradition of quality and reliability

A complete line of TV lenses for studio, field and ENG/EFP combines Schneider quality with advanced technology.

The newest addition to the studio and field lens line, is a 14.5x zoom which features improved color correction, low geometric distortion and high MTF. The studio/field lens line includes 15x and 30x lenses for 1¼", 1" and ⅔" formats.

In ENG/EFP lenses, the lightweight 14x zoom with built-in 2x extender is now being used by all leading camera manufacturers. Ruggedly designed, it features 3 built-in zoom ranges (9-126mm; 18 to 252mm, with 2x extender; 6.3 to 9 mm superwide with aspheric attachment).

Contact us today for a demonstration.

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✉ 947, D-6550 Bad Kreuznach, ☎ (06 71) 60 10, Telex: 42 800

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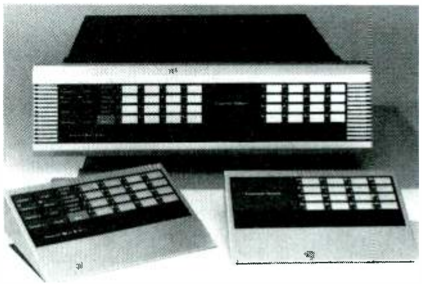
Circle (133) on Reply Card

Schneider
KREUZNACH

to ensure protection against abuse in transportation. All models include a 3-position brake lever. In locked position, the reel will not rotate. In the soft-brake position, cable can be pulled from the reel, but friction prevents excess spillage when cable is pulled quickly. In the free position, the cable will pull from the reel easily.

Circle (515) on Reply Card

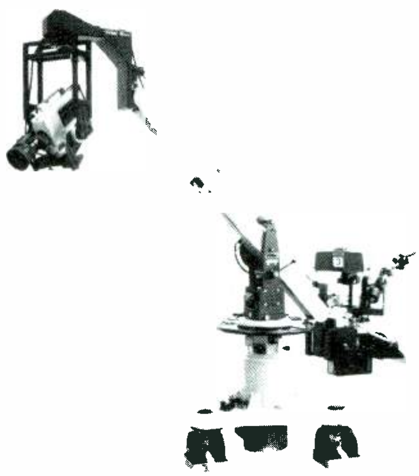
Audio routing/mixing system



The *IMS* model 200 Smart Switcher audio routing/mixing system can be configured in matrices including 32x8, 8x32 and 16x16 in a 5¼-inch frame including power supply. Matrix configurations are in groups of eight, and can contain up to 256 crosspoints per frame. The matrix can be expanded up to 128x128, with up to 32 control stations. The unit is available with both local and remote control panels to access the matrix. The switcher can be structured in multilevels and is easily field upgradable.

Circle (516) on Reply Card

Camera crane



Vinten's Merlin Arm is a low-cost camera crane designed to allow flexibility and freedom in lightweight ENG-type camera productions done in the studio. The camera is mounted separately at the upper end of the crane arm, with camera operator's pan and tilt controls at the rear. A 7-inch viewfinder with power supply and automatic tilting mechanism provides direct vision at any elevation. Zoom and focus controls are connected to the pan bar at the rear of the arm through extended cables. Stainless steel wire and a series of grooved pulleys provide immediate response through the camera operator's hand controls, which are in the standard and familiar configuration. The Vinten Merlin weighs 116 pounds without camera, viewfinder, power supply or counterbalance weights. It has a capacity of 30 pounds and an arm travel of 102 inches from high level to low level with the standard arm.

Circle (517) on Reply Card

Extra lightweight monopads

Gitzo has introduced two extra lightweight (16 ounces each), but solid ¾-inch diameter monopods. Each is supplied with hard rubber tip, soft cushioned platform, reversible ¼-inch to ⅜-inch screw, wrist strap and soft grip for firm, comfortable holding, minimizing vibration. The 3-section Mono Weekend has a range from 23 inches to 63 inches, the 4-section Mono Weekend-Luxe from 19 inches to 64 inches. Both are available with handgrip instead of standard platform, to be used as walking sticks. Deeply anodized (1/10 mm), corrosion-proof extensions glide smoothly, lock firmly on fiber sleeves (no metal on metal) and with soft-cushioned locking rings.

Circle (513) on Reply Card

Portable video cameras

Panasonic Industrial Company has introduced a pair of versatile new portable cheek rested color video cameras that are designed for low-light applications to capture high-quality video images. The WV-3040 and WV-3050 feature f1.2 lenses, auto white balance and 6X power zoom lenses.

Circle (522) on Reply Card

SCA carrier

CRL Audio has introduced the new SCA300A model, which has an adjustable carrier frequency with no nulling or balancing and a low distortion quartz crystal-controlled oscillator. The SCA300A can be used for a variety of applications: paging, music, data and telemetry. The SCA 300A has an upgraded VCO response to accommodate a wide range of signals. The unit comes with both a standard D (RS232) connector and a BNC connector for insertion of digital or FSK signals directly into the modulator. Linearity is excellent and an advanced digitally synthesized carrier is used.

Circle (506) on Reply Card

Fiber-optic cables

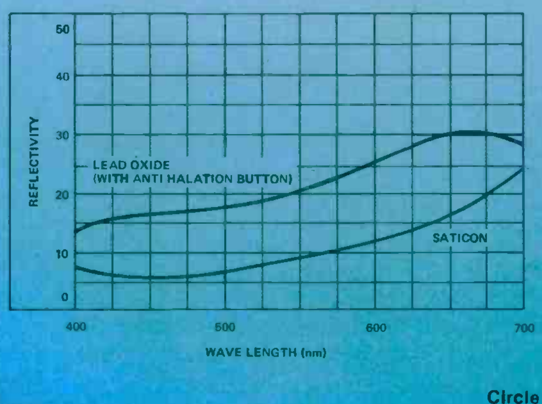
Hard-clad silica duplex fiber-optic cables are now available from Ensign-

To know how good your camera tube is, look it straight in the eye.

For better color pictures, compare the color of the photoconductors.

This simple comparison demonstrates why you'll get better broadcast quality with Saticon* II. The dark red faceplate of Saticon II shows its selenium-arsenic-tellerium photoconductor. The lighter reddish-yellow faceplate of the Plumbicon™ tube reveals its lead-oxide photoconductor.

This color difference indicates significant Saticon II advantages. Because the darker photoconductor absorbs more light, picture quality is enhanced. On the other hand, Plumbicon's lighter color photoconductor reflects more light at all visible wavelengths, as shown in the chart below.



Because Saticon II reflects less light, you benefit with reduced flare and less blooming. Low-light colors maintain their integrity and accuracy.

As a consequence, Saticon II does a remarkably good job of handling high contrast scenes in uncontrolled lighting conditions because of its low flare. What's more, Saticon II's photoconductor is a glassy, amorphous, high resistivity film. Its structure serves to ensure high resolution, high sensitivity and unmatched depth of modulation.

For more information on Saticon II, contact your RCA distributor or write to RCA Camera Tube Marketing, New Holland Avenue, Lancaster, PA 17603. Or call (800) 233-0155. In Penna., phone (717) 397-7661. Over- seas, contact RCA Brussels, Belgium. Sao Paulo, Brazil. Sunbury-on-Thames, Middlesex, England. Paris, France. Munich, W. Germany. Hong Kong. Mexico 16 DF, Mexico.

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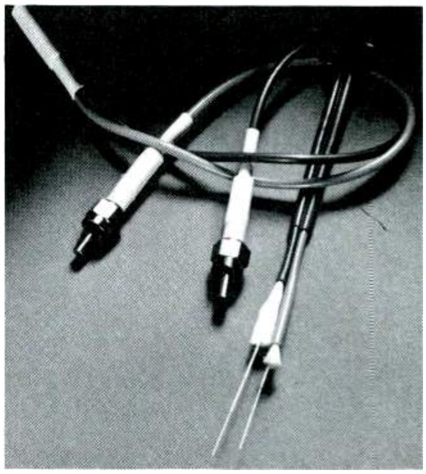
RCA

Take out the doubt.

Circle (121) on Reply Card

Circle (122) on Reply Card

Circle (123) on Reply Card



Bickford Optics and are offered in fiber sizes of 110/125, 120/140, 200/230 and 400/440. The cables, except for the 400 micron, have attenuations of 14dB or less and 8dB or less in 1.1km lengths. Jacketing materials include polyurethane, polyethylene, Tefzel, PVC and thermoplastic rubber. Cables can be supplied cut-to-length and terminated ready to be plugged into a system.

Circle (511) on Reply Card

High resolution character/ graphic display monitors

Hitachi Denshi America is offering two high resolution color monitors designed specifically for biomedical, industrial and computer display applications. Model CU-1420 has a 14-inch CRT and model CU-1220 has 12-inch CRT. Both models have a resolution of 540 lines, a dot pitch of 0.31mm and weigh 26.4 pounds. The switchable comb filter in these monitors make them suitable for computer and graphic use.

Circle (507) on Reply Card

Digital storage oscilloscope

Leader Instrument's LBO-5825 is equipped with 2K word memory, has a 5MHz maximum sampling rate and pre-trigger view capability. X-Y recorder output terminals are provided for use with a plotter, and simultaneously display of real time and stored waveforms are possible. Other features include roll function, memory protect, external clock provision and automatic chop/alternate model select. This storage oscilloscope is suited for such applications as stress analysis, shock and vibration testing, power-line transient monitoring and computer glitch problems.

Circle (510) on Reply Card

Video processor

ICM Video's new automatic video processor, the VC-2500P, regenerates all video synchronizing signals and has video AGC and video clamping. The device can solve most stability problems such as: picture jitter, bending, rolling and satellite receiver flicker. At the same time, it can maintain the video level correctly at 1V peak to peak.

The VC-2500P is useful ahead of CATV and MATV video modulators to prevent over/undermodulation problems and maintain stability.

Circle (509) on Reply Card

Audio distribution system

The *Bonneville* PC-2 audio distribution sytem is suited for use on location at media-covered events, such as press conferences, sporting events and conventions. It also provides a means of providing pool press coverage in courtrooms. The PC-2 works to provide isolated feeds at any production assignment in the field. Up to 16 microphone or line-level outputs are provided from a single line input.

Circle (508) on Reply Card

Bar/dot mixer

Vii's model 17 bar/dot mixer develops bars and dots to be used in testing scan linearity in TV cameras. The generator mixes a reference pattern onto the camera video signal for comparison with a linearity test chart viewed by the camera under test. Position and spacing of the bars and dots patterns are fully adjustable for convenient match to the video image of the test chart. The mixer is designed for operation at the 525/60 scan rate, but also is usable at other scan rates.

Circle (550) on Reply Card

Don't wade through 1000 different product brochures...

Use BE's Spec Book instead!

Broadcast Engineering's 4th Annual **Spec Book** is designed to save you valuable time. And that makes it an essential tool for any broadcast equipment buyer.

Comprehensive Equipment Listings

Spec Book provides reliable specifications on nearly 1,000 different broadcast and broadcast related products, making it the industry's **only single-source equipment comparison reference encyclopedia.**

Spec Book is Unique

Spec Book is vastly different from buyers' guide directory issues, because it lists performance specifications, model numbers and special product features.

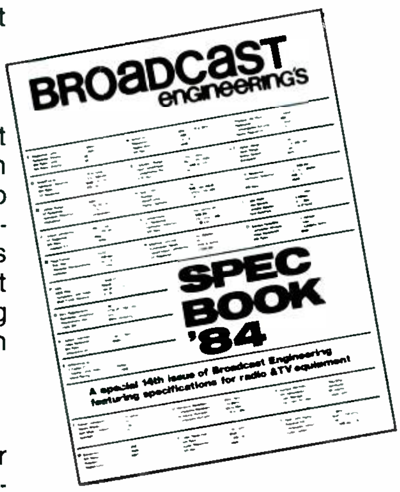
Easy-to-Read

Spec Book's convenient format developed from your feedback on past Spec Books, allows you to gather information quickly and efficiently. This way, you spend less time searching through product literature, and more time studying valuable equipment comparison data.

Spec Book Also Includes:

—Reader service numbers—for each listed product. So you can request additional manufacturer information quickly and easily.

—How-to editorial—hands-on technical articles designed to help you stay informed on the latest technology. Expertly edited by BE's radio and television editors, both FCC-licensed engineers.



SPEC*TACULAR Reader Contest

Spec Book is a proven winner with equipment buyers like you. And now you can be a winner, too! With the **2nd Annual SPEC*TACULAR Reader Contest.**

On the front cover of the forthcoming **Spec Book** you'll see 25 sections of equipment specs carefully selected from inside the issue. If you can match the cover specs with their exact location inside **Spec Book,** you can win one of two Studer ReVox B225 Compact Disc Players—valued at over $1,000 each. The B225 is suitable for home or broadcast use and performs every programming function imaginable.

You'll find complete contest rules and an entry blank inside the **4th Annual 1984 Spec Book.** Don't miss your chance to win—enter the **Spec Book SPEC*TACULAR Contest!** And watch for this valuable issue coming to you in **November.**

Circle (124) on Reply Card

business

Westpark Communications, Arlington, TX, has been named as a new distributor for Ikegami black-and-white, closed-circuit televisions and monitors, Westpark president Gene Ware has announced. Westpark Communications manufactures drive-through and communication systems for some of the restaurant industry's largest chains.

Modulation Sciences, Brooklyn, NY, which designs and manufactures equipment for the broadcast industry, provided KTCA-TV, Minneapolis-St. Paul, with the opportunity to demonstrate the benefits of stereo TV to its audience during a series of special stereo broadcasts over a 3-day period last month. Modulation Sciences supplied the Twin Cities Public Broadcasting outlet with a stereo TV generator, which puts full-range stereo on the station baseband. KTCA-TV began its stereo TV tryout with "An Evening at The Pops," featuring conductor John Williams and the Boston Pops Orchestra. The demonstration concluded with a "Live From Lincoln Center" broadcast, celebrating Johann Sebastian Bach's 300th birthday.

The management of **Acrodyne Industries,** Blue Bell, PA, has reached an agreement in principal with its parent company, **Whittaker Corporation,** Los Angeles. The agreement in principal provides for the purchase of a majority position in the company, by a group of investors, including present Acrodyne management. Whittaker Corporation will retain a minority equity interest. Acrodyne Industries is a manufacturer and worldwide distributor of transmitters and translators/transposers for the low- and medium-power TV broadcasting industries. Whittaker Corporation provides products and services for health care, energy, aerospace, marine and specialty chemicals markets.

Three new dealers have joined the **Logitek** sales network, including Logitek's first dealer in Canada. **Oakwood Audio,** based in Winnipeg, Manitoba, becomes Logitek's first Canadian dealer. Oakwood is a full-line broadcast dealer, with an additional office in Edmonton. Logitek has also added two domestic dealers. **Jim Walters Company** will handle Logitel products in Honolulu, and **Hall Electronics,** Boise, ID, will cover the Northern Rocky Mountain area.

Tektronix, Beaverton, OR, has announced an extended warranty period for 650HR and 690SR color picture monitors. The warranty period for Tek's 650HR series and 690SR series monitors has been changed from 12 months (15 months under OEM terms) to 36 months for all units. Other terms and conditions of the warranty remain unchanged. The 3-year warranty applies to any Tektronix TV picture monitor or associated interface module shipped (invoiced) after Jan. 1, 1984.

Allied Film & Video, Detroit, has purchased 12 Ampex VPR-3 VTRs for installation in its various post-production facilities in four major U.S. cities. The 12 machines, valued at more than $1 million, will be distributed among Allied installations in Detroit, Chicago, Dallas and a sister company in San Francisco, Diner + Allied Film & Video. James Merkle, Allied vice president and general manager, said the company also recently took delivery of 10 Ampex VPR-80 1-inch VTRs for its film-to-tape transfer and tape duplication activities.

After a successful 1984 NAB introduction, orders worth $650,000 for nine Harris HDE digital video effects systems have been received by the Studio Division of **Harris Corporation,** Quincy, IL. According to Roger Burns, division director of marketing administration, orders were almost evenly divided between TV broadcast stations and TV production companies. Deliveries began in May. The system is available in three configurations, depending on the type and number of effects desired. It emphasizes a building block concept that allows small- to medium-sized stations and teleproduction facilities to achieve a professional look in video effects with systems starting at less than $50,000.

A revised organization has been announced by **3M's** Optical Recording Project, affecting manufacturing, sales and marketing functions for videodisc and data products. The purpose of the changes is to centralize the management of all activities, according to Dave Davies, project manager. The previously separate technical and manufacturing activities have been combined under the overall management of Richard Anthony, who has been appointed project manufacturing manager. He is located at 3M's worldwide headquarters in St. Paul, MN. The project technical facilities are located at Mountain View, CA, and Vadnais Heights, MN, and the manufacturing plant at Menomonie, WI. Separate sales functions existed for video and data products, and these have now been combined into one sales function, with Frank Price appointed national sales manager. He was formerly sales and marketing manager, videodisc products. Separate marketing functions also had existed for the two product lines, and these have been combined, with Mark Anderson named project marketing manager for all products. He previously held the position of market manager, Electronic Systems Program, Office Systems Division.

Another record-setting 41.8km span of **Siecor** optical cable has been placed in service by MCI. As part of the recently completed MCI Tampa to Orlando system, one of the five high-capacity 405Mb transmission spans set a record of more than 40km without a regenerator. The 22-fiber, single-mode optical cable was installed in ducts and direct buried along a railroad right of way. A single pair of these fibers is capable of carrying more than 6000 simultaneous voice circuits. The extra-long 5km cable lengths supplied by Siecor were spliced together by MCI crews using the Siecor M67-OSM single-mode fusion splicer.

RCA Astro-Electronics, East Windsor, NJ, announced the signing of a contract in excess of $260 million to design and build an Advanced Communications Technology Satellite (ACTS) and supporting ground stations for the National Aeronautics and Space Administration's Lewis Research Center, Cleveland. One of the primary goals of ACTS is to make available to public and private sectors alike—corporations, universities of the ACTS spacecraft and ground systems for experimentation. The ACTS satellite launch is currently scheduled for 1989 aboard the space shuttle.

Convergence Corporation and **Lucasfilm** announce the opening of a Los Angeles demonstration facility for EditDroid. Introduced at the NAB Convention last May, EditDroid is described as "an old approach to editing using new technology." Deborah Harter, product manager, expects several of the first systems shipped in December will be delivered in Los Angeles. The EditDroid system is located at The Egg Company, 3855 Lankershim, North Hollywood, CA 91604; 818-505-0044.

people

Crown International, Elkhart, IN, has announced the addition of **Bill Raventos** as microphone product director. Previously, he was director of technical services for Ringling Brothers Barnum & Bailey Circus at their Circus World theme park in central Florida. He also worked for Electro-Voice in marketing and new product development of professional microphones and monitor speakers, and later was responsible for development and marketing of acoustic test equipment at Ivie Electronics.

Harry E. Mahon has been promoted to the top spot in VideoStar's Broadcast Services Division. He will be based in VideoStar's Atlanta office. Mahon recently served as manager of broadcast sales in VideoStar's New York office, where he was responsible for broadcast sales and service in the Eastern region.

Satellite Communications Network, Edison, NJ, announced the appointment of **Gordon L. Robertson** as general manager. Robertson had been SCN's manager of technical operations since May 1982, responsible for all engineering and operations functions of the company's three earth station facilities.

Clifford J. Eggink has been appointed president of Robert Bosch Corporation, Video Equipment Division, Salt Lake City. Before coming to Salt Lake City, Eggink served as general manager of the New York-based Robert Bosch Electronics Division.

Modulation Associates, Mountain View, CA, a manufacturer of satellite communications equipment, announces that **Donald H. Haight** has joined the company as president and chief executive officer. Haight comes to Modulation from a 10-year management career with Ampex, where he was general manager of the Audio and Camera Products groups and director of marketing for the Video Systems Division.

Convergence, Irvine, CA, welcomes **Steve Di Franco** as manager of sales for the New York office. Di Franco takes over for **Monique De Vusser,** who moves into the position of Western regional sales manager. Di Franco previously was a video systems salesman for Technisphere Corporation, New York.

Audiotronics Corporation, North Hollywood, CA, has announced the appointment of **Diane M. Pollock,** manager, advertising and public relations. She was most recently with Graphics Network, Los Angeles.

California Paltex Corporation, Tustin, CA, has announced the promotion and appointments of three regional sales managers. **S. Douglas Sorensen,** who has been with the company for two years, has been promoted to Eastern region sales manager. **Joseph L. Cirincione** will serve in that capacity for the Central region, and **Gary L. Carter** takes over the Western region.

Compucon, Dallas, a subsidiary of A.C. Nielsen Company, announces the appointment of **Scott Goldman** as director of business development for Compucon's Communications Services.

Broadcast Systems, Austin, TX, announces the appointment of **Leonard J. Barreca** as the Great Lakes and Midwest regional sales manager, and **John Duggin** as the West Coast regional sales manager. Barreca has several years experience with Sony Corporation, Hitachi and Central Dynamics Corporation. Duggin joins BSI from Hoffman Video Systems, where he just completed the design and sale of two production studios for a major cable system.

Thomas E. Mintner has been appointed vice president and general manager of Studer Revox America, Nashville, TN. Mintner has served as director of Studer Products at the company since 1982, and he will continue to direct all Studer division activities in his new position.

Nortronics Company, Minneapolis, has announced the addition of **James D. Kuhn** as national sales manager of its Consumer Products Division. Most recently, Kuhn has been employed as a regional sales manager for True Temper Corporation and the WD-40 Company.

Charles D. Oesterlein has been appointed manufacturing director of the Magnetic Audio/Video Products Division at 3M, St. Paul, MN. Oesterlein previously was plant manager at Weatherford, OK, and before that held a similar position at Camarillo, CA. He is a 19-year veteran of 3M, having joined the company in 1965 as a product development chemist.

Data Communications, Memphis, TN, announces the promotion of **Doug Rother** to vice president, Corporate Marketing. He will assume all marketing activities of the company, including planning and product development. He formerly held the position of manager, Market Research, Broadcast Division, and joined DCC in 1974.

Ampex Corporation, Redwood City, CA, has appointed **Donald B. Macleod** business manager for small format systems. Macleod has served in a number of key engineering and marketing posts during his 25 years with Ampex. Most recently, he was a senior product manager in the company's International Division. In his new post, he will assume responsibility for the existing Ampex ARC M-format products.

Bill Powers has been promoted to vice president, sales, Sony Broadcast Products Company, Park Ridge, NJ. He will be responsible for coordinating Sony Broadcast's national sales organization, which markets a complete line of audio and video equipment for broadcast stations and production use. Powers joined Sony Broadcast in 1982 as Southeast regional manager. Before joining Sony, Powers was director of engineering at Cox Broadcasting's WSB-TV in Atlanta.

The election of **Walter H. Braun** to the new position of vice president, Systems Engineering and Program Management, RCA American Communications, Princeton, NJ, was announced by James J. Tietjen, president. Braun is responsible for the design, procurement, installation and overall program management of RCA Americom's satellite and terrestrial communications systems.

Michael Greene and **Lawrence J. Thorpe** have been promoted to new positions in product development, Sony Broadcast Products Company, Park Ridge, NJ. Greene has been named director, video recording management. Thorpe, formerly manager of studio products, has been promoted to director of this area.

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DREAM POSITION: Chief Engineers, this is the position you have always wanted. Excellent pay, challenging work with the latest equipment, one of the most beautiful places in the world to live, excellent benefits. Only the most highly qualified need apply with full details to Dept. 627, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 10-84-1t

ENGINEER: Excellent opportunity for experienced engineer to create a state-of-the-art facility. Knowledge of high power FM transmitter and all phases of studio construction a must. Submit resume to WEZS-FM, 121 Wyck Street, Richmond, Virginia 23225. No phone calls please. 10-84-1t

HELP WANTED (CONT.)

UNIVERSITY OF NEW HAMPSHIRE: PROFESSIONAL, ADMINISTRATIVE, TECHNICAL VACANCY. TITLE: Chief Studio Engineer (Studio Engineering Supervisor). **RESPONSIBILITIES:** Under supervision of the Director of Engineering, to be responsible for overall engineering operation, maintenance, and budget control for all studio and engineering facilities. Directly supervise Operations Crew Chief, Maintenance Crew Chief, and studio engineering staff of 10. Will assist Director of Engineering in planning and designing new studio facilities. Implement intensive training and preventive maintenance program. Be able to challenge and lead a dedicated, competent professional team for maximum performance. New Hampshire Public Television is a growing organization located on the New Hampshire seacoast—60 miles north of Boston. **MINIMUM QUALIFICATIONS:** First Class or General Class FCC Radiotelephone license, 5 years experience in broadcasting or related field 2 of these years in an administrative capacity, preferably as an Assistant or Chief Engineer. Associates Degree in Electronics or equivalent. **SALARY:** $20,230 to $31,520; normal starting salary not to exceed $22,710. **APPLICATION DEADLINE:** October 15, 1984. **SEND RESUME DIRECTLY TO:** New Hampshire Public Television, Attn: John W. Gray, Director of Engineering, Box 1100, University of New Hampshire, Durham, New Hampshire 03824. 10-84-1t

EXPERIENCED ENGINEER: VHF network affiliate in Texas medium market with excellent facilities seeking experienced engineer ready to move up. Please send resume to: Dept. 626, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 10-84-2t

ASSISTANT CHIEF ENGINEER: UHF, net affiliate looking for quality oriented candidates with 3-5 years of broadcast TV maintenance experience. Must have solid background in electronics: solid-state, digital and linear. Transmitter experience or strong aptitude required. Must have excellent background in studio and control facilities maintenance. Salary range from 20K-25K, depending on experience. Send resume to: Ken Johnson, Chief Engineer, WHAG-TV, P.O. Box 310, Hagerstown, MD 21740. No phone calls. EOE Minority candidates encouraged to apply. 9-84-2t

VOA

VOICE OF AMERICA...

is seeking Radio Engineer/Broadcast technicians for its domestic relay stations (Delano CA., Dixon CA., Bethany OH., Greenville NC.). Technicians are responsible for the operation, maintenance, repair and redesign and fabrication of equipment for one of the world's most highly complex radio broadcasting systems.

Requirements:

- 6 years of experience as a technician, Instructor, Inspector, mechanic (civilian or military) which shows progression in theoretical and practical knowledge of electronic theory.
- Ability to operate various types of high/medium and short wave transmitter systems with power outputs of up to 500 kw.
- Ability to service, maintain and install transmitter and receiver systems and associated equipment.
- FCC License and experience in a broadcast facility highly desirable.
- Education may be substituted for experience.

Salary ranges from $23,199 to $25,489 depending upon qualifications.

Send resume to: Voice of America, Suite B-18, Post Office Box 1625, Washington, DC 20013.

US Citizenship required, a thorough background inquiry may be necessary. Voice of America is an equal opportunity employer.

CHIEF ENGINEER: FULL POWER INDEPENDENT in Midwest is searching for a chief engineer or a strong #2 man ready to take charge. Extensive studio/UHF operational experience necessary. Knowledge of ¾" equipment required. Strong organizational/managerial skills a must. Responsibility for additional UHF stations is a possibility. Qualified applicants call: Don O'Connor, General Manager, KCBR-TV, Des Moines, Iowa 50321, (515) 284-1717. AN EQUAL OPPORTUNITY EMPLOYER. 10-84-1t

CHIEF ENGINEER wanted for AM/TV public broadcast station in Bethel, Alaska. If you have extensive experience overseeing, maintaining and repairing transmitters, microwave, VTR's, cameras, switchers and translators, this may be the opportunity you've been waiting for. Smalltown atmosphere on one of the greatest salmon rivers in the North; bring your FCC General Class license and expertise to the Great Land. Salary commensurate with experience. Deadline for applications is 9-1-84. Send resumes to Jerry Brigham, General Manager, KYUK TV/AM, P.O. Box 468, Bethel, Alaska 99559. EOE. 9-84-2t

NATIONS ONLY INDIAN 100,000 watt community licensee seeks chief engineer. Need a committed individual willing to relocate to the Pine Ridge Reservation in South Dakota and work with Indian people. Salary negotiable. Send resume to KILI Radio, P.O. Box 150, Porcupine, South Dakota 57772. 10-84-1t

TELECOMMUNICATIONS: TOP TELECOMMUNICATIONS FIRM seeking experienced talent in video-based systems integration. Positions available require 5 years experience in the video systems industry with knowledge of both industrial and broadcast level equipment. • SALES MANAGER • SYSTEM SALESPEOPLE • SYSTEMS ENGINEERS/DESIGNERS • PROJECT COORDINATORS. Positions offer exciting and challenging career opportunities and excellent company benefits. Send resume to FRED POWERS, CENTRO CORPORATION—9516 Chesapeake Drive, San Diego, CA 92123—No telephone inquiries accepted. 10-84-1t

IMMEDIATE OPENING FOR TV Maintenance Engineer with a minimum of one year experience in maintaining TV Studio Equipment. KBIM-TV is an equal opportunity employer. Send Resume to Gene Rader, KBIM-TV, P.O. Box 910, Roswell, N.M. 88201. 10-84-2t

VIDEOTAPE MAINTENANCE ENGINEERS, VIDEOTAPE OPERATORS. AMPEX 2", 1" TYPE C and ¾" BVU EQUIPMENT. Immediate openings for experienced personnel. Please reply to: TOM MONJACK, 1541 North Vine Street, Hollywood, CA 90028, (213) 460-2112. 9-84-2t

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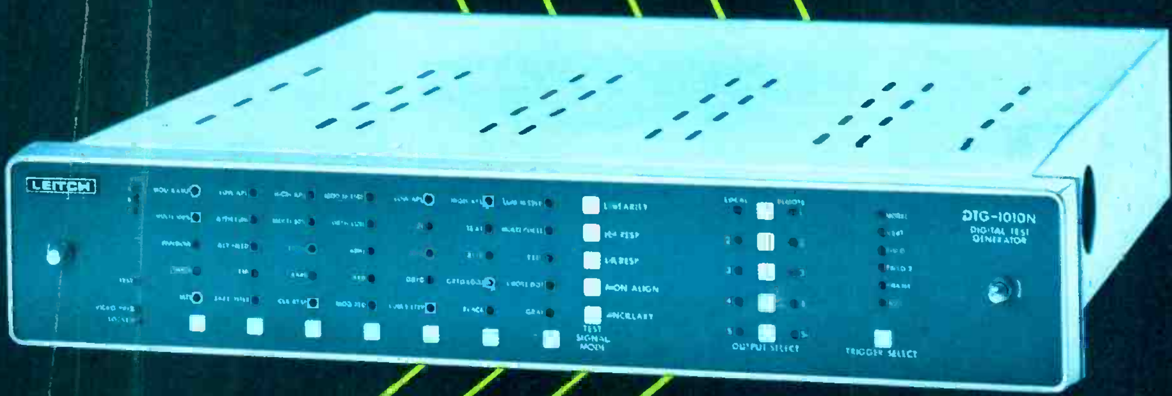

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