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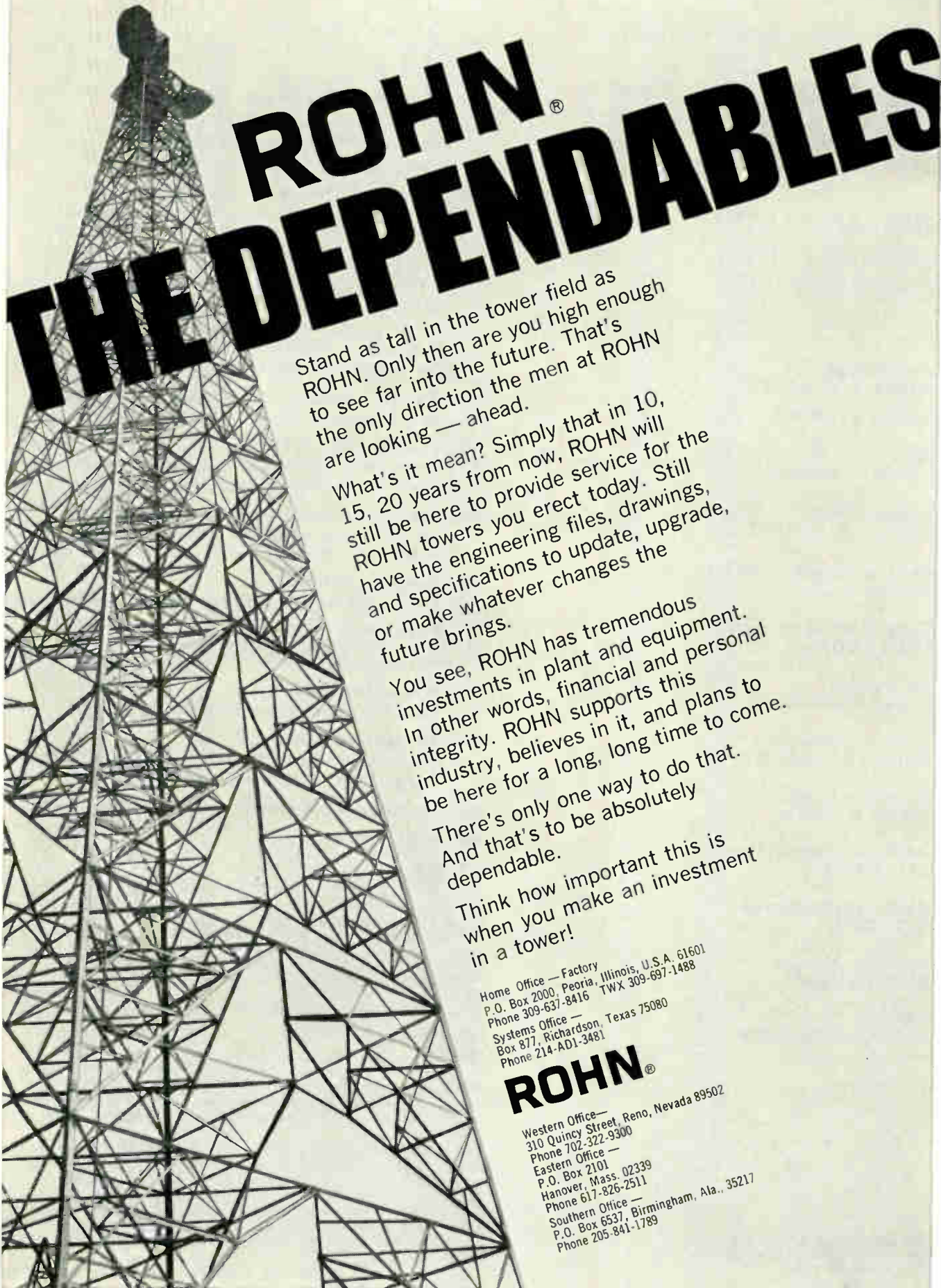
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BROADCAST
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Co-Publishers:
HAROLD. H. SHORT
JAMES A. LIPPKE

Editor:
JAMES A. LIPPKE

Assistant Editor:
ALBERT P. LAHNDT, JR.

Broadcast Consulting Editor:
VERNE M. RAY

Cable Distribution Contributing Editor:
LON CANTOR

Art Director:
SUSAN CUTTLER

Production Manager:
ARLINE G. JACOBS

Circulation Director:
JAMES R. ASTOR

Advertising Services Manager:
JILL FISHER

Reader Service Manager:
R. R. BELL

Promotion Manager:
OREN HELMING

President:
RALPH RICHARDSON

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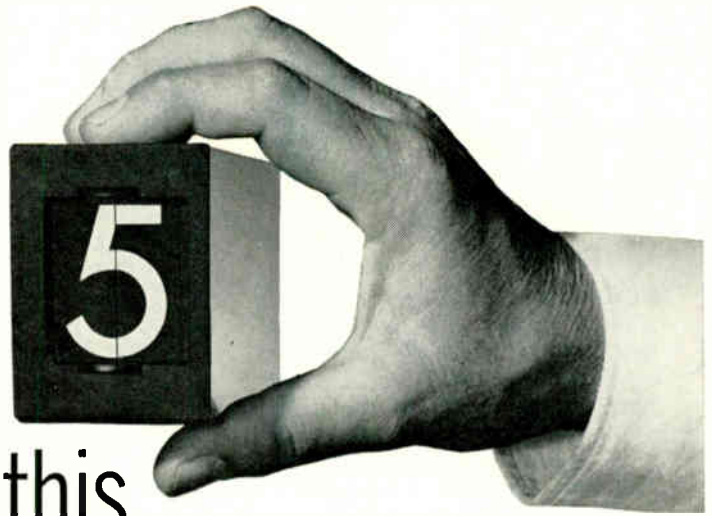
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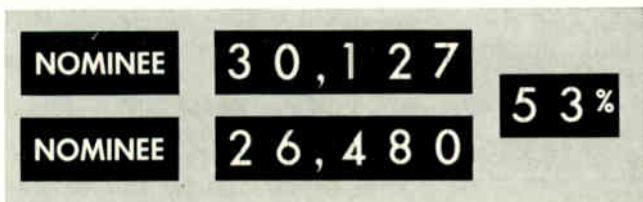
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This month's cover: The TV networks will be transmitting signals domestically within two years. Plan now to be first. It's easier than it looks here. See page 35.

Look what your cameras can do with display units like this

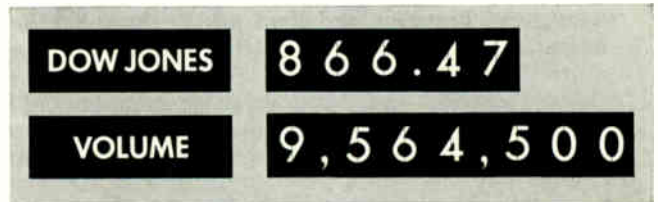


CBS Laboratories' Digital Display Units are part of a low cost, compact system that works daily wonders in any size TV studio!



ELECTIONS—No contest.

These modular units were designed specifically for TV use to give optimum clarity up to 70 feet — from any camera angle up to 145 degrees.



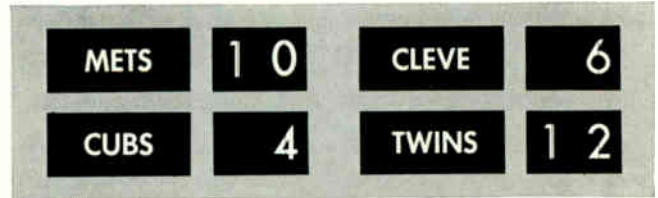
STOCK REPORTS—Excellent for the long pull.

Rugged electro-mechanical operation is fool-proof and built to last. No bulb burn-out or the other problems of rear-illuminated displays.



WEATHER—Cool operation.

Only 2.7 watts required per unit, with no power between postings. Glare-free even under the strongest lighting conditions.

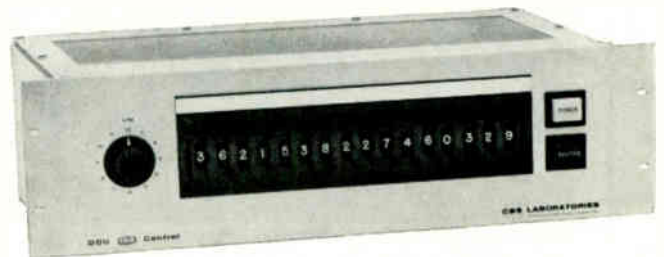


SPORTS—An easy set-up.

Just stack these units in a flat to suit any requirement. Custom designed matrix wiring also available for complete flexibility.

And all operated by one Controller that can handle 192 units — as many as 12 groups of 16 units each. This means up to 12 two-candidate election races; or runs, hits and errors for all major league teams; or 40 local stock issues plus volume and Dow Jones closing. A one-time investment for the professional way to take care of all your daily display needs.

Our engineers will even design your system for you. Don't take our word for it. Write or call us collect (203) 327-2000, and let us show you.



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BROADCAST INDUSTRY NEWS

Updating NAB Convention

FCC Chairman Rosel H. Hyde will address the management luncheon of the NAB Convention on Tuesday, April 2 . . . "New Fm Horizons" will be the theme of the special fm session on Sunday, March 31st, the Convention's Fm Day. National Association of Fm Broadcasters will be in charge of the morning session and NAB will program afternoon meeting. To be discussed: growing use of fm car radios, operations in both small and large markets by newer stations, and new technical developments including translators, on-channel boosters, and dual polarization . . . It is expected that more than 5000 radio and television executives and 3000 representatives of affiliated organizations will make this year's

convention the greatest ever. The broadcast equipment display will cover a total exhibit space of 54,000 square feet.

Other News from NAB

Howard H. Bell resigned as director of the NAB's Code Authority as of January 31st to become president of the American Advertising Federation, replacing retiring president Charles Collier . . . NAB Board of Directors has re-elected unanimously Everett E. Revercomb to his 13th consecutive one-year term as the Association's secretary-treasurer . . . The NAB has asked the FCC to trim down its program logging rules for a-m and fm radio stations making them compatible with the simplified logging requirements that now apply to television . . . The 44-man Board of Directors

of the NAB held its semiannual meeting at the Far Horizons Hotel, Sarasota, Florida, from January 22 through 26. On the agenda: review of current problems in self-regulation under NAB's Radio and Television Codes, consideration of proposed amendments to limit the number of consecutive commercials to four within programs and three within station breaks, and a discussion of the impending Supreme Court review of the FCC's Fairness Doctrine.

CCTV Sales Up

Sales of closed circuit television and supporting equipment increased 4.5 percent during the first three quarters of 1967— from \$17.6-million in 1966 to \$18.4-million in 1967, the Electronic Industries Association Marketing Services Department reports. CCTV cameras showed the largest gain: 8.8 percent; while sales of video monitors showed only a modest 0.3 percent gain. CCTV supporting equipment sales increased by 0.4 percent.

CCTV Association Founded

The Closed Circuit Television Association has been founded in Chicago. Chairman pro-tem is G. George Fox, a pioneer in the field of CCTV and president of Fox International, a company engaged in worldwide construction of communications systems. The purpose of the association is to foster and develop training methods and technical improvements for education through the use of closed circuit television as well as to devise new uses and markets for the commercial field.

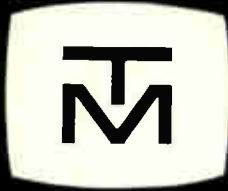
Conferences Set

The 103rd Technical Conference of the Society of Motion Picture and Television Engineers will be held at the Century Plaza Hotel in Los Angeles, May 5-10. An 85-booth equipment exhibit is planned by Exhibit Chairman War-

CAI Programming Made Easy . . .



Philadelphia School District coder/programmer Deborah Carynyk and teacher Alex H. Alexander prepare curriculum for computer assisted instruction system in central computer center at Philco-Ford Corporation's Willow Grove, Pa., plant. Curriculum for the Philco-Ford system, now in use in Philadelphia school teachers using special INFORM computer language that permitted them to prepare curriculum without special knowledge of programming skills.



The world's most precise broadcast sync generator!

(Proved in over 200 installations.)

The EIA Sync Generators in Telemation's TSG-2000 Series are more accurate—more stable—than any available. Here are some of the reasons why:

- All-digital design
- No monostables — no delay lines
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See Telemation's all-digital broadcast sync generators at the NAB Convention!
Booths D and E, Writing Room, Conrad Hilton Hotel

Other products on display:

New Color Film Multiplexer / New Black-Burst Generator / New Vidicon Camera

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ren Strang of the Hollywood Film Co., Hollywood. More than 3000 persons are expected to attend . . . The 3rd Annual Tape Cartridge Forum is set for June 21st in New York City.

Visual Announces New Vidicon Tube

Visual Electronics Corp. has announced a series of 1-inch electrostatically focused EEV vidicon tubes for use in transistorized film and live broadcast color cameras, military and space systems. The EEV type 8134 tube series utilizes an electrostatic focusing electrode requiring virtually no current, eliminating the need for a focus coil and its associated bulk and higher power consumption. The EEV 8134 is thus ideally suited for small, lightweight cameras where low-power consumption is essential. The EEV tube types are designated 8134 for monochrome applications, 8134-VI and 8134-VB for color film cameras, and 4493, 4494, 4495B for live color cameras.

Color Playback Disc Used in Rose Bowl

NBC-TV provided viewers with instant full-color slow-motion and stop-action playbacks of the Rose Bowl Game in Pasadena through use of the color video disc recorder playback unit newly devel-

oped by Visual Electronics Corp. offer instant full-color replay and The disc recorder is designed to stop action sequences with an added "plus" to viewers of eliminating somewhat "jerky" movements produced by conventional frame-by-frame recorders.

SCA Modulation Monitor Rules Amended by FCC

The FCC has modified its requirement that fm broadcast stations operating a multiplex subchannel under Subsidiary Communications Authorization install a type-approved SCA modulation monitor effective March 1, 1968 by extending the required installation date to January 1, 1969. The action was taken because the Commission did not believe the SCA monitors could be type-approved and delivered to customers in time for March 1st installation.

Anaconda Coaxial Cable Patented

Anaconda Wire and Cable Company has received a patent on the overlapped seam feature of their Sealomatic high frequency cable.

The cable, on which Anaconda has received Patent 3,315,025, is being used in CATV systems now being installed by Anaconda Astrodata Co., Anaheim, Calif. and major CATV operators. The pat-

ented feature has also been applied to cables consisting of twisted video pairs, Anaconda said. See page 49.

Reports Indicate Steady Growth For Fm

Fm radio stations authorized to broadcast in stereo have grown to 588 in the six years since such programming was first permitted, RCA reports.

An RCA survey shows that stereo broadcasts now are approved for nearly one-third of all U.S. commercial fm stations on the air. One or more stereo stations are located in 397 cities and towns, the study discloses. The count by states showed California in the lead with 66 stereo stations covering 35 state markets.

Gathered in New York, some 300 fm broadcasters recently got a look at new Electronic Industries Association statistics revealing continuing growth for fm. EIA Consumer Products Division Staff Vice President Jack Wayman said while speaking at the second New York Sales Seminar of the National Association of FM Broadcasters that in the first six months of 1967, the proportion of radios in the U.S. market with fm capacity attained 39.3 percent, the highest penetration ever recorded.

Georgia Tech Gets GE Multi-Vapor Lamps

Grant Field, gridiron home of the Ramblin' Wrecks from Georgia Tech, has been transformed into one of the best-lighted college football stadiums in the country by a new floodlight system using General Electric's 1000-W Multi-Vapor lamps. The new lighting made possible the regional color telecasting of the November 25th gridiron battle between arch rivals Georgia Tech and Georgia. The Multi-Vapor lamps were selected because of their compact light source size, high initial light output (90 lumens/W) and good color rendition.

CP Granted to WTOA

WTOA, 97.5 fm, Trenton, New Jersey, has been granted a construction permit by the FCC to increase its power to 100,000 W (50,000 horizontal, 50,000 vertical) making it New Jersey's

Continued on page 96

CRT Relics . . .



Dr. Philo T. Farnsworth's tubes, dating from 1927, include, left to right on the table, the first image dissector, first projection oscilloscope, a primitive image orthicon with electron multiplier and the first oscilloscope tube with a flat screen. Victoria Lynch of ITT holds the world's first oscilloscope with internal deflection plates.

how to stop fighting temperature problems... in your CATV system?

Let's face it! Environmental temperature changes still cause amplifier response changes in a majority of CATV distribution systems. Result? Poor signal fidelity . . . and a really bad headache since the advent of color TV. Are temperature changes causing problems in your system? Take a good, hard look at your trunk line amplifiers.

Then . . . take a look at Colorvue amplifiers for the solution . . . ultra-flat response, even in extreme system environments. How do we do it? Easy! We heat sink the DC power supplies to the chassis for maximum heat dissipation, provide variable power transformers for lowest input voltage—lowest ambient temperature, utilize Zener diode biasing and a stud transistor to hold response flatness. And that's not all. Exclusive AEL designs supply major answers to major problems.

If you're really serious about solving your temperature and other system problems, look into AEL's total problem solving capability. Update or expand your present system or build a worry-free new CATV system with trouble-free Colorvue equipment. Write today for the Colorvue solutions to your problems. Better yet, call us at 215/822-2929.



CATV DIVISION

American Electronic Laboratories, Inc.

RICHARDSON ROAD, COLMAR, PA. • Phone: 215-822-2929 • TWX: 510-661-4976

Correspondence: Post Office Box 552, Lansdale, Pennsylvania 19446

Tell me more about AEL's CATV problem-solving capability

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COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Dept. CL

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FOCUS ON **CATV**

FCC Still Busy With CATV

Despite a backlog of some 220 top-100 market waiver requests, the FCC again refused to delegate waiver authority. By only a single vote, the Commission killed a proposal that would have allowed their CATV Task Force to act on waiver requests involving communities on the outskirts of top-100 markets. The plan, suggested by Commissioner Bartley several months ago, would have given the Task Force authority to grant waivers on systems serving about 140 communities.

Rather than expediting waiver requests, the FCC has made them more difficult with tough new pleading standards. Cable system petitions must now include data and projections on the cumulative effect of cable TV on existing and possible new stations in the area.

At the same time, however, the FCC pleased some CATV operators by requiring the same type of information from broadcasters petitioning for protection from

CATV's in non-top-100 markets.

The effect of this is that in top-100 markets the burden of proof is on the CATV operator, while in other markets the burden of proof is on the broadcasters.

Also cheering to the CATV industry was the news that the FCC has tentatively decided to approve an actual study of CATV's economic impact on broadcasters. Earlier, they had voted 4-3 against Philadelphia and 6-1 against Goshen, Indiana, as test sites. Then some of the Commissioners apparently had a change of heart, voting in favor of Goshen. Unless the FCC reverses itself again, which is not unlikely, Goshen will provide the first hard facts on the often debated question, "Does CATV hurt the broadcasting industry?" With only three uhf channels and no independent or educational stations, however, Goshen is not really typical of most television markets.

On yet another front, the FCC is being urged to use the capabilities of cable TV to free much needed frequencies for land mobile use. More than two-million transmitters compete for space in the mobile radio band and 15,000 applications for additional units hit

the FCC each month.

An FCC committee assigned to study the problem noted that a single TV channel frequency spectrum can accommodate about 300 mobile radio channels. They also pointed out that radio is the only way to communicate with vehicles, but that there is an alternative—cable TV—for carrying TV programs into homes.

While the FCC will not seriously consider moving all TV to cable, it is quite possible that they will assign a few uhf channels to mobile service.

NCTA Stirs Up Activity

NCTA President Frederick W. Ford has been busily rallying support for the CATV cause. Speaking before a meeting of the National Association of Religious Broadcasters, he said cable TV is not at this time available to residents of large cities, but predicted that the FCC will soon be forced "by pressure from Congress, the public and the courts" to soften CATV regulations.

Ford urged the religious broadcasters to help to "eliminate the arbitrary restraints on the freedom of expression, particularly the freedom of religion," pointing out

TO ALL CP HOLDERS:



that cable TV provides an excellent opportunity for religious broadcasters to reach congregations.

Later, Ford sent each Congressman in Washington a kit of materials designed to give them "a better idea of what our industry is doing to bring more and better television to more Americans." His letter told 534 Senators and Congressmen that "Congress is expected to pass legislation dealing with the copyright liability of cable systems. And the Supreme Court has agreed to review cases dealing with both the copyright issue and the question of FCC jurisdiction over cable operations." The NCTA president invited the lawmakers and their staffs to call on the association "if you feel that we can be of assistance to you or your constituents."

The busy Mr. Ford also took time to reply to an editorial in *Telephony* magazine which said that "every telephone company that can . . . should get into the CATV business, preferably by forming a separate company."

Ford discussed the problems of competition between the two industries and the leaseback issue, but stated that "the time has come for the telephone industry and the

cable television industry to resolve their differences."

Leaseback and pole right problems have spurred the cable TV industry to turn more and more to underground systems.

Aside from politics, the NCTA staged a successful National Cable TV Week, February 4-10, supplying members with aids such as a new 20-minute color film, radio commercials and billboards. A February 28 through March 1 cablecasting seminar was also a huge success. In addition to nuts and bolts technical instruction on studio equipment and techniques, the Association presented talks by Senator Frank E. Moss (D-Utah), George Hatch, president of the ad hoc committee that produced 10-point agreement with broadcasters on CATV copyright liability. (See February *BM/E*, p. 10.)

CATV News Briefs

California is considering a proposal that CATV be made a state monopoly, with several channels reserved for university and unemployment retraining purposes . . . Eleven out of 21 legislatures which met in 1967 considered bills directly affecting CATV . . . A group headed by Milton J. Shapp,

CATV pioneer, recently purchased Berks TV Cable Company, serving approximately 4000 subscribers in Reading, Pa. . . Intermountain Microwave, a subsidiary of Teleprompter Corporation, has airlifted nearly a ton of solid-state electronic equipment to the top of Mt. Aeneas, near Kabspell.

Continued on page 14



Pre-opening dinner is held by Lower Bucks Cablevision, Inc. to kick off subscriber campaign. Serving Levittown and Lower Bucks County, Pa., the system is first in the nation to provide 24 channel capability. Congratulating system. President John Zettick (center) are Pat Dean, vice president of Lower Bucks, Cablevision, Inc., and Lee Zernick, vice president of The Jerrold Corp. Jerrold is prime contractor for the possible 28,000 house system.

Extraordinary FM Monitor Offer

McMartin will help you get started

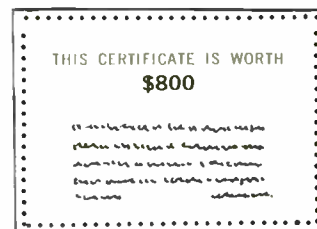
McMartin guarantees in writing that a new TBM-3500 Monaural Monitor will be worth \$800 if you trade it, even as late as 1973.*

Many FM operators start with monaural broadcasting and later add Stereo and SCA.

Choose a McMartin TBM-3500 monaural monitor and receive with it a trade-in certificate worth \$800.

When you go Stereo or SCA within five years*, return the TBM-3500 Monaural Monitor and certificate as \$800 down payment on the purchase of a TBM-4000A FM/SCA Modulation Monitor or a TBM-4500A FM Stereo Modulation Monitor.

That's a pretty fair offer when a new TBM-3500 costs \$995. Look at it this way: it's like getting your TBM-3500 almost free.



McMartin

McMartin Industries, Inc.
3104 Farnam Street
Omaha, Nebraska 68131

*Offer effective February 1, 1968, and applies only to orders received on or after that date. This offer may be withdrawn at any time.

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Only the finest play the



PALACE... where the new RE15 was born!



(E-V) The biggest names in show business play the Hollywood Palace on ABC-TV. They demand the finest sound possible. And they get it from the new Electro-Voice RE15. It's no accident, and here's why: ABC-TV sound engineers worked with us for almost two years perfecting the RE15. Their demands reflected the problems that make TV variety programs one of the toughest assignments for any sound engineer.

Small in Size

They asked for a small, light microphone. The RE15 is shorter than a pencil, with a body no thicker than a Cannon XL connector. And it weighs just 8 ounces. Perfect for a fast-moving boom or for hand-held applications.

Flat Off-Axis Response

ABC engineers requested the same response curve off axis as on axis. With a big band in the same studio, some band pickup from the back of the solo microphone would be inevitable. It wasn't easy to make this "off mike" pickup as smooth, flat and wide range as the on-axis response, but that's exactly what the RE15 has to offer at every angle.

Super-Cardioid Pattern

But the next request almost stumped us. They asked for wide front pickup, so that a boom operator could easily "work" two or more performers, yet they wanted the RE15 dead at the rear for longer "reach". In short, a polar pattern similar to a ball sliced neatly in half! And that's almost what they got.

The RE15 is down only 3 db at 80° off axis (in any plane) and just 8 db at 90°. But at 120° and 180° the level drops over 19 db, and at 150° the RE15 response is almost 26 db below the on-axis level. This super-cardioid pattern (with a small lobe at the back, 15 db down) proved much more useful than a classic cardioid. With the microphone tipped 30° (a



L. to R.: Robert Crawford, Chief Utility; Eric Reid, Chief Boom Operator; Eugene Lukowski, Technical Director; John Neal, Audio Engineer, for ABC's Hollywood Palace.

typical boom or stand operating position) the area of greatest cancellation is oriented directly at the sources of unwanted sound—the audience and the sound reinforcement speakers.

E-V Reliability

ABC-TV also demanded plenty of output. They got it. A crisp -55db. And they got the reliability and ruggedness typical of all E-V professional dynamic microphones, as well. Famous E-V Acoustalloy® diaphragm plus multiple dust and magnetic filters assured unchanging response and sensitivity. Plus a "bass tilt" switch to cure boomy acoustical problems.

The slotted "backbone" of the RE15 identifies it as the latest in the Electro-Voice series of Variable-D® and Continuously Variable-D® microphones.

It's very possibly the most significant achievement of them all. Write for your copy of

Microphone Facts that gives all the details. And, for an impressive demonstration of RE15 capability, find a TV set with really good audio, and tune to the Hollywood Palace on ABC-TV, any Saturday night. Or match the RE15 with your own list of demands. We think you'll agree that a star was born on the Hollywood Palace!

FREE! Any E-V professional microphone will be repaired without cost if it fails in the first two years—regardless of cause. That's right, repairs are free for the first two years... no questions asked!

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Cecil Street, Buchanan, Michigan 49107

Electro-Voice®

A SUBSIDIARY OF GULTON INDUSTRIES, INC.

high fidelity speakers and systems • tuners, amplifiers, receivers • public address loudspeakers
• microphones • phonograph needles and cartridges • organs • space and defense electronics

Mont. The new equipment will improve signals to CATV systems serving seven Montana communities . . . Jim Davidson of Davco Electronics Corporation has purchased three more cable systems located in McGehee, Dermott and Lake Village, Arkansas . . . Craftsman Electronic Products, Inc. has completed development of special hardware to be used by H&B American Corporation to gather CATV system market research data and to test TV commercials. (See also page 99.)

BUSINESS OF ETV

New Directors of NAEB Division. Howard D. Holst, director of WKNO, Memphis, and Warren A. Krawtzer, executive vice president and general manager of WUHY, Philadelphia, and WHY, Wilmington, have been elected to the Board of Directors of the Educational Television Stations division of the National Association of Educational Broadcasters. Each will serve a three year term on the six-man board.

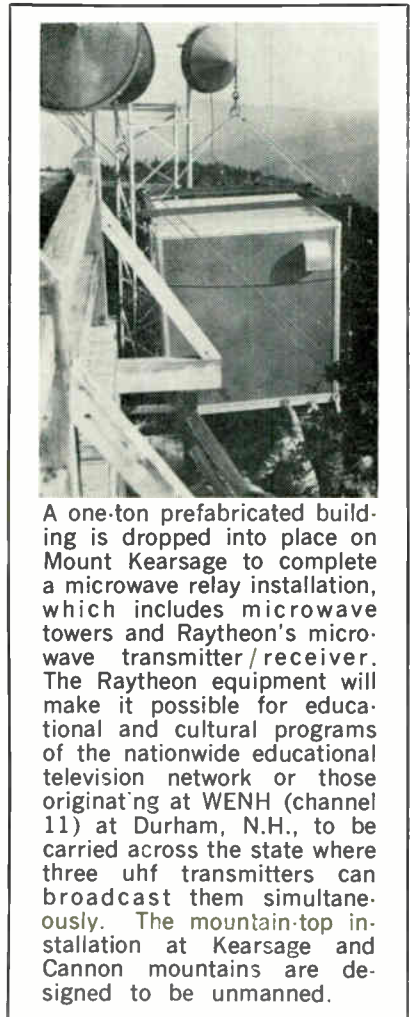
"Edutainment" Is Here. The Edu-tronics Corp., headed by Stanley Colbert, has revealed a broad slate of projects aimed at classrooms, educational television, libraries, and commercial video, and a unique plan for low-price "Film of the Month" clubs in gardening, stamp, coin, sports, medical and dental fields, to be marketed complete with Kodak Super 8 sound projector. Colbert's concept of "edutainment" is the basis for the company's projects for educational television, which Colbert says is "as it's beamed into classrooms, for the most part is just as vast a wasteland as some commercial television and just as sterile as some community video." Colbert believes that other professionals are willing and anxious to serve educational causes, and he intends to ask for their help based "not on dollars alone but on the challenge of participating without restriction in the worthwhile task of improving materials and methods with which we teach our children."

Storer Donates Equipment. Florida State University's educational television station WFSU-TV has been given broadcasting equipment valued at \$84,250 from the Storer

Broadcasting Company of Miami Beach. Ed Herp, director of broadcasting at Florida State said it is another example of commercial television's valuable help to ETV and that it would have cost WFSU-TV \$200,000 to purchase comparable equipment.

RCA Wins First Maryland ETV Contract. Maryland Broadcasting System has awarded \$399,200 contract to RCA for transmitting facility which will radiate one-million watts including tower, antenna, and associated equipment for the Baltimore transmitter of the state ETV system. Award was announced by Dr. Frederick Brientfeld, Jr., executive director of the Maryland Educational-Cultural Broadcasting Commission.

New Georgia ETV Station. The tenth outlet for the Georgia Educational Television Network went on the air January 1st from Cochran. Station's Monday through Friday schedule will consist of in-school and teacher refresher telecourses from 8:30 A.M. until 4:30 P.M. After 4:30 P.M. programs of *Continued on page 94*



A one-ton prefabricated building is dropped into place on Mount Kearsage to complete a microwave relay installation, which includes microwave towers and Raytheon's microwave transmitter/receiver. The Raytheon equipment will make it possible for educational and cultural programs of the nationwide educational television network or those originating at WENH (channel 11) at Durham, N.H., to be carried across the state where three uhf transmitters can broadcast them simultaneously. The mountain-top installation at Kearsage and Cannon mountains are designed to be unmanned.



Here's your chance to write an ad for Audiopak and win this coffee cup.

Just for a few, sincere words about Audiopak, you get free, this useful gift in recognition of your ad-making ability.



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Gentlemen:

I've joined the big switch to Audiopak. Send me my free coffee cup for this ad: (write on a separate piece of paper if you feel cramped)

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Title _____

Station _____

Address _____

City _____

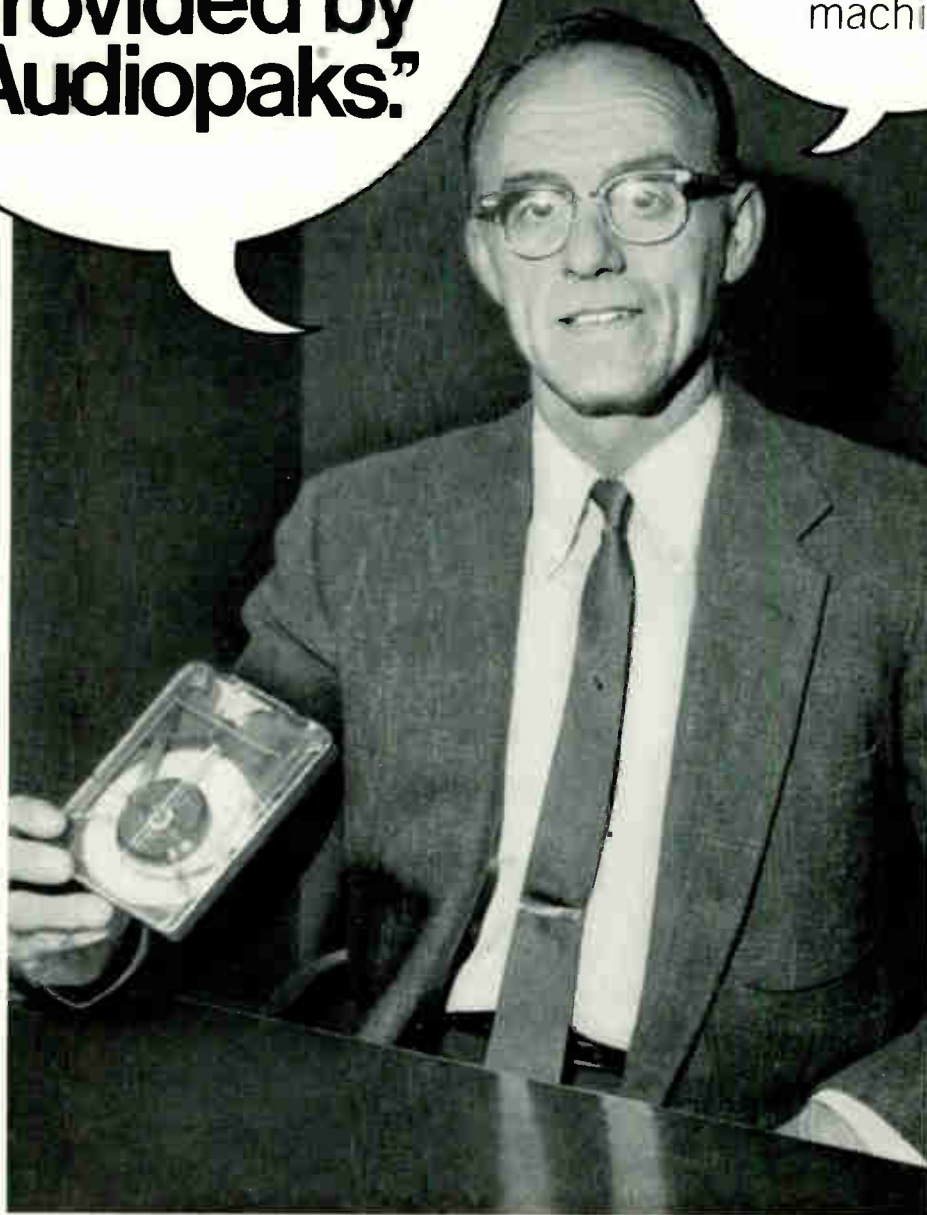
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Sorry, I must be one of the few who haven't had the pleasure of trying Audiopak. Send me a free sample.

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Audiopaks."**

"It's without
a doubt a
most needed
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for all tape
machines."



Arthur Nix, WKDL, Clarksdale, Miss.

Extra channel CATV

Thanks to the ITC Gamut 25.

This handsome unit is a fully-shielded 25 channel converter that offers the 12 standard channels ghost-free and adds another 13 channels interference free. Each with perfect color reception and outstanding frequency stability.

Gamut 25 can be quickly and inexpensively installed between your existing cable and the

home TV set input.

The result is up to 25 channels over a single cable, without the costly duplication of distribution cables and the complications of additional electronic support equipment.

And just because we like to do things right, this fully transistorized unit actually doubles as a remote tuner.



is beginning to blossom.

When will your CATV area be ready for all-sports, all-news, all-weather, all-travel, all-home study, and all do-it-yourself channels?

With Gamut 25 integrated into your present CATV system, you'll be ready come what may.

For full information on the Gamut 25, write to ITC, the problem solvers of the CATV industry.

Or call us at (213) 478-7751.

With new programming ideas blossoming throughout the country, why not make your CATV system fresh as a daisy?

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Rank Taylor Hobson Varotal V lenses now fit all major TV cameras



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That means that I can keep my favorite Varotal V lens when I buy my new camera. No matter what I choose?

Right. In addition to all monochrome cameras and RCA color cameras, our lenses now fit General Electric, Norelco, Sarkes Tarzian and Marconi color cameras.

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Right again. Our lens fits 2-tube, 3-tube, and 4-tube color cameras. Image Orthicon, Plumbicon, and Vidicon.

How did you do it?

With a new Lens-Pak developed by Rank Taylor Hobson.

Does it work as well as a lens without the pak?

Better. The focal length of the Varotal lens can be easily changed by finger-tip control. And the Lens-Pak has a "ride the rails" device that allows "close-up" focusing to less than 1 inch.

Hmmm. Sounds like something I should look in on.

Fine. Why not look in on us at the N A B Show, Booth 251.

* * *

While you're there, we'll show you the newest thing in color T.V. monitors and in color title card and transparency scanners. And we have another electronic device on display that takes unusable color film and applies calibrated gamma correction to make the film acceptable for T.V. use.

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NAB Convention Shaping Up Big



A preview of topics and products

Joint management/engineering workshops on Monday, a general conference dwelling on news coverage on Wednesday, and some brand new exhibitors will draw keen attention from those attending the 46th NAB Convention, March 30 to April 3 at the Conrad Hilton Hotel, Chicago, Ill.

Two new areas will be opened up to accommodate the 126 exhibitors (the largest number ever). Fifty-four-thousand square feet of space is being used by the manufacturers.

In most respects, however, the 1968 Conference will be more similar than different from previous conferences. The topics, of course, will be the big issues in '68.

Engineering topics focus on *what's new*, and where patterns are not yet clearly settled, a *review* is the order of the day. Radio automation and, for the first time, TV automation will be thrashed by a panel on Monday.

Tuesday morning it's heavy emphasis on new experiences with dual a-m transmitters, digital frequency monitoring, and automatic logging of directional antenna parameters. How Rollins Broadcasting Company is making out with

vapor cooling of transmitter is also on the docket.

Jampro will discuss their new circularly polarized fm transmitting antenna.

Television engineers will hear about optical multiplexing, new lighting systems, new measuring and processing techniques, and new trends in color broadcast equipment. Philips Broadcasting is expected to unveil some plans on new equipment it will market, and Ampex is expected to reveal details on its portable color camera.

Engineers will honor Howard A. Chinn, director of General Engineering, CBS Network, by awarding him the Engineering Award on Wednesday.

The management program gets underway with reports from NAB President Vincent Wasilewski, and delegates to RAB and TVB. Five concurrent management/engineering workshops take place at 3:45 on Monday; two on automation already mentioned; one on small market radio; another on secondary market TV and a last entitled NAB Labor Clinic. This year the labor session is open to all and not closed to members only.

Highlights of Tuesday's radio sessions include a how-to-do session on building a large dollar volume in a small community and another on broadcasting for the community.

On Wednesday the big event is the session on broadcast news. Seven authorities are lined up to give their views.

The NAB Distinguished Service Award this year goes to Lowell Thomas.

Fm broadcasters can get a full week's worth of ideas since the National Association of Frequency Modulation Broadcasters commences its program two days earlier, in Chicago, March 29 and March 30. The NAFMB meeting will take place at the Palmer House.

This year the sessions will be broken by market size so that attendees will always be getting relevant material.

On Sunday, March 31, the scene shifts back to the Conrad Hilton and the NAB. Fm day at NAB will include presentations by Charles Stone on fundamentals of management, and Harold Kassens of the FCC will discuss new fm technological developments.

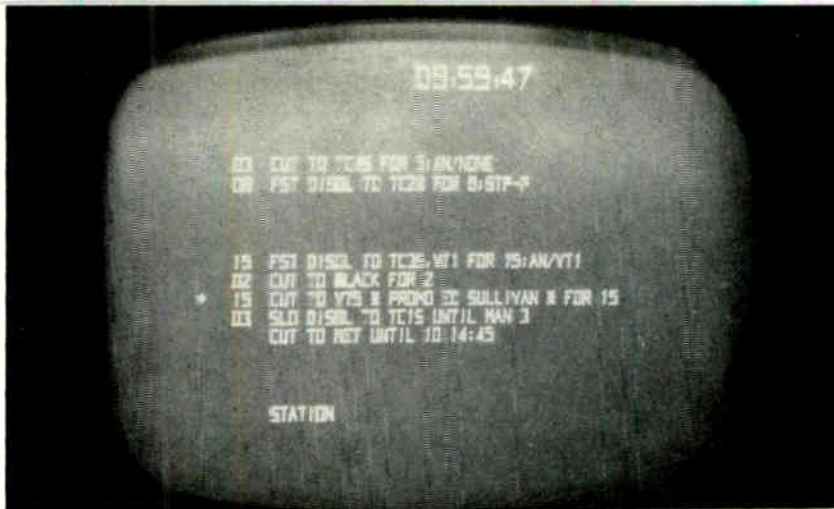
Sophistication & Complexity in Exhibits Seen

A sampling of new products to be shown at the 46th NAB follows. (A full report will appear in *BM/E* April to be mailed the third week of March.) Product refinements, rather than product innovations, appear to be the order of the day. We expect one or two surprises to be unveiled at Chicago—as they usually are—but as we go to press, these secrets are still in the bag.

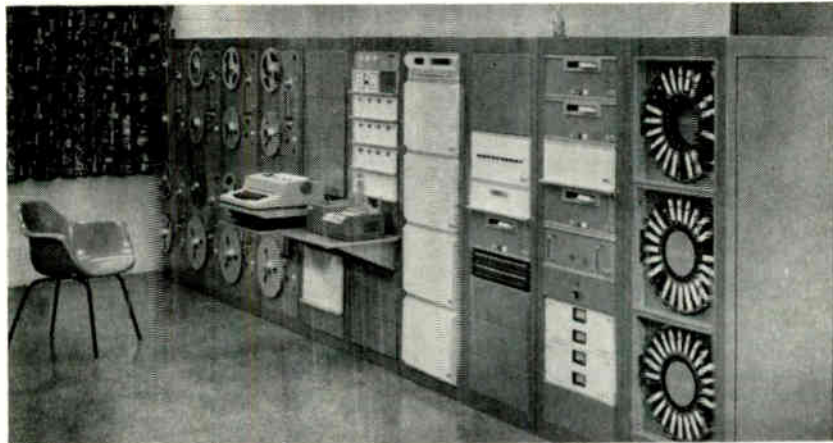
- Consoles and audio equipment will omnipresent this year at NAB. Sparta will feature a complete showcase broadcast studio audio control center incorporating many new products, including a newly introduced Sparta-Matic tape cartridge system, speech input audio consoles, turntable systems and a reel tape recorder.

Three firsts will be introduced by McCurdy at booth 309, with the emphasis on audio for TV: two consoles (production and program) and a television intercom system. McCurdy also will display monitor amplifiers, preamps, equalizers and power supplies.

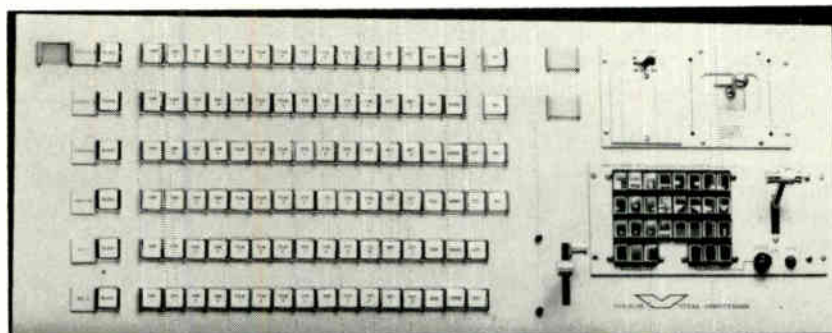
Acousta-Voicing from Altec Lansing, a new method of connecting special filters that tune sound systems to match characteristics of the auditorium where they're installed, will be unveiled for '68 NABers. Altec Lansing says voicing system is brand new, and promises more information soon. Also on display at the Altec Lansing booth will be the newly-introduced 9200A control console, studio monitor speakers, a condenser type mic and two new performer type mics being introduced just prior to the show.



Readout of AMP's computer integrated broadcast programmer.



Punch-card actuated Series 600 audio control system from IGM.



Vital Industries' video switcher.

New FET microphones will be introduced by North American Philip's AKG Division and Gotham Audio's Neumann line. The AKG mic, Model C451E, is the first of its type to be introduced by AKG, and will feature a cardioid capsule that's interchangeable with an omnidirectional capsule. Also on display at AKG will be their line of two-way microphones (Models D-200E and D224E), incorporating internal crossover at 500 Hz.

At booth 226, Gotham will display several foreign and widely diversified audio products. In addition to the Neumann condenser microphones with silicon FETs,

the Studer A-62 solid-state professional tape recorder from Switzerland and the Gotham OY rack-width monitor speakers will be featured. Also at booth 226 will be the EMT's 930st studio turntable and the SE-200 professional stereo fm tuner. Other Gotham products in the test equipment and tape accessory categories will be on hand.

Highlight of the Gray Research display will be their Micro-Trac stereo tone arm. The display will include a recorded story of Micro-Trac using a Micro-Trac tone arm. An impedance matching preamp, broadcast equalizer and other Gray tone arms will be included at the display.

Gates Radio will introduce a new TV-15 audio console, featuring TVS6 submixer panels. Gates' booth 221 also will have a live demonstration of a completely automated radio station.

• In the automation category, Tape Athon will feature their Programmer III, and introduce a new program logger that will use 15/16 to 15/32 in./s speeds, and is capable of recording one to eight channels up to 384 hours on one 10½-in. reel. Tape Athon says logger's basic configuration will be the same as the Model 900, and will sell in the \$1500 price range.

Some tasty sounds will be emanating from booth 224 where IGM will be displaying their Series 600 with a punch-card-actuated 60-5 random select feature not previously shown. The 500 Series audio control system with 50-3 random select and the IGM 362 logger with cartridge and touch-tone encoder will fill out the IGM display. The tasty sounds will be a continuous audition of the IGM program services, including "Jazz Quartet," "Americana," and "Downbeat."

Chrono-Log will display the STEP system for TV station break automation. System controls video and audio switching at break time, rolls and stops projectors and VTRs, advances slides, and operates multiplexers, etc.

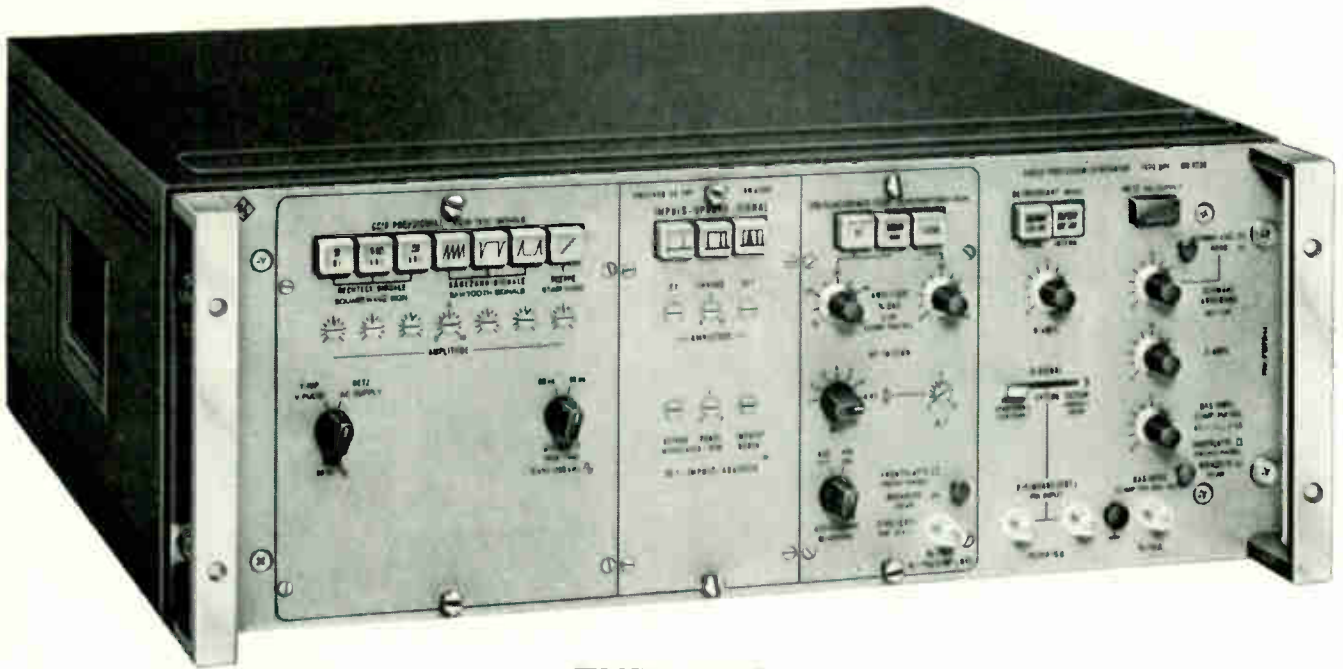
Automatic broadcast programmers from AMP and Central Dynamics promise something new for TV broadcasters. Central Dynamics will have a fully operational broadcast automation system with simulated "On Air" programming designed to put the system through its paces in any mode from one event manual to an infinite series of pre-programmed events.

The AMP system consists of a computer integrated system designed for complete control of all audio-video switching operations in a master control television system. The system employs a general purpose digital computer that provides a printed output of the memory contents, or a logging of scenes as they go on the air.

• Norelco will have live and continuous demonstrations of their "Little Shaver" PCP-17 portable color camera, introduced in prototype form in November. Norelco's PCF-701 triple Plumbicon film camera will be busy showing movies on monitors.

• Vital Industries says it will display the largest video switch-

Continued on page 99

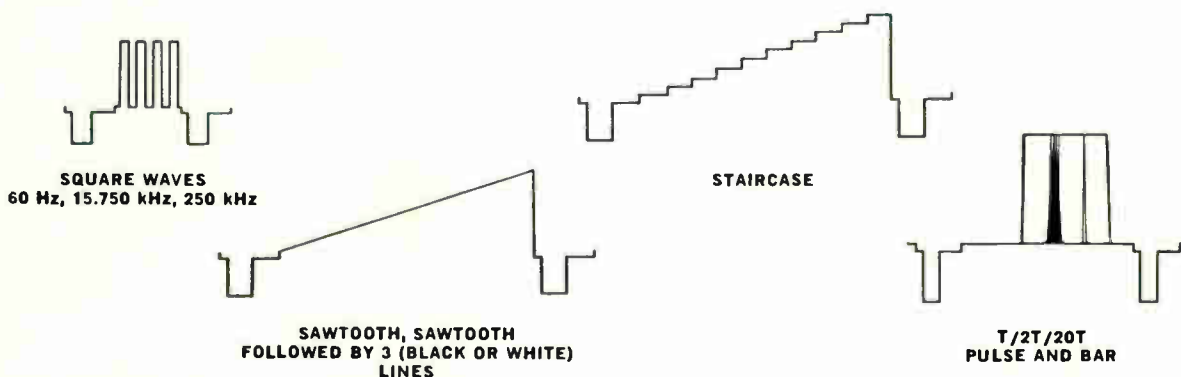


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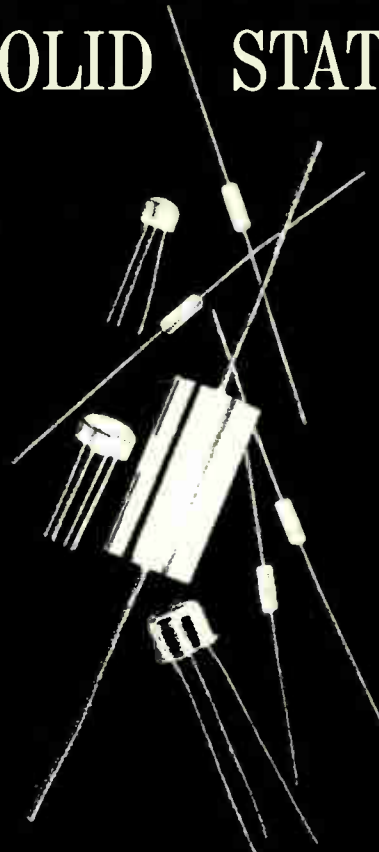


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INTERPRETING THE **FCC** RULES & REGULATIONS

Translator Policies And Rules—Part I

SINCE THE EARLY 1950's, numerous licensees as well as the Commission have wrestled with the "translator problem" and the place that translators should occupy in the total broadcast allocations scheme. On various occasions, broadcasters have alleged that translator stations constitute substantial adverse economic impact upon existing or potential television broadcast stations—particularly those in small markets. The Commission has borne a real burden in trying to placate these fears and protect licensees who may be seriously prejudiced with its statutory responsibility to bring the greatest possible television services to the public. This article (the first in a two-part series) will analyze the background and present policies of the Commission relating to translators.

On April 23, 1965, the Commission issued a Notice of Inquiry and Notice of Proposed Rule Making in Docket No. 15971 (CATV and Related TV Auxiliary Services) FCC 65-344 [4 RR 2d 1679], in which it proposed "a reexamination of all our rules and policies relating to auxiliary services to see if they are holding back or encouraging a variety of off-the-air services." On March 8, 1966, the Commission released its Second Report and Order in Dockets 14895, 15233, and 15971, (Distribution of TV Signals to CATV Systems and Related Matters), 2 FCC 2d 725, [6 RR 2d 1717], in which it resolved some of the questions presented and terminated the proceedings in Docket Nos. 14895 and 15233. However, it ordered that the proceedings in Docket No. 15971 were not terminated pending consideration of the comments filed in Part II of that proceeding. These comments included the question of the Commission's future policies for

television broadcast translator stations. On June 22, 1967, a second notice initiated a general reexamination of the Commission's policies and rules applicable to television broadcast stations. The comments and replies have been received; because of the complex problems under consideration, an early decision is not foreseen. However, before proceeding with an analysis of proposed changes in the translator rules and policies, a review of the more salient changes to date is warranted.

Background Of Present Rules And Policies

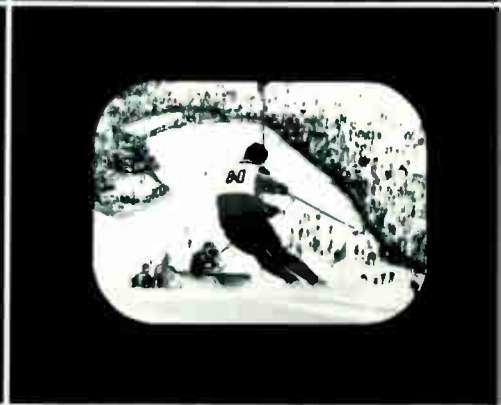
The pattern of the Commission's present translator policies and rules can best be understood in the light of the circumstances in which they were formulated. Translators, like CATVs, are the product of public demand for television service. Beginning in the early 1950s, individuals and groups in areas which did not receive adequate off-the-air television service installed a variety of small transmitters known variously as "repeaters," "boosters," and "translators," which were intended to rebroadcast television signals and thus provide services desired by the public. These unlicensed transmitters were operated in the vhf frequencies, and, therefore, they posed a danger of interference to licensed radio users in the safety services. The Commission initially attempted to forbid such operations because of this danger.

In 1956, in order to make possible the provision of television service to small, isolated communities and sparsely settled areas beyond the range of existing stations, the Commission began the authorization of uhf translator stations (relatively inexpensive installations which picked up television signals and rebroadcast them on channels in the higher portion of the uhf band). Initially, they were permitted to operate with a

This section, providing broad interpretation of FCC rules and policies, does not substitute for competent legal counsel. Legal advice on any given problem is predicated on the particular facts of each case. Therefore, when specific problems arise, you would be well advised to consult your own legal counsel.



When the record's being broken,



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Except on something like tape.

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That's why we designed 78V as carefully as we did. It captures once-in-a-lifetime events the second they happen. Faithfully.

And that's why ABC chose 78V to tape the Winter Olympics at Grenoble.

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maximum power of 1 watt; thereafter, in order to increase the opportunity for reception of this service, the Commission amended its rules so as to permit operation with power up to 10 watts. For technical reasons, translators were not permitted to originate any broadcast material themselves or to rebroadcast any signal except that of a broadcast station or another translator. Therefore, they did not, in their own operations, generate any revenue. They were usually operated by nonprofit corporations or associations, and built by subscription, or operated by public bodies; in a few instances, television licensees constructed translators to fill "holes" in the coverage areas of their stations. Like broadcast stations generally, translators were required to have the consent of the stations whose signals they rebroadcast.

Although the authorization of uhf translators eased the situation, in view of the relatively high installation and operating costs of uhf translators as well as the limited number of receivers, public demand for the licensing of vhf translators continued. This demand was finally satisfied in 1960 when Congress amended the Communications Act by adding Section 319 (d) to permit the Commission to license the pre-existing vhf repeaters, and by amending Section 318 to allow operation of translators without an operator. The Commission then adopted rules permitting the licensing of one-watt vhf translators, and provided for a change-over procedure to permit the licensing of existing repeaters until they could obtain permits and equipment for regular vhf translator operation under the new rules. Ten hundred and forty-four repeaters were authorized under the change-over procedure, and provision was made for conversion of these repeaters to regular translator operations.

The policies and rules developed in the early translator proceedings were shaped by the nature of the repeater operations as they then existed. As a result, the policies and rules were primarily designed to accommodate the interests of small community groups, principally in the far west, which sought translators to supply service not otherwise available. Soon, however, a new element appeared. With the legalization of vhf translators, numbers of commercial television broadcast licensees filed applications for vhf translators to rebroadcast their stations' signals. The motive underlying many of these applications was mainly competitive, and it posed obvious new problems. When the new trend became apparent, the Commission formulated limitations on the use of vhf translators by commercial licensees which were adopted in 1962. In essence, these limitations prevent the use of vhf translators by commercial licensees for competitive purposes by: (a) authorizing their use only within the predicted Grade B contour of the primary station (§ 74.732(e) (1) of the Rules); and (b) forbidding their use where program duplication would result within the predicted Grade A contour of the duplicated station and beyond the predicted principal community contour of the primary station (§74.732(e) (2) of the Rules). Because the Commission considered that a demonstrated public demand for vhf translator service was a countervailing consideration not present in the case of licensee applications, no such limitations were imposed on the use of vhf trans-

lators by private parties. At the same time, in order to promote the wider use of uhf generally, the Commission placed no restrictions on licensee use of uhf translators.

While these events were occurring in the translator field, a great territorial expansion of CATV was taking place. Since the unregulated CATVs were not subject to the limitations imposed on translators, this development proved to have significant implications in the translator field. Television stations were faced with the competition of distant and duplicating signals but the signals were supplied by CATVs rather than translators. At the same time, the rapid spread of CATVs minimized the public's anticipated role in seeking translators, both as a result of lessened demand and because of the CATV's other advantages over translators. These advantages included (1) the CATV's ability to use microwave relays to obtain input signals regardless of location or distance; (2) the ability of the CATV to furnish a large number of signals; and (3) the assured financial base of the CATV which, in contradistinction to most translator operators, can enforce payment for its service. The growth of CATV has affected the Commission's translator policies in other ways. As concern mounted over the possible adverse effects of CATV on regular television stations, the Commission recognized that some of the considerations applicable to CATV are, in at least related form, applicable to translators. Thus, the Commission has found it has to devote considerable attention to questions of economic impact and program duplication in connection with translator applications.

On July 7, 1965, the Commission adopted a Report and Order in Docket 15858 to permit high power TV translators on unoccupied assignments in the Table of Assignments. The Order (1) permitted vhf and uhf translators of 100 watts transmitter output; (2) regular TV station licensees as well as other qualified parties were eligible to be a licensee of a high-power translator; (3) the high power translator would in no way preclude the grant of an application for a regular or satellite television station on the channel, and the licensee of the translator also would be given an opportunity to file a competing application to convert the translator to a regular broadcast station, (4) the rule prohibiting existing TV stations to extend their Grade B coverage by means of vhf translators could be used on the remaining vhf assignments in the Table; and (5) objections to high power translators from regular TV stations would be treated on a "case-by-case" basis. Basically, the Commission adopted the foregoing Order because it believed that TV assignments are unused due to the financial problems associated with small markets. The Order established a simple and economical method whereby existing licensees and others could provide service to people in underserved areas on a translator basis until such time as a regular station may become economically feasible. With respect to the impact of the high power translator stations on regular TV stations, the Commission decided to treat this on a "case-by-case" basis. Several parties commenting were concerned that the impact of these high-power translators on

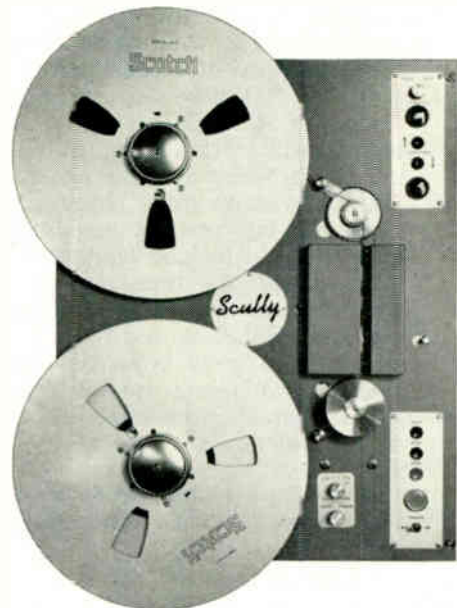
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small market stations required safeguards such as nonduplication of programs; however, the Commission stated, "We do not believe that we should at this time attempt to foresee all the problems which may occur and to cure them in this proceeding. As we stated in our Notice [4 RR 2d 1679] "More generally, we are of the opinion that all of our rules and policies should be reexamined to see if they are holding back or encouraging a variety of off-the-air services." Pending the formulation of a definitive policy with respect to these matters, we have in recent actions on translator requests, adopted the policy of generally conditioning grants upon the outcome of Docket 15971, and further that the translator, upon the request of a television broadcast station within whose Grade A contour the translator will operate, will not duplicate a program broadcast by the TV station, simultaneously or within 15 days."

On November 30, 1966, the Commission adopted a Report and Order (Docket No. 16424) amending the rules providing for certain frequencies in the 1990- to 2110-MHz band be made available for use by TV translators as microwave relays from TV stations to translators.

Policy Problems

The Commission believes that the policy areas now requiring consideration in Docket 15971 include: (a) the need for continuing the policy of prohibiting licensee-owned vhf translators beyond the primary station's Grade B contour; (b) the limitations, if any, to be imposed on translator duplication of regular television stations; (c) the possibility of different requirements for translator stations used in connection with educational television stations; (d) the limitations, if any, to be imposed on vhf translators in areas with predicted uhf service; (e) the possibility of higher power for vhf translators; and (f) new steps, if any, which may be taken by the Commission to encourage the wider use of translators. In addition, this proceeding provides a convenient forum in which to consider various other changes which have been suggested but not yet acted upon. These possible changes include tightening of the technical requirements for translator equipment, origination of local announcements and programming on uhf translators, and use of translators solely as relays to carry broadcast signals greater distances for ultimate use by translators. The following paragraphs contain a brief discussion of these matters.

Licensee-Owned Vhf Translators Beyond the Primary Station's Grade B Contour

Licensee use of vhf translators beyond the primary station's Grade B contour is now prohibited by §74.732(e) (1) of the Rules. The Commission adopted this restriction after a rule making proceeding and a determination that, "The vhf spectrum is too crowded and the problems of potential interference are too great for the Commission to authorize vhf translators unless there is a clear and compelling need therefor demonstrated by active interest of the people in

the area." The Commission also said at that time that it was apparent that some television stations were planning to use vhf translators to extend their service ". . . into new markets at relatively little cost and with no responsibility for meeting the needs of the new community for local programming and might result in delaying the development of new stations and keep existing stations from expanding their service to cover these areas through authorized facilities."

The reasoning set forth above still largely obtains today. However, the proliferation of CATV systems and the Commission's actions on requests for waiver of this translator rule require a new look at the problem. The Commission has waived the rule in several instances where it was indicated that the proposed vhf translator would be located beyond the predicted Grade B of *any* regular television broadcast station. This has been done in the sparsely populated southwestern states and in Alaska and Hawaii. The Commission believes, on the basis of its experience since 1962, that it may now be appropriate to allow television stations to establish vhf translators beyond their predicted Grade B contours when doing so does not result in the invasion of another television station's predicted Grade B contour. In those situations, the Commission's concern with potential interference and the effect on the possible development of new stations would appear to be less valid now—particularly, since with respect to the latter concern, CATV is being established freely in such areas under the CATV rules adopted earlier in Docket 15971. Accordingly, the Commission proposes to amend §74.732(e) (1) of the Rules to permit a television broadcast licensee to establish a vhf translator beyond its predicted Grade B contour when it does not invade the predicted Grade B contour of another television station.

The Commission also believes that it may be appropriate to amend §74.732(e) (1) to allow television broadcast licensees to contribute to the costs of operation and maintenance of established vhf translators which rebroadcast their signals wherever such translators are located. It believes that this type of support can be allowed without doing damage to its policies beyond the present rule. Since the establishment of the translator usually disposes of the interference problem, it may additionally dispose of its concern that vhf translators not be used merely as competitive weapons, but, rather, reflect the true interests of the public within the communities concerned.

Translator Duplication of Regular Television Stations

In its 1962 rule making, the Commission attacked the problem of duplication by adopting a rule refusing to permit a licensee-owned vhf translator within the predicted Grade A contour of another regular television station if program duplication would result, except where the primary station to be rebroadcast furnishes a predicted principal community contour over the area to be served. However, since such a station would be affected regardless of the status of the

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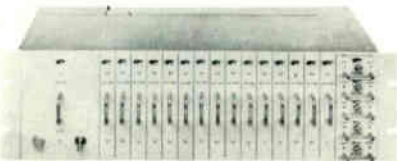
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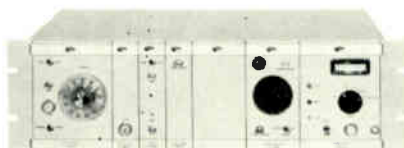


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translator applicant as a licensee or nonlicensee, this solution does not really meet the question of the translator's impact on the duplicated station. The Commission has responded to this problem in two ways: (a) beginning in 1963, it has authorized licensee-owned vhf translators within the Grade A contour of duplicated television stations provided the translator is operated on a nonduplication basis, and (b) it has considered the possible effects of duplication in all cases without regard to the ownership of the translators or whether the translators would be vhf or uhf. A product of this case-by-case approach to duplication problems was adopted as an interim policy in *Lee Co. TV, Inc.*, FCC 65-483, [5 RR 2d 257] (1965). In this proceeding, the Commission announced that as an interim measure, pending the outcome of this proceeding (Docket 15971), it would impose nonduplication conditions on all translators proposed within the predicted Grade A contour of a duplicated station.

Frequently, the duplicated station had not sought protection; therefore, the *Lee Co.*, approach to the duplication problem presented difficulties. Additionally, the task of providing nonduplication protection added to the difficulties confronting the translator operator—especially if it was not a commercial operator. Consequently, in its Second Report and Order in this proceeding (Docket 15971), the Commission amended its interim policy and returned to a modified form of its 1962 policy requiring imposition of a nonduplication condition only in

the case of a licensee-owned vhf translator located within the predicted Grade A contour of a duplicated station.

The Commission's experience with translators has been that only in a relatively few situations do proposals for translators result in controversy concerning duplication of programming or economic impact. However, when problems arise, they arise whether or not the translators are licensee-owned and with both vhf and uhf proposals. Therefore, the Commission believes that it would be desirable to take a completely new look at its translator nonduplication policy. It may be desirable to remove the present limitation on licensee operation of translators which duplicate a regular television station's programming and revise the policy to treat all translators the same way—regardless of ownership. Also, it is quite obvious, that in the area of duplication of programming, its experience with the nonduplication rule in CATV is relevant. Certainly, the Commission will at least consider whether it would not be appropriate to apply the same nonduplication policy to translators where a strong signal is available from the television broadcast stations whose programs are proposed to be duplicated.

This article has dealt with the background of the translator rules and some of the policies presently under consideration in Docket 15971. Next month's article will continue with the remaining major policies under consideration and the additional possibilities that may emerge as new rules.

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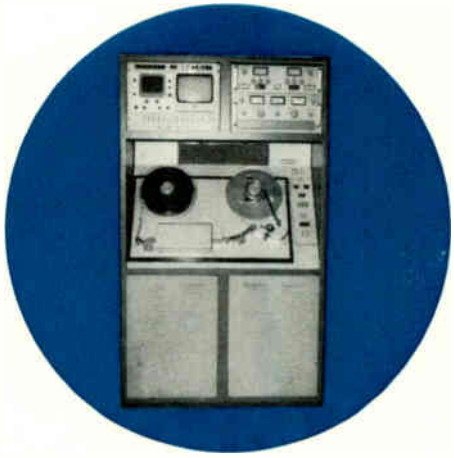
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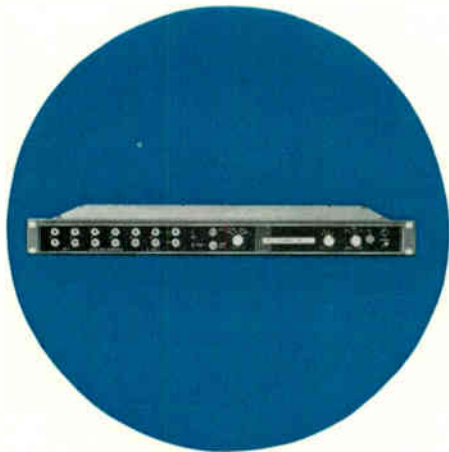
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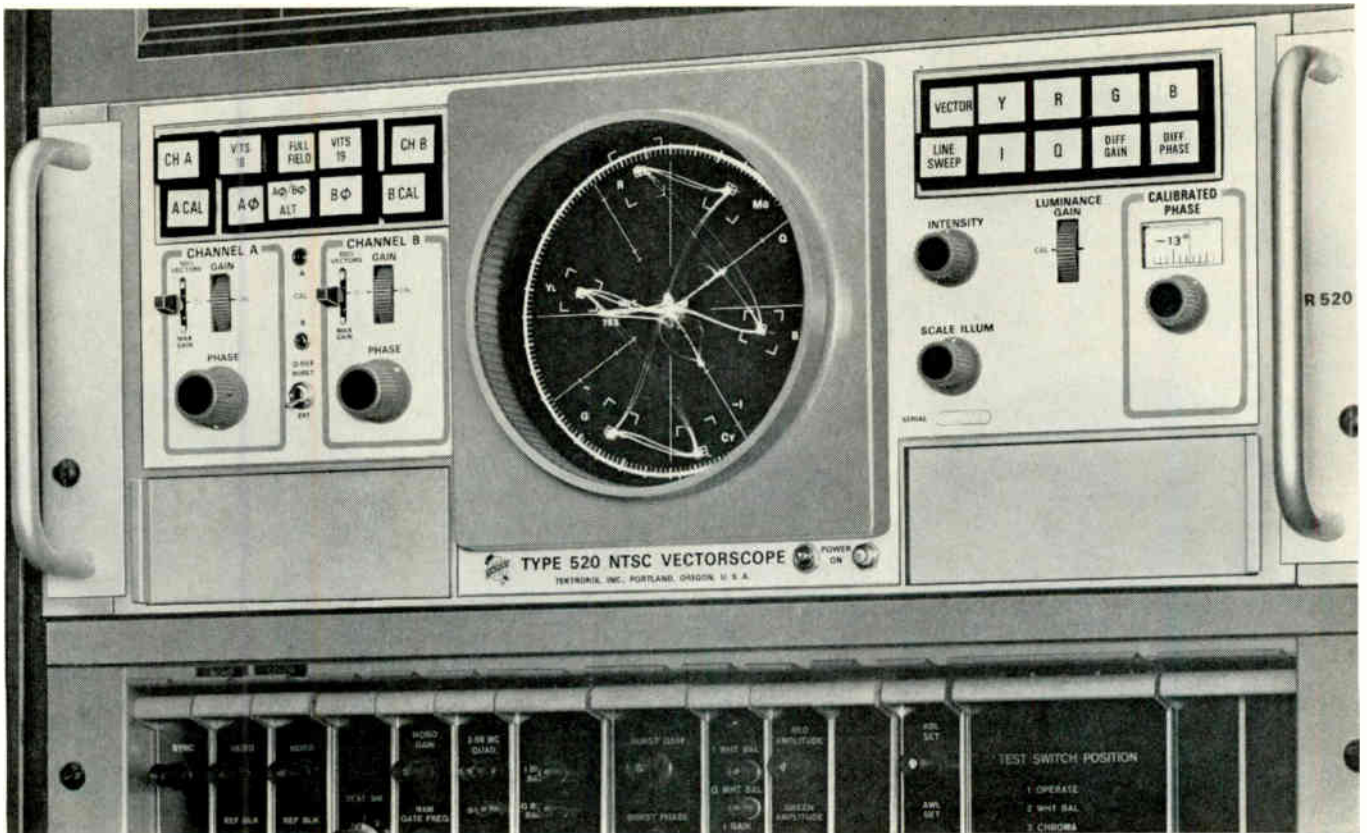


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Design For Domestic Satellite Terminals

By Thomas J. Vaughan, P.E.

The fundamentals of a satellite TV receiving terminal described here may be used by broadcasters or CATV system operators to receive the first network TV satellite transmissions—expected within two years.

SATELLITE TERMINALS located at the broadcast station will become a reality in a few years. These terminals will be used for receiving network programs, educational and instructional TV. There are no major technical obstacles to overcome in designing and implementing such a system. The problems still to be resolved are political and economic.

The advantages of direct broadcast to a network affiliate via satellite will be lower cost and more uniform quality of received signal over the 6-MHz band.¹ This, coupled with the ability to receive educational and instructional TV, will make satellite terminals as commonplace as STLs are today.

In response to a recent FCC notice of inquiry, a number of plans have been submitted to the FCC for domestic distribution of TV signals via satellite.

It is not the purpose of this article to discuss the merits of each plan, but to acquaint the broadcast engineer with the terminal design parameters which are common to all plans. Although each plan differs in the number of terminals proposed, their location and the nature of station ownership, they have a number of common features. These are as follows:

The network signal will be transmitted to the satellite from two metropolitan areas, New York and Los Angeles.

The satellite will be in synchronous orbit (i.e., at an altitude of 23,000 miles).

¹Although this discussion is concerned primarily with TV, it is expected that programming material for a-m and fm will also be broadcast by satellite. These signals will be considerably easier to handle because of their narrow bandwidths.

Mr. Vaughan is president of T.J. Vaughan and Associates, consulting engineers to broadcasters and manufacturers. He is a member of Association of Federal Communications Consulting Engineers.

The majority of the terminals will receive only.

The up frequency will be 6000 MHz and the down frequency 4000 MHz.

The variables not yet decided are:

The erp of the satellite.

The size of ground terminals.

The noise temperature of the receiver.

The erp of the satellite will be, most likely, in the range of 30 to 40 dBW. The ground terminal size and noise temperature of the receiver are related to bandwidth. For a single TV channel, the antenna size will be approximately 20 ft and the system noise temperature 870°K (nf = 6 dB).

System Consideration

The system consists of the satellite, the space between the satellite and the ground antenna, the receiver and the i-f demodulator. The power of the receiver terminal is a function of the effective radiated power (erp) of the satellite.

The power of the present and planned satellites is listed below:

Present	
Intelstat II	15.5 dBW
Planned: (1970's)	
Domestic TV System	
AT & T Plan	37 dBW
Com-Sat Plan	37.5 dBW
Ford Foundation Plan	43 dBW

Space Loss

The signal lost between the satellite and ground terminal can be determined from the following:

Signal lost,

$$dB = \alpha = 36.6 + 20 (\log f) + 20 (\log R)$$

where f = frequency, MHz.

R = satellite range, miles.

For a synchronous satellite above the equator, the slant range at mid-U.S. latitude is 26,100

Fig. 1. Signal level received for various satellite erp's and receiving antenna diameters.

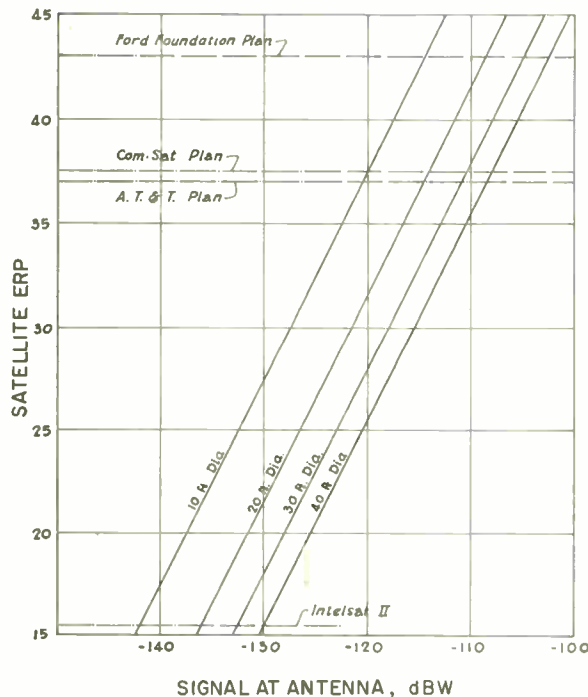
Fig. 2. Conversion of receiver noise temperature to noise density (power) in dBW/Hz.

Fig. 3. Signal needed at antenna for various type amplifiers and bandwidths.

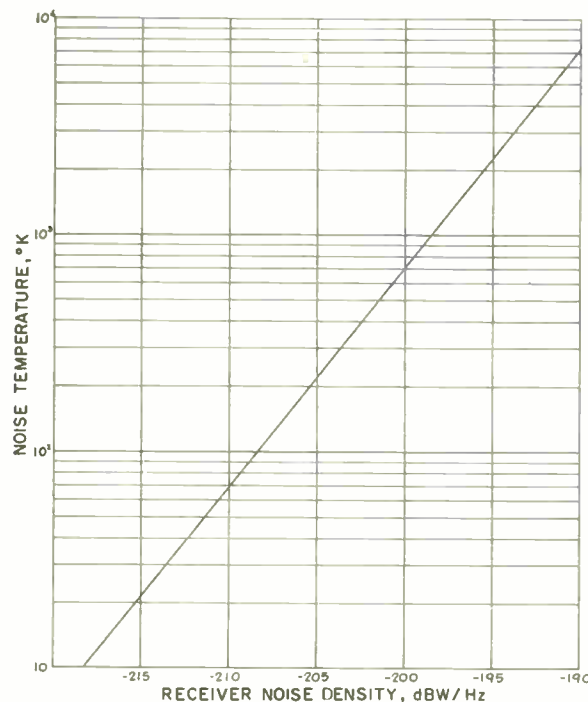
Fig. 4. Reduced field strength as a result of satellite drift. Satellites to date have been held to station positions within $\pm 0.2^\circ$. Future satellites will be held to $\pm 0.1^\circ$, precluding need for automatic tracking antennas.

Fig. 5. Typical satellite receiving antenna and mount.

1



2



miles. Therefore, operating at $f = 4 \text{ GHz}$, $\alpha = 196.9 \text{ dB}$.

Ground Antenna Gain

The ground antenna gain is a function of the area, efficiency and frequency:

$$\text{Gain dB} = 10 \log n \frac{4\pi A}{\lambda}$$

n = efficiency (55 percent typical)

A = Antenna area

λ = wavelength

The gain for different size antennas operated at 4 GHz is listed below:

Size	Gain
10 ft	39.5 dB
20 ft	45.5 dB
30 ft	49 dB
40 ft	51.5 dB

The signal at the antenna terminal is shown in Fig. 1 for the above variables.

Receiver Noise Temperature

The receiver used must have a very low noise figure. Receivers today are normally rated by "input noise temperature" rather than the formerly used noise figure (see Fig. 3).

The noise temperature at the input to the receiver is related to noise power. The total noise power at the input is

$$N_t = K T B$$

where N_t = Noise power, watts.

T = Noise temperature, $^\circ\text{K}$.

K = Boltzman's Constant = 1.38×10^{-23} Joules/ $^\circ\text{K}$.

B = Bandwidth, Hz

This is plotted in Fig. 2.

The conversion of noise power to noise density can be demonstrated by the following example:

Assume a parametric amplifier with an effective noise temperature of 180°K and the bandwidth of 10 MHz.² From Fig. 2, the receiver noise density will be -206 dBW/Hz . To correct for the 10-MHz bandwidth, we must add the bandwidth ratio in dB to the power density thus giving us the total power

$$\frac{10 \text{ MHz}}{1 \text{ Hz}} = 70 \text{ dB} [10 \log (10^7) = 70\text{dB}]$$

$$\therefore N = -206 + 70 = -136 \text{ dBW}$$

If we require a carrier to noise ratio of 20 dB, then the incoming signal must be -116 dBW . From Fig. 1, a 20-ft-diameter reflector will be sufficient. We can also see from Fig. 1, if the erp of Intelsat II is used, the signal will be at threshold level (marginal) for the 20-ft-diameter reflector. The minimum detectable signal level for other bandwidths is shown in Fig. 3.

Although this discussion assumes reception

²The bandwidth will be 9 MHz if the video is converted to fm as is now being done on the Early Bird Satellite.

of a single channel, multichannel reception is possible, increasing the bandwidth of the receiver by an additional 10 MHz to 20 MHz reduces the receiver capability only 3 dB (or 6 dB for 40 MHz). Since we have allowed for a handsome fade margin (signal to noise ratio) of 20 dB, the additional bandwidth could be received with only a slight reduction in reliable reception. The 20-ft antenna would likely be adequate and only a diplexer and separate demodulators need be added to the receiver to receive all of the networks and ETV channels.

The figure of merit used to evaluate terminal performance is the gain to noise temperature ratio, G/T . This may be used in cost tradeoff studies of antenna size versus noise temperature of the receiver. If a G/T of 25 is required, the following combinations of antenna and receiver can be used:

Antenna and receiver required for $G/T = 25$

Antenna Size	Receiver
10 ft	Cooled Par-Amp (20°K)
20 ft	Uncooled Par-Amp (120°K)
40 ft	Tunnel Diode (800°K)

Other sources of noise temperature are:

Source	Typical Value, °K
Cosmic noise (at 4 GHz)	8
Rain	300
Sun (aligned with satellite)	30,000
Transmission line/0.1 dB	7
Atmospheric noise (elev. angle 40°)	7
Spillover around reflector	≈ 15

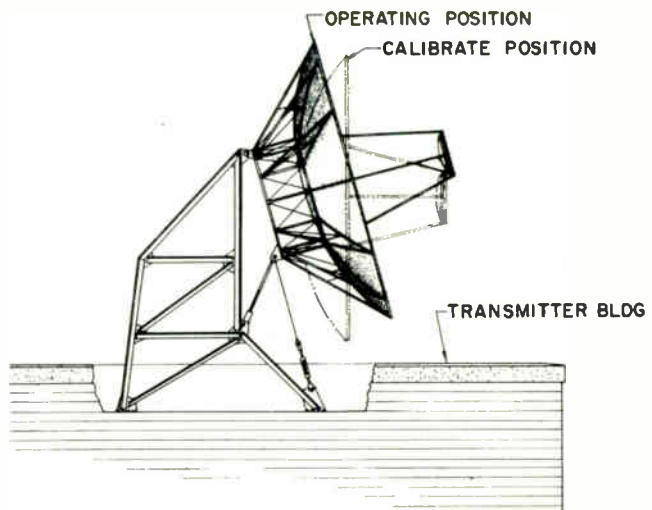
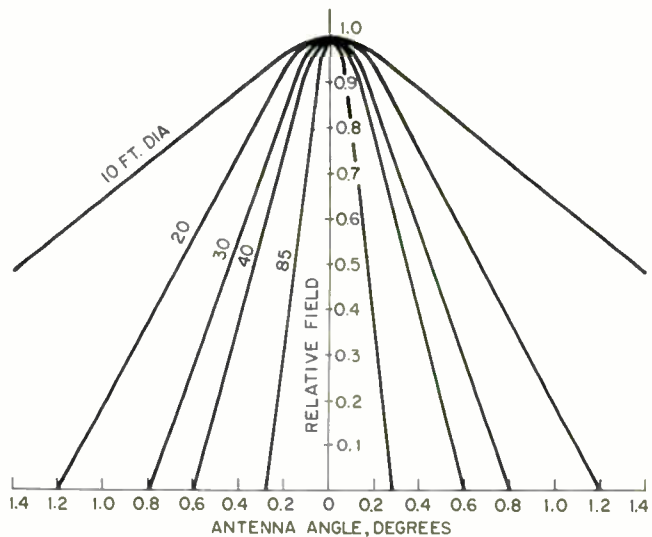
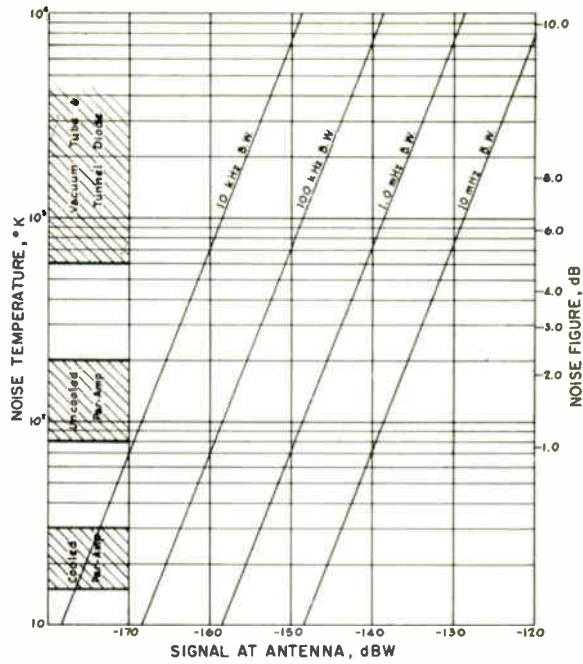
In a well designed ground terminal, the spillover energy, that is, the energy re-reflected from the warm ground, can be kept to less than 5 percent. Therefore, its contribution will be approximately 15°K. With Cassegrainian geometry, the receiver can be mounted close to the feed and the insertion loss kept to <0.2 dB (approximately 14°K).

If we assume the satellite positioned at 100° W Longitude above the equator, then from anywhere in the continental USA, the elevation angle will be between 20° (10°K) and 40° and (7°K). There will be two occasions per year when the sun and satellite are in conjunction with respect to any ground station. For any set of geographical co-ordinates the day and time of each conjunction is readily predicted and local, tape, or film programs may be scheduled for these times to replace satellite transmissions.

Antenna Design

Present day antennas are 85 ft in diameter, have system noise temperature of 70°K and are designed to receive a 500-MHz bandwidth.

A synchronous satellite does not remain stationary due to thermal and gravitational effects. For the Early Bird satellites, the station keeping characteristics were not too well known prior to its launching. Fuel is carried aboard the satellite and expelled on command from the ground to



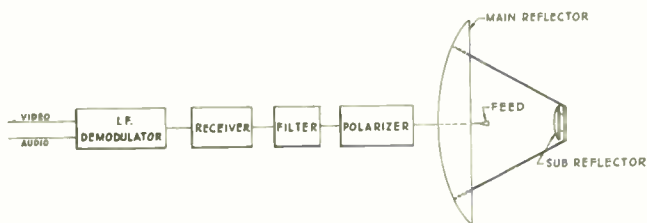


Fig. 6. Block diagram of typical receiver.

What About Cost?

The elements making up the total system cost are the antenna, the feed line and miscellaneous costs, and the receiver.

Typical antenna costs for the examples in the text are: 10-ft, \$8,000; 20-ft, \$14,000; 40-ft, \$30,000. The feed line and related costs for these antennas might be \$14,000, \$15,000, and \$18,000, respectively. Thus the antenna and related costs are 10-ft, \$22,000; 20-ft, \$24,000; 40-ft, \$48,000. Typical receiver costs are: cooled Par Amp, \$50-70,000; uncooled Par Amp, \$15-25,000; tunnel diode, \$2-4,000. Receiver-antenna tradeoffs are possible and the best amplifier can be used with smallest antenna and vice versa. System costs, then, might run from a high of \$97,000 to a low of \$50,000.

This modest cost is possible because the antenna is located on a fixed mount. Experience has shown that as satellites can be kept in quite stationary positions, eliminating the need for servo controlled tracking antennas.

maintain the satellite on station. The useful life of the satellite is dependent on the amount of fuel available. Since future satellites will not be weight limited, and, therefore, will carry greater quantities of fuel, they will remain in a more stationary position.

As can be seen in Fig. 4, even with the high directivity of an 85-ft antenna, there is little need for a servo controlled drive on the antenna if the station keeping of the satellite is held to $\pm 0.1^\circ$.

The spare satellite in the domestic TV network will be located well within the beam of a 20-ft-diameter reflector. Therefore, if station keeping can be maintained and there is no need of repointing the antenna to a different portion of the sky, the antenna need not be mounted on a servo controlled pedestal but on a fixed mount. The use of a fixed mount will reduce the cost of the terminal significantly and increase the relia-

bility. The antenna could be mounted on the roof of the studio and beamed toward the satellite.

Antenna Details

A block diagram of the antenna system is shown in Fig. 6. The signal will be received by the antenna. Since the incoming signal will be circularly polarized, a waveguide polarizer will be used to convert the signal to linear polarization. The signal will then be processed through a highly selective filter and into the receiver. The signal will be amplified at rf, demodulated and separated into audio and video components. The signal can then be processed in the same manner as the output of the studio-transmitter link.

Reflector. The reflector will be of Cassegrainian geometry, consisting of a main reflector (paraboloid) and subreflector (hyperboloid). In this configuration the feed is on the vertex side of the dish. This permits the receiver to be mounted immediately adjacent to the filter thereby minimizing line losses. Since a fixed mount is proposed, beam adjustment necessary to sight on the satellite may be obtained by tilting the sub-reflector. The main reflector can either be spun or fabricated in pie sections and assembled at the station. The reflector will use solid aluminum panels and must have an assembled surface tolerance of ± 0.10 in. rms.

Feed. The feed complexity will be greatly reduced with the elimination of the tracking requirement. If there were a tracking requirement, a four horn monopulse feed capable of generating sum and difference patterns must be used to determine the satellite movement. With no tracking requirement a single electromagnetic horn will be used. High aperture efficiency can be obtained with this configuration.

The mount would be a welded steel assembly supporting the reflector as shown in Fig. 5. The mount must be rigid enough to maintain pointing accuracy to within $\pm 0.2^\circ$ in 120-mi/hr winds.

A radome would not be required over the antenna, but a small radome or fiberglass cover would be used over the mouth of the horn.

The mount should be configured to permit the antenna to be rotated to a face side position. This is necessary during installation to calibrate the gain and noise level. It would also be used periodically to check the signal level radiated from the satellite.

Rfi Considerations

The high directivity of the reflector will discriminate against interfering signals around the frequency of interest. All signals beyond $\pm 1\frac{1}{4}^\circ$ (20-ft dish) of the main beam will be down at least 20 dB. With a well designed antenna and feed, side and back radiation can be kept below -45 dB.

The filter located between the polarizer and the receiver will discriminate against other frequencies. ●



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FIG. 1. BLOCK DIAGRAM OF A TYPICAL STEREO AND SCA AUDIO SYSTEM

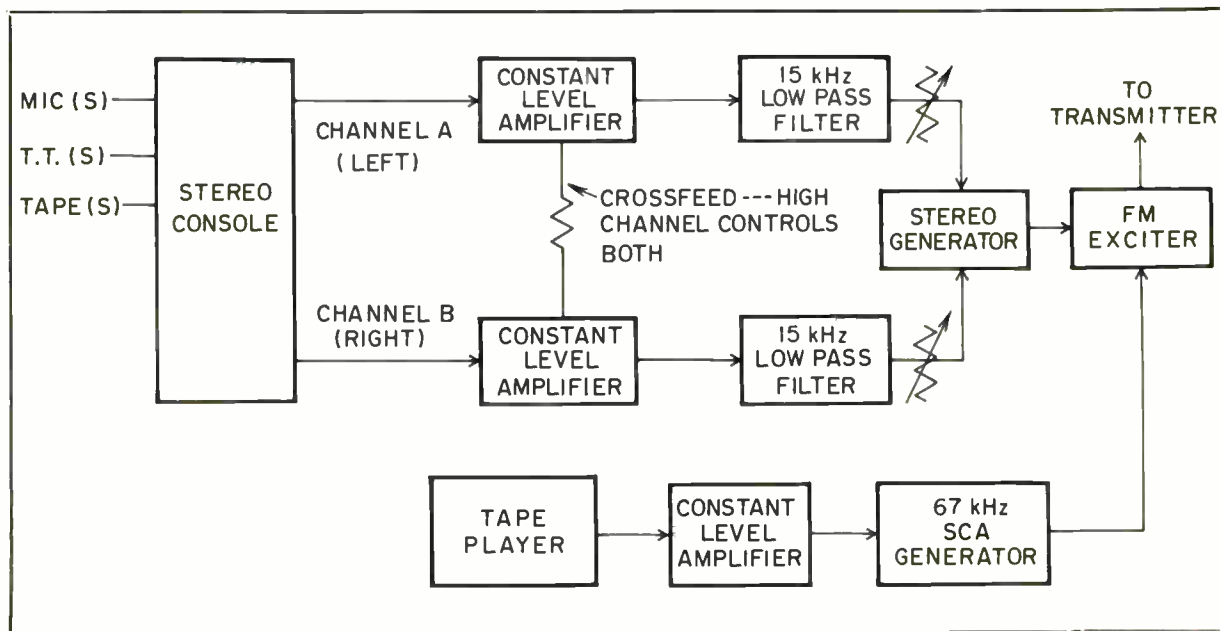
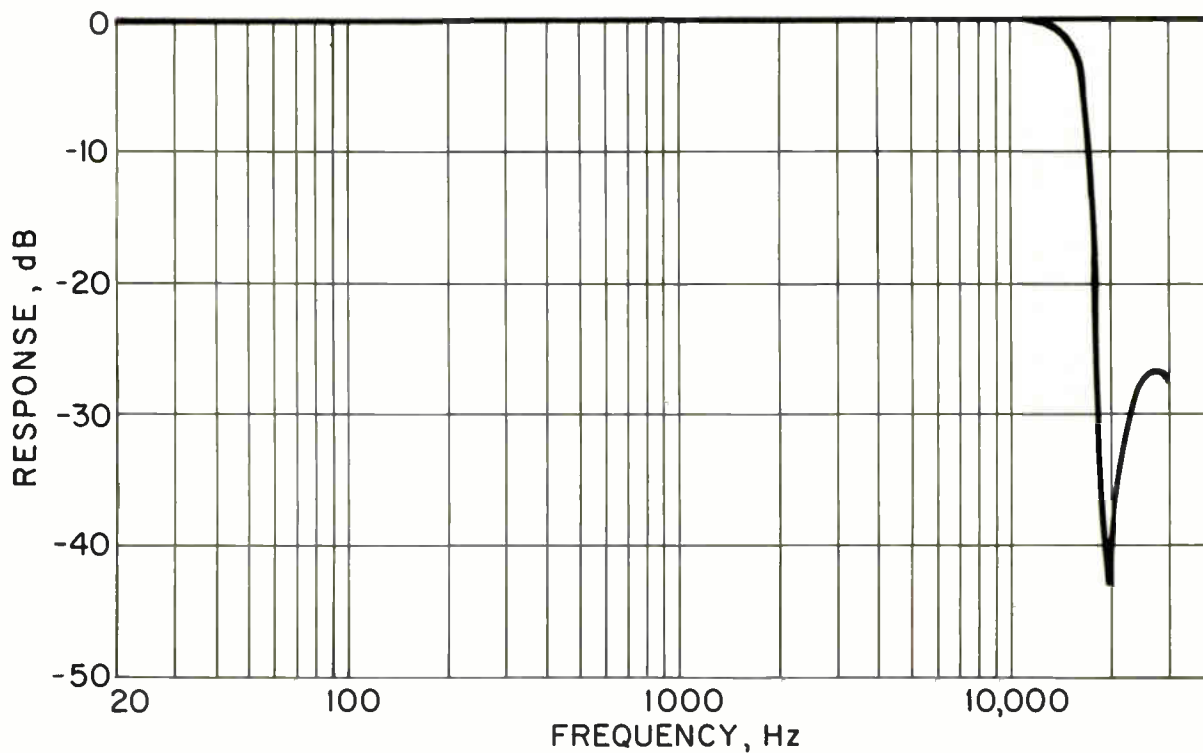


FIG. 2. OVERALL RESPONSE OF A TYPICAL 15-kHz LOW-PASS AUDIO FILTER



The Wasteland of Stereo Fm

By Carl E. Roliff

Is your stereo system up to par? These criteria simplify system evaluation.

IN ALL TOO MANY INSTANCES, stereo fm is a technical wasteland of distortion, hum, noise and poor separation. Apparently some fm broadcasters assume that stereo programming is simply a matter of installing a stereo generator, then sitting back to wait for the new accounts to roll in. Good fm multiplex stereo, however, requires conscientious attention to every aspect of the total system. Seldom is the problem one of the equipment itself; design and engineering has been accomplished by various equipment manufacturers. The problem is proper installation, adjustment and maintenance. The overall stereo system is capable of a better performance than many stations are achieving.

Stereo/Monaural Compatibility

The first consideration is compatibility with existing fm equipment. Therefore, the first FCC requirement (Rule 73.322a) is that the main fm channel be modulated with the sum of the left and right signals. The addition of the two signals is accomplished in the stereo generator. Due to the transmission method, a 19-kHz pilot subcarrier (produced by the stereo generator) at 8- to 10-percent modulation is required (73.322b). The FCC rule of December 1, 1966, requires daily measurement of the 19-kHz pilot subcarrier frequency. (Perhaps if broadcasters had met their responsibility of maintaining an accurate 19-kHz pilot subcarrier frequency, the rule would have been avoided.) The stability of currently available and operating equipment is excellent, and repeated weekly or monthly measurements have shown negligible frequency change. The station that was 1.3-Hz low last week is still 1.3-Hz low this week. The 67-kHz SCA subcarrier also requires frequency measurement. On a recent service call I noticed a log entry of "SCA subcarrier frequency measured at +200 cycles." Measurement of the SCA subcarrier with a recently-calibrated electronic counter indicated a frequency of 68,118 Hz, or +1118 Hz from the desired 67 kHz. A quick look at the unit revealed that the calibration crystal was not even in the socket; therefore, all

Mr. Roliff is chief engineer, KRSN, Reno, Nev.

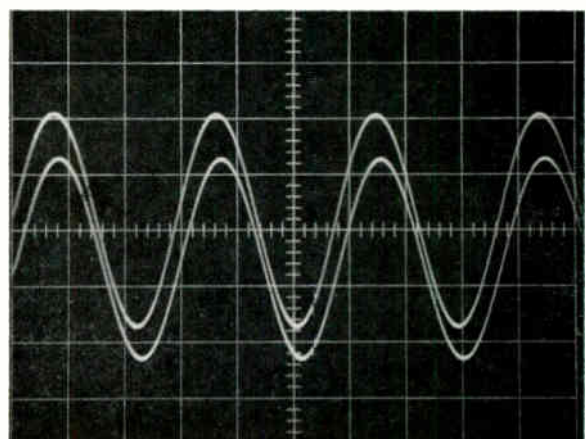
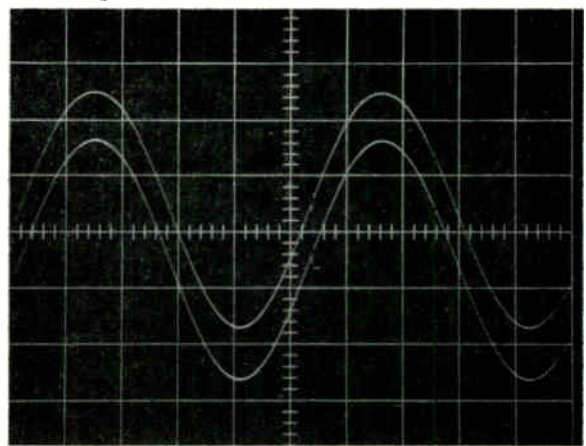
previous measurements were inaccurate.

Subcarrier Phasing

One of the major stereo problems involves phasing the 19-kHz pilot subcarrier in relation to the 38-kHz subcarrier. Rule 73.322c states: "The stereophonic subcarrier shall be the second harmonic of the pilot subcarrier frequency and shall cross the time axis with positive slope simultaneously". Error here causes a definite separation problem. To measure the relative phase of the 19-kHz and 38-kHz subcarriers, many stations try to use inexpensive kit-type oscilloscopes which are prone to have internal phase shift at

Fig. 3. Scope photograph shows equal amplitude and phase between stereo channels with 400-Hz modulation.

Fig. 4. At 15,000-Hz modulation (Fig. 3) amplitudes are equal, but appreciable phase difference is occurring.



38 kHz; therefore, even if the scope indication is correct, the equipment is still improperly adjusted. The 19-kHz phasing adjustment must be made with a good wide-band professional oscilloscope, using a low-capacity probe.

Once properly adjusted, most stereo generators are very stable and do not need frequent readjustment. The instruction book provided with the stereo generator contains adequate alignment instructions and the waveforms which should be obtained. The stereo subchannel is an amplitude-modulated, double-sideband suppressed-carrier signal. The suppression of the 38-kHz carrier is accomplished in the stereo generator (73.322e). The modulating signal for the stereophonic subcarrier must be equal to the difference of the left and right signals (73.322g).

For both the main and subchannels, the audio frequency response should be a minimum of 50 to 15,000 Hz, with standard 75 μ s pre-emphasis characteristics (73.322h). I have found pre-emphasis networks installed that had different attenuation characteristics and case grounds missing. Check the pre-emphasis network. If the station converted from mono to stereo and purchased an additional pre-emphasis network, there may be considerable difference in signal phase and amplitude at the output of the two networks. It is very simple to install a matched pair.

Audio Response and Phase

The prime objective of stereo is to transmit two separate channels with a minimum of crosstalk. The FCC requirement is a channel separation of 29.7 dB at all frequencies between 50 and 15,000 Hz. This is a major problem and many stations do not meet this specification. Amplitude and phase differences anywhere in the audio system can cause trouble.

Rule 73.322m specifies maximum phase difference of $\pm 3^\circ$ for modulating frequencies from 50 to 15,000 Hz. Unless the left and right channels are identical in all respects throughout the audio system, up to and including the input of the stereo generator, phase differences will result. I found one station using a peak limiter as a line amplifier on one channel, and a constant-level amplifier of another make on the other channel. Equipment in the two channels was not identical; therefore, the two audio signals could not be equal in amplitude and phase. A pair of matched line amplifiers eliminated that particular problem. The instantaneous addition and subtraction ($L + R$) ($L - R$) of the right and left channels can only be accomplished if both channels are identical. Some stereo consoles introduce phase differences at 15,000 Hz. Equalized telephone program lines will also produce phase differences between higher audio frequencies. Phase and amplitude must be matched (within 3°) at all audio frequencies from 50 to 15,000 Hz. Each installation is different and no one phase correction system is a cure-all, but using the best quality components with a minimum of phase

shift throughout the audio range may eliminate the need for phase correction.

The use of a 15-kHz low-pass filter is recommended on each channel at the stereo generator input (see Fig. 1). The filters sharply attenuate any program energy above 15 kHz; 40 dB attenuation at 19 kHz can easily be obtained. The graph in Fig. 2 shows the response characteristics of the 15-kHz filters installed at KSRN. The filters prevent any program energy from interfering with the 19-kHz pilot subcarrier. Unless properly installed, though, they can do more harm than good; considerable phase shift can be introduced at higher frequencies. If such filters are being used, they should be balanced for phase and amplitude throughout the 50 to 15,000 Hz frequency range. A good oscilloscope (with add-algebraic feature of A-B) provides a simple means of checking the entire audio system for phase and amplitude characteristics.

Channel Separation and Crosstalk

In Fig. 3, the 400-Hz modulation on both left and right channels is shown at equal amplitude and phase. When the two signals are combined ($L + R$), instantaneous addition or subtraction ($L - R$) is complete. In Fig. 4, the modulating frequency is 15,000 Hz. At this frequency, however, considerable phase shift is present. During instantaneous addition and subtraction of the two channels, it is impossible to obtain the required separation with this excessive phase difference. The stereo transmission system requires that the two channels be combined $L + R$ and $L - R$. In the receiver, the signals must be recovered and separated to left and right channels. Addition and subtraction of the composite signals in the receiver may result in cancellation of one channel. For example:

$$\begin{array}{r} L + R \\ (+) \quad L - R \\ \hline 2L \end{array}$$

The right channels cancel. Now, invert the $L - R$ signal and subtract.

$$\begin{array}{r} L + R \\ (-) \quad L - R \\ \hline 2R \end{array}$$

If the right channel signal was produced by a piano, this mathematical result does not mean that we would have the sound of two pianos, but the same piano signal with twice the amplitude. FCC Rule 73.322(n) (o) specifies that crosstalk between main and stereo subchannel shall be down at least 40 dB. Figs. 5 and 6 compare a monaural fm signal with a stereo signal. The original mono system had a modulation capability of 100 percent. Now with stereo (73.322i) modulation levels are 45-percent main carrier, 45-percent stereo channel and 10-percent pilot subcarrier. Overdriving the system to the point where one channel deviates into the other will cause crosstalk and distortion. If the equipment is properly adjusted and modulation levels are cor-

rect, crosstalk is not a problem. With stereophonic broadcasting there is a definite decrease in modulation levels; don't worry about it, the listener will set the volume control on his amplifier to the desired level.

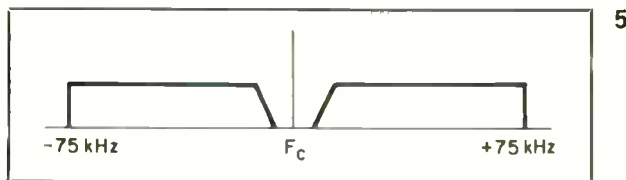
Positive and negative main-carrier deviations should be equal (73.322k). If there are push-pull modulators in the exciter, check for equal input signal voltages. I have found only one station with this problem, and in this case the positive input was 5 times greater than the negative signal. Routine servicing and troubleshooting solved the problem.

Equipment performance is a matter of frequency response, inherent noise and distortion, and with stereo, channel separation. With today's modern audio consoles, frequency response of 20 to 20,000 Hz is easily obtained. This, of course, exceeds the 15,000-Hz upper limit. Good frequency response is also obtained from quality tape machines and phono cartridges. Therefore, overall frequency response should never be a problem. However, phono preamp equalization is often incorrect. Hum and noise reduction is a matter of equipment design, proper shielding of cables and placement of parts. (Don't run a high-voltage primary wire next to an audio input transformer.) Distortion should never be greater than 1 percent from 50 to 15,000 Hz. Any increase in distortion means defective components. Start troubleshooting and beat that distortion down to where it belongs. It takes a low-distortion audio oscillator, a good distortion meter and a good engineer. Getting all three together is sometimes difficult.

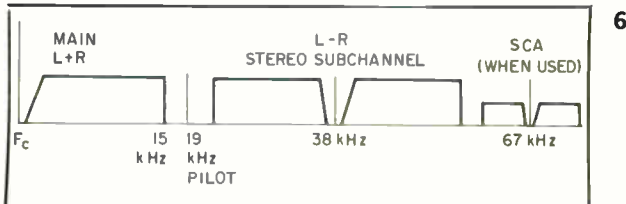
Stereo Receiver Problems

No discussion of stereo is complete without reviewing the problems which may occur in the receiver. A good receiver must have wide-band i-f and detector response in order to recover the composite stereo signal without phase shift or loss of the higher frequencies. The multiplex adapter should be mounted on the main chassis. The use of long high-capacity cables in high-impedance circuits between the multiplex output and the adapter will attenuate part of the stereo signal and degrade the final sound system.

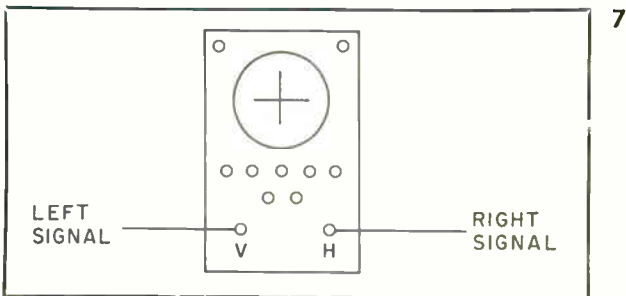
Since the stereo signal is a double-sideband suppressed-carrier signal, the 38-kHz subcarrier must be reinserted at the receiver in order to recover the modulation. The receiver phase adjustment, which controls the phase of the reinserted carrier, seldom matches the phase adjustments at any of the stations in the receiving area; 90 percent of the stereo tuners in the field over one year old are not properly adjusted. If the tuner is aligned correctly on one station, just tune to another station and the phasing on that station is sure to be different. For tuner alignment the service technician should ask the listener which station he listens to most and complete the alignment on that station's signal. Since few service shops have the necessary calibrated professional



5



6



7

Fig. 5. Diagram of a monaural fm channel with 100-percent modulation.

Fig. 6. Subcarriers are shown in this diagram of a stereo upper sideband.

Fig. 7. Connected in the manner shown here, a scope may be used as a stereo monitor.

instruments properly to align test equipment, a method I have used is to align the multiplex adapter on an off-air signal using the oscilloscope as a stereo monitor.

Oscilloscope Stereo Monitor

Connect the left channel to the vertical input and the right channel to the horizontal input of the oscilloscope, as shown in Fig. 7. Adjust vertical and horizontal gain controls for equal deflection with equal input to both channels. When only the left or right channel signal is on the air, the scope should show a straight line (vertical or horizontal, depending upon which channel is being broadcast). A high quality, properly aligned system will give excellent results. Any tilting or curvature of the line indicates poor separation and trouble somewhere in the total system. (See oscilloscope photographs, Figs. 8 through 11.) A monaural signal will show a straight line at 45°. With good stereo music, the scope pattern looks much like a ball of steel wool. The best stereo performance may be obtained by adjusting separation and balance controls for the best straight line while one channel is silent.

FCC rules require annual proof-of-performance measurements. Some stations conduct the tests grudgingly and only for the purpose of satisfying the rules. They should be conducted with the objective of providing listeners with the best possible fidelity. Professor William Thomson (Lord Kelvin) said: "I often say that when you can measure what you are speaking about, and

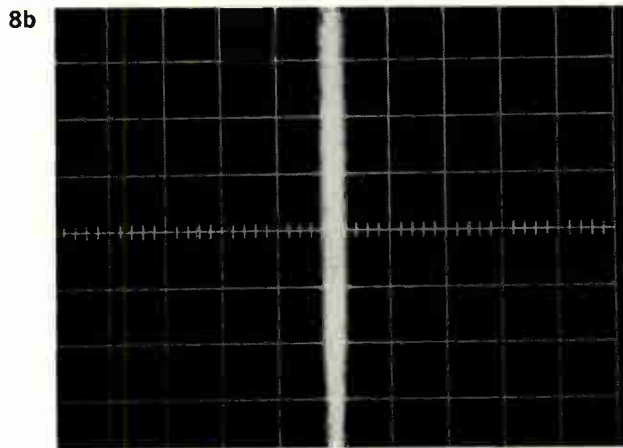
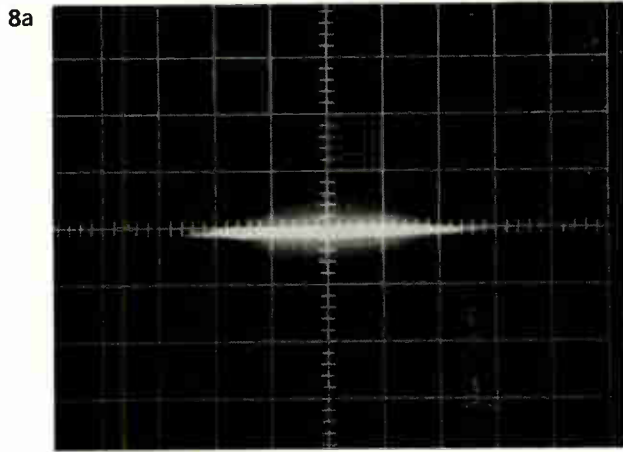
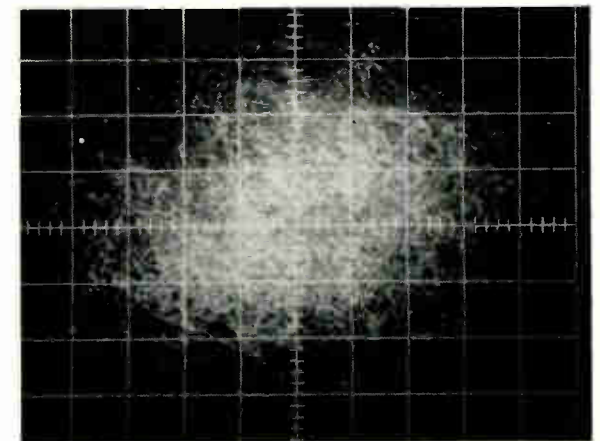
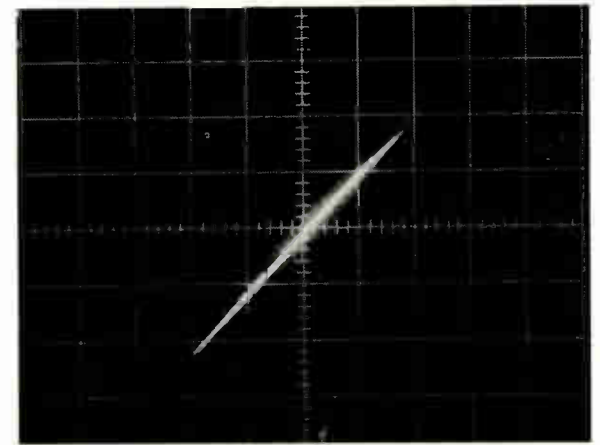
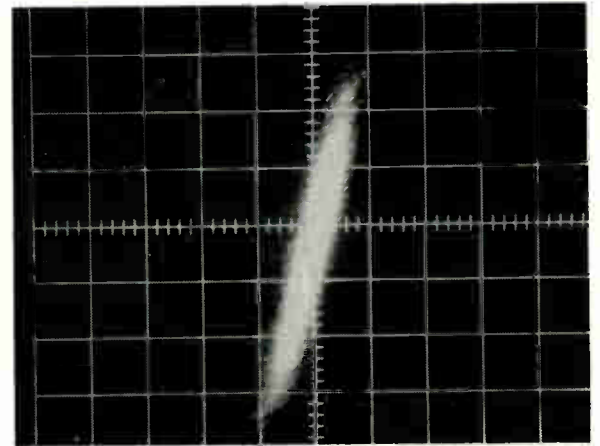


Fig. 8. Scope photographs (a) and (b) show channels with no modulation.

Fig. 9. An off-vertical (or horizontal) scope trace is an indication of poor channel separation, as shown by this waveform.

Fig. 10. A monaural signal at the input of the scope stereo monitor will produce a diagonal line.

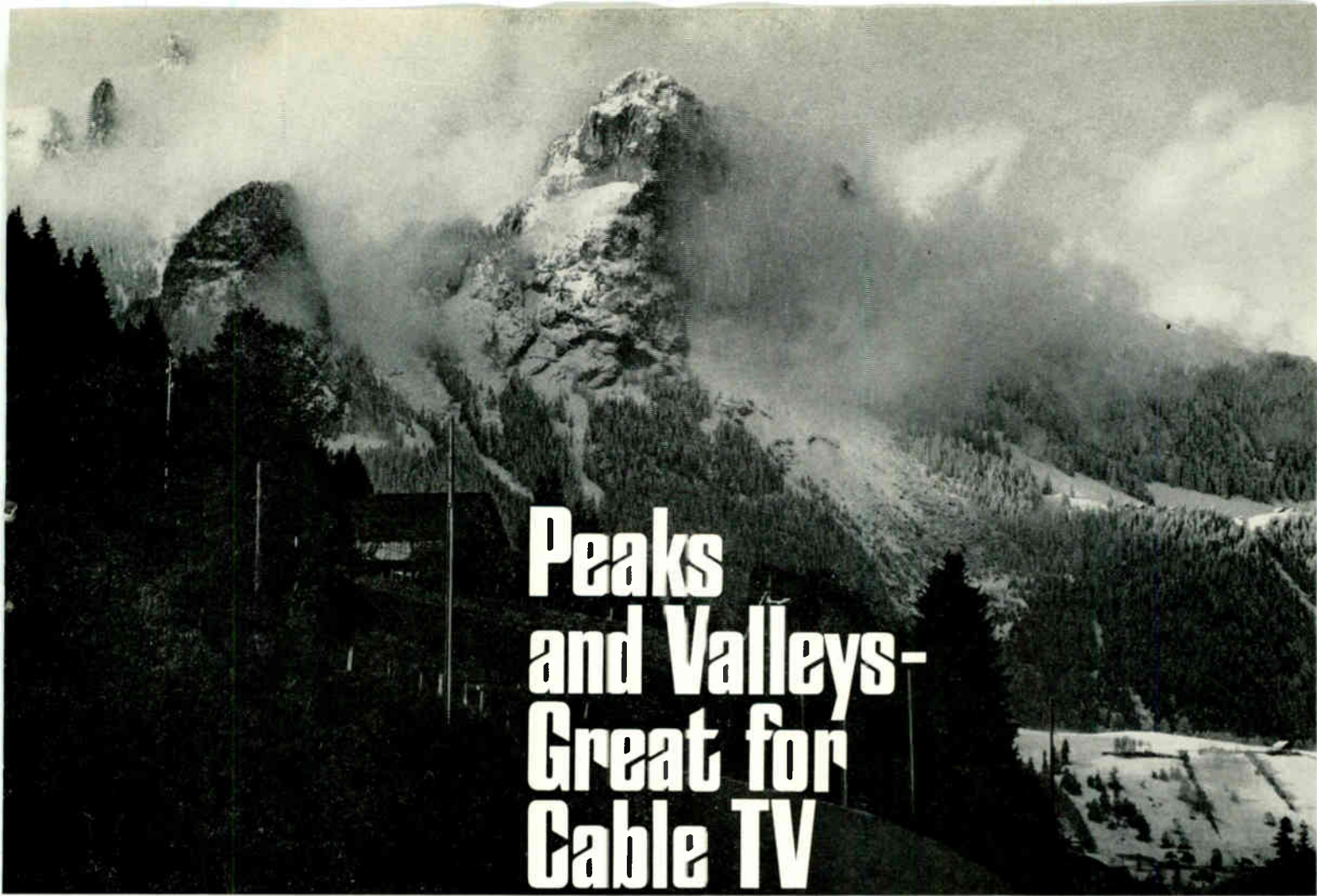
Fig. 11 Full stereo modulation produces a scope display similar to that shown here.



express it in numbers, you know something about it. But when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the stage of science, whatever the matter may be." His exact words summarize as follows: If you cannot measure and express it in numbers, you do not know what you are doing.

In the case of stereo sound, the proof is in the listening. There are many people who claim that measurements are meaningless, and that there is that undefined quality of transient response which gives a sound system that extra quality. Nonsense! I have never measured a system that sounds bad and obtained good measurements, and any system that measures good has always sounded good. With a good oscilloscope and square-wave generator, transient response and rise time can easily be measured.

It is the responsibility of every broadcaster to comply with all applicable requirements of the FCC rules and regulations. For those systems that already comply, the engineering job is simply one of system maintenance. For others, the only solution is to put a good competent engineer on the job with a coordinated effort to accomplish the best possible stereo. It is doubtful that even an FCC inspection will cure the complacent broadcaster who disregards both the technical standards and his responsibility to the listeners. ●



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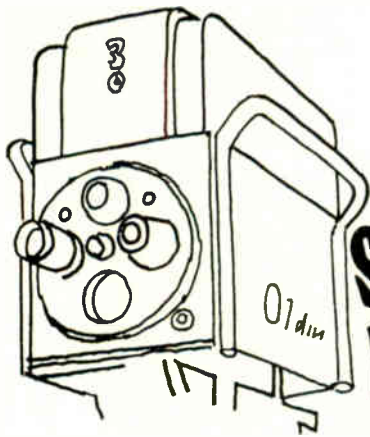



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Here's some plain talk about amplifiers.

CAS line extender amplifiers are weatherproof, not waterproof. As a matter of fact, they won't float either. They install cover down on the cable, operate reliably during blowing rains, snow, hail, and sleet. When the sun comes out they keep right on operating.

CAS has nothing against modular construction. But plug-in replacement *does* cost you more. It's a nice feature when and *if* you need maintenance.

Quite frankly, CAS feels its TRA-217 amplifier maintenance history *doesn't* justify the additional cost of modular construction, so it builds a minimum maintenance unit and passes the savings on to you.

If a CAS amplifier ever does require maintenance, there are



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Here's what Mr. Dale Mathis, (above) chief engineer of TV Cable of Abilene, Inc., says about the reliability of CAS amplifiers:

"We now have 670 CAS TRA-217 amplifiers in over 250 miles of system. Most of these amplifiers have been in operation since 1964.

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Guide To CATV Cable Selection

Part 1

A discussion of cable characteristics and the various basic approaches to cable manufacturing. Next month, Part II tabulates CATV cable available from all major manufacturers.

WHEN A CATV PLANT is built, costs are generally divided into three approximately equal segments: (1) active and passive hardware, (2) cable, (3) labor. Cable is such an important factor that the initials CATV were recently changed from Community Antenna TV to mean Cable TV. Yet little has been done to standardize, classify and compare cables. This article will attempt to synthesize the current knowledge of CATV cables, covering all of the most important factors. It is based upon interviews and correspondence with all leading CATV cable manufacturers, plus the experience of a number of cable TV operators.

We cannot recommend one specific manufacturer's model number for each specific cable application. We can, however, list the types of cable available, give you the specifications and characteristics of each, explain the significance of the variables and let you draw your own conclusions.

This article will cover the factors involved in

judging CATV cable and the basic types of cables available. Part II will include a listing of all major manufacturer's CATV cables.

Factors In Judging Cables

You must consider a number of important factors when choosing a cable for a specific CATV application, including the following:

- A. Impedance
- B. Attenuation
- C. Return loss
- D. Moisture resistance
- E. Flexibility
- F. Resistance to environmental conditions

Impedance

CATV systems use 75-ohm coaxial cables exclusively except for the very short length of twin-lead between the matching transformer and the subscriber's receiver. The characteristic impedance of a cable is determined by the diameter of the inner and outer conductors, the spacing between the conductors and the dielectric used. The formula is:

$$Z_0 = \frac{138 \log_{10} D/d}{\sqrt{\epsilon}}$$

where D is the inner diameter of the shield, d is the outer diameter of the center conductor, and ϵ is the dielectric constant of the dielectric.

Attenuation

All cables attenuate signals. Attenuation is usually stated in terms of loss per 100 feet at specific frequencies. Early CATV systems used the low vhf band only. Thus, losses were calculated at 88 MHz, or 108 MHz to include fm. Later, more and more systems included the high vhf band and losses were calculated at 220 MHz. With the advent of 20-channel systems, some manufacturers are developing systems using frequencies above channel 13, but since no one really knows the direction the industry will take in this respect (see *BM/E* January, p. 10), we'll stick to specifying losses at channel 13 in these articles.

Two basic types of dielectrics are used in CATV cables: solid polyethylene and cellular polyethylene, or "Foam." The attenuation of the cable is directly proportional to the dielectric constant (ϵ) of the dielectric. Foam has a dielectric

constant of only 1.50, compared with a dielectric constant of 2.30 for solid polyethylene. Thus, cables using foam dielectrics cause considerably less attenuation than similar cables with solid dielectrics.

Foam is less moisture resistant than solid and more easily collapsed, but it is used widely and successfully in CATV plants.

Cable attenuation is generally specified at +70°F. However, temperature has an important effect on cable losses. Attenuation increases or decreases by 0.1 percent for each 1°F change in temperature.

Return Loss

Perhaps the best overall criterion of electrical "quality" of CATV cables is return loss. Until recently, cables were checked by a sweep test. A sweep generator sent its output through a cable and each frequency was checked on a scope. Any notches, or "suck outs" indicated trouble at that frequency. Then a marker generator and a calibrated attenuator were used together with a nomograph to determine the vswr at the suspected frequencies. Unfortunately, this method was inexact. It was impossible to attain reliable measurements

better than 1.5 to 1., which is not good enough for CATV.

Thus, return loss test techniques were developed to fill the need for accurate, reliable, repeatable quality measurements. Fig. 1 shows a typical return loss test setup. One end of the cable to be tested is terminated by a close tolerance 75-ohm resistor, and the other is connected to an impedance bridge. The switcher enables you to see the signal fed into the cable and the signal reflected back from the cable simultaneously on the scope. The marker generator identifies the frequency of any notches observed. Return loss is actually the difference, in dB, between the amplitude of the signal fed into the cable and the amplitude of the signal reflected back from the cable. It is usually specified at the worst possible frequency. Return loss is easily translatable into vswr. A number of nomographs are available, but the following conversions should be about all that a CATV engineer needs:

Return Loss	=	Vswr
20 dB	=	1.220 : 1
25 dB	=	1.120 : 1
26 dB	=	1.105 : 1
30 dB	=	1.066 : 1

Fig. 1. Return loss with this type of test setup provides best overall indication of cable quality.

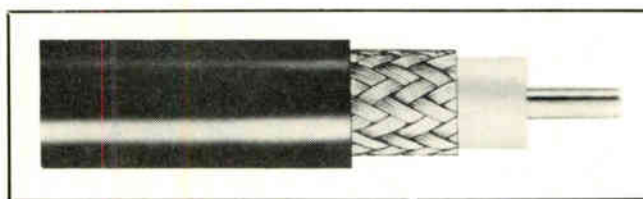
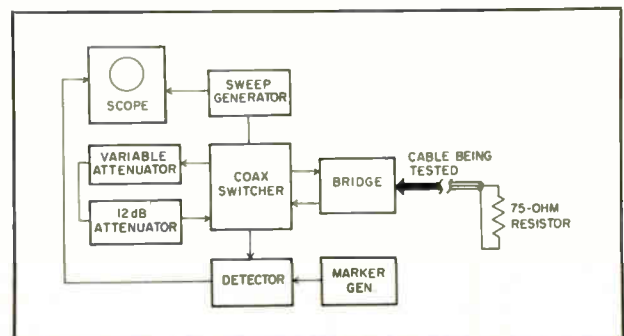


Photo Courtesy of Times Wire & Cable.

Fig. 2. Semiflexible solid aluminum sheathed cable.

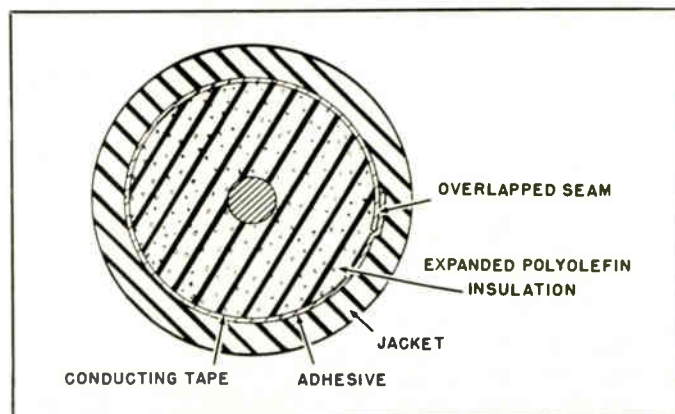


Fig. 3. Cross section of hermetically sealed cable.

How good a return loss is required for CATV cables? It's hard to say. Poor return loss shows up as poor picture quality—faint ghosts or smears, especially on color TV. But recognition of picture defects is subjective, to a great extent. What one viewer thinks is an excellent picture, another might rate as just fair. Also, many things (connectors, splices, etc.) in a CATV system cause reflection besides cable. And reflected signals that travel a long distance are usually more noticeable than those close to the primary image.

Perhaps the NCTA will one day set return loss standards, but in the meantime we must rely on the experiments run by Jerrold. These tests indicate that a 26-dB return loss produces ghosts so faint that subscribers generally ignore them. A return loss of 30 dB produces excellent pictures, with only the most experienced and critical viewers noting even the faintest of ghosts.

These tests, however, were made on black and white receivers. No similar data on the subjective effect of return loss on color TV is currently available.

Moisture Resistance

Water and water vapor can cause a tremendous increase in cable attenuation. Many of the early systems which worked well originally, got complaints from their customers that pictures were snowy, especially at the extremities of the feeder lines. Then it was discovered that the polyethylene jackets used are waterproof, but not vaporproof. Water vapor entered the cable easily, condensed, and accumulated between the jacket and the shield, especially at the bottom of downhill runs. Attenuation in these instances was severe, especially at high frequencies. To check this factor, polyethylene jacketed cable was sprayed thoroughly each day for 60 days. Attenuation per 100 feet increased by 0.19 dB at channel 6, and 0.43 dB at channel 13.

Moisture resistance was one of the main reasons that the CATV industry turned to aluminum sheathed cables.

Flexibility

Aluminum sheathed cable has many things to recommend it, but it is hard to bend. This makes installation more difficult and time consuming. Semiflexible aluminum sheathed cable can also crack from overflexing.

Resistance To Environmental Conditions

Bare aluminum sheathed cable works well in some installations but it cannot be used in others. For example, salt air and other pollutants attack aluminum and corrode it. Thus, in shore areas and highly industrial areas, a jacket is required. Jackets must also be used in underground systems and in areas where there are a lot of squirrels. Squirrels don't eat aluminum, but they like to sharpen their teeth on it. Drop line cables never

use a solid outer shield and are always jacketed.

Three basic types of jackets are commonly used: polyethylene, polyvinyl chloride and non-contaminating polyvinylchloride (see table).

Polyethylene is an excellent long life jacket. It is moisture resistant, abrasion resistant, water resistant, crack resistant, noncontaminating and protected against ultraviolet damage. Polyethylene is recommended for underground installations.

Polyvinylchloride is more flexible than polyethylene and more flame retardant. However, it is contaminating. In other words, the plasticizer in polyvinylchloride is so volatile that some of it is lost by diffusion and migration to the dielectric. This increases cable losses and makes the jacket more brittle at low temperatures. This is a very slow process, but within 5 or 10 years contaminating cable may have to be replaced.

As the name implies, noncontaminating polyvinylchloride is similar to ordinary polyvinylchloride, but the plasticizer is not volatile. This jacket will not lose flexibility or increase attenuation for the life of the cable.

A great deal of confusion exists in the field about jackets. There are so many names and nicknames that cable buyers often ask manufacturers for the wrong thing. Polyethylene is often called "Poly" and designated by the initials "PE." However, people often ask for "Poly" when they mean Polyvinylchloride, which is more commonly known as "vinyl." To make matters worse non-contaminating polyvinylchloride is also known generally as "Vinyl." In an attempt to minimize the confusion, the table shows the proper name, the initials and the most common nickname for each type of jacket.

Basic Cable Types

CATV cables can be classified in a vast number of ways. The first, and perhaps most significant classification is by function. There are four basic applications for CATV cables:

1. Trunk lines
2. Feeder lines
3. Distribution lines
4. Subscriber drop lines

To a great extent, the first three applications can be lumped into one. The same types of cables

Characteristics Of CATV Cable Jackets

Name	Polyethylene	Polyvinylchloride	Noncontaminating Polyvinylchloride
Common Designation	Poly	Vinyl	Vinyl
Abbreviation	PE	PVC	NCV
Weather Resistance	Excellent	Good	Good
Crack Resistance	Good	Poor	Poor
Abrasion Resistance	Excellent	Good	Good
Flame Retardant	No	Yes	Yes
Contaminating	No	Yes	No
Direct Burial	Recommended	Not Recommended	Recommended
Operating Temperature	-55°C to +80°C	-40°C to +80°C	-40°C to +80°C

are commonly used for trunk, feeder and distribution lines, except that the diameters are usually different. For example, a CATV system might use 0.750 in. outer diameter (OD) for main trunk lines, 0.500 in. OD for feeder lines, and 0.412 in. OD for distribution circuits.

On the other hand, subscriber drop lines are far less critical. They can utilize smaller, less expensive and easier to handle cables, generally of the RG-59/U type.

Solid Aluminum Sheathed Cable

CATV cables are commonly classified as to the type of outer conductor. Semiflexible solid aluminum sheath (see Fig. 2) is most often used for CATV trunk, feeder and distribution lines. Manufacturers of this type of cable start with a center conductor (solid or tubular copper) around which they form a dielectric, generally foamed polyethylene. The center conductor and dielectric are made to the proper length and then pulled through a loose-fitting aluminum tube. The aluminum tube is then squeezed tightly and elongated around the dielectric. Enough pressure is used so that the formed dielectric is actually compressed. This compression keeps any moisture that does get between the shield and the dielectric (through

pinholes in the aluminum, splices, connectors, etc.) from traveling along the cable and accumulating in one spot.

The quality of the cable produced by this method is dependent on a number of factors including: the quality of the materials used, the uniformity of aluminum shield thickness, and whether or not the center conductor is in the exact center of the cable over its entire length.

Because the dielectric and center conductor have to be pulled through the tube, there is a limitation on the continuous length of solid aluminum sheathed cable that can be produced. However, a number of manufacturers make it in lengths exceeding half a mile.

Welded Seam Aluminum Sheathed Cables

Because of the difficulty of manufacturing solid aluminum sheathed cable, and the nonuniformity of shield thickness that sometimes results, a number of manufacturers produce aluminum sheathed cable with a longitudinal welded seam. Good quality welded seam cable is as strong, or almost as strong, as solid aluminum sheathed cable. However, the dielectric is not compressed as much and there is a greater possibility of moisture traveling through the cable. The big advan-

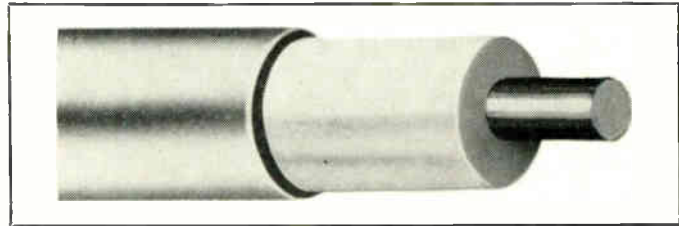


Fig. 4. RG-59/U type cables are generally used for subscriber drops.

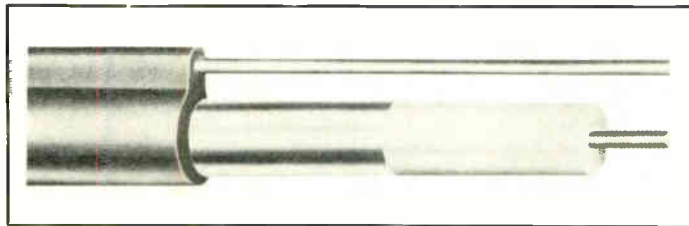


Fig. 5. Integral messenger-supported cables eliminate need for lashing.

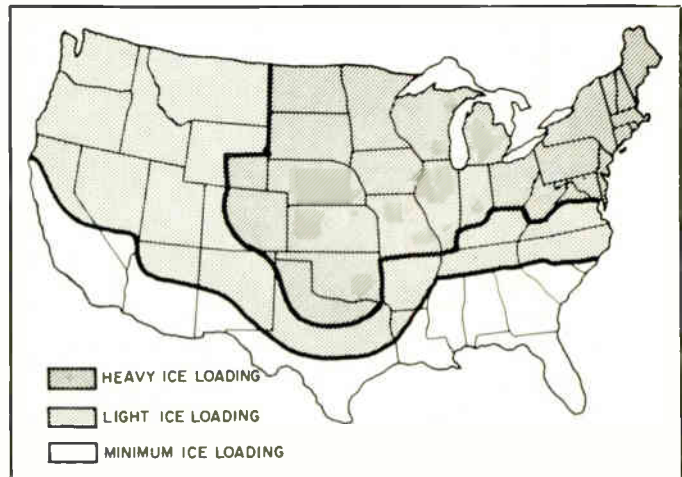


Fig. 6. Integral messenger supported drop lines are recommended for systems in areas with heavy ice loading.

tage of welded seam cable is that it can be made in any desired length.

Hermetically Sealed Cable

A relatively new approach to CATV cable is the hermetically sealed type, available at present only from Anaconda. Like aluminum sheathed cable, this cable provides 100-percent shielding. However, in this case, the outer conductor is an aluminum strip less than a thousandth of an inch thick. Fig. 3 shows a cross section of this type of cable. Moisture proofing is provided by the plastic adhesive material, which bonds chemically to both the conducting tape and the polyethylene jacket during extrusion. It also hermetically seals the overlapping portions of the conducting tape.

Because the outer conductor is so thin, this type of cable is remarkably flexible. Since it can easily be bent by hand, no special bending tools are required.

Corrugated Copper Or Aluminum Shield

Flexibility is also the prime virtue of corrugated copper and corrugated aluminum type cables. Corrugated cables are not as flexible as hermetically sealed cables, but they are considerably more crush-resistant.

Braided Shields

In the early years of CATV, braided shields were used in all parts of the system. Now, however, braided shields are used only on subscriber drop cables. Braided shields are inexpensive and flexible, but do not provide 100-percent shielding or good moisture resistance. Drop cables are short, however, (generally 100 feet or less) and affect only the reception of the individual sets they serve.

The RG-59/U type shown in Fig. 4 is most commonly used in CATV systems. It has an outer diameter of about $\frac{1}{4}$ in., including the shield. In choosing a drop cable, bear in mind that the amount of copper used in the shield varies tremendously from cable to cable. Cables may have under 80-percent coverage or as much as 98-percent coverage. Increased coverage not only reduces cable loss but it also prevents interference pickup. In areas where radiation and interference problems are severe, double shielding is recommended.

Center Conductors

Only three types of center conductors are commonly used in CATV coaxial cables: solid copper, copper clad steel and copper clad aluminum. Solid copper is most popular, but the other two types do have some advantages.

Copper, of course, is a better conductor than either aluminum or steel. However, "skin effect" makes this difference in conductivity unimportant. In a coaxial cable, skin effect causes the signal to be confined to the conductor surfaces closest to the dielectric. In fact, only about 0.001

in. of metal on the outer surface of the center conductor is used to carry CATV signals. Thus, it makes no difference to rf if the center of the conductor is not copper.

Aluminum clad copper is sometimes used in trunk, feeder and distribution lines. Its advantage is that since the center conductor is the same metal as the outer conductor, it will not pull back in cold weather. Copper center conductors shrink by an inch or more between trunkline amplifiers in extremely cold weather. Unless seized, center conductor equipment is used, this shrinkage can cause the system to be inoperative. And it's no fun to try to track this kind of a problem down on a cold night.

Aluminum clad copper is also a little bit less expensive than solid copper. Considered as part of the overall price of the cable, however, the savings is negligible.

The big disadvantage of copper clad aluminum as a center conductor is increased resistance to 60-Hz power. Modern CATV systems are all cable powered. The increased resistance of copper clad aluminum generally means that more power supplies will be required in the system.

Aluminum clad steel is sometimes used as a center conductor for drop cables. Again, skin effect makes the difference in conductivity between copper and steel unimportant. Since no power is carried on drop cables, this factor can be ignored. The advantage of steel is that it is stronger than copper, giving the cable greater mechanical strength.

Because skin effect is so pronounced at vhf frequencies, an important consideration in judging any CATV cable is the outer diameter of the center conductor. A thicker center conductor means lower loss.

Integral Messenger Supported Cables

CATV cables are often lashed to stranded steel messenger cable, but the messenger can also be an integral part of the cable. Messenger strand is bonded to the cable by the jacket, as shown in Fig. 5.

Not only are integral messengers used for trunks, feeder and distribution applications, they are also used in some systems on drop cables. Messengered drop cables are recommended for areas with high winds, heavy ice loading or where drop cable spans are unusually long. Otherwise, drop cables are generally self-supporting. Fig. 6 is an ice-loading map showing where messengered drop cables are recommended.

In this introductory article, we've discussed the basic factors involved in CATV cable selection. Our next article, Part II of this series, will show electrical and mechanical characteristics of currently available CATV cables. We will cover the major CATV cable manufacturers, reporting on their design philosophies, the reasons why their cables are designed as they are, and the competitive advantages each manufacturer claims for his own products. ●

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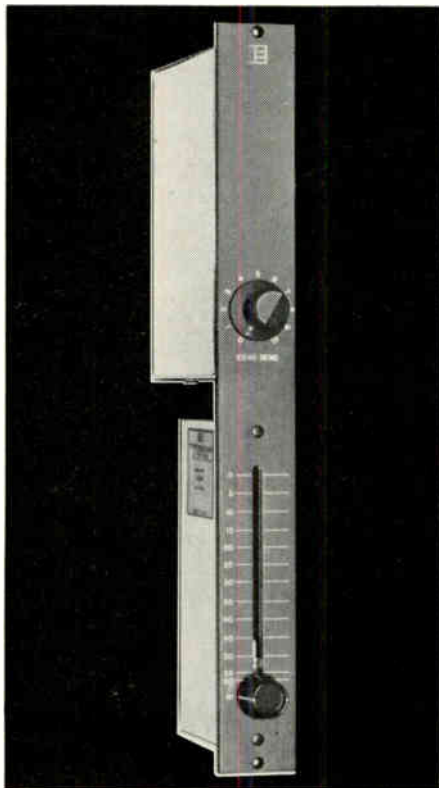
The 309L, 509L and 709L incorporate a low noise microphone pre-amplifier, an input switch for selection of line or microphone input, -10db and -20db to accommodate various microphone output levels.

Low frequency equalization point of the 409L and 509L is 100Hz and the high frequency point is 10kHz. Low frequency equal-

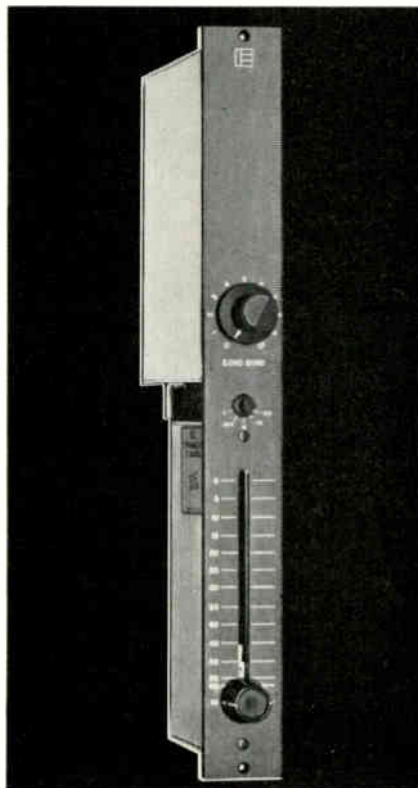
ization points of the 609L and 709L are selectable at 40 or 100Hz and the high frequency points are selectable at 1.5, 3, 5, or 10kHz.

The 609L and 709L have a coaxially mounted switch which selects echo send output from before the attenuator or after the program amplifier.

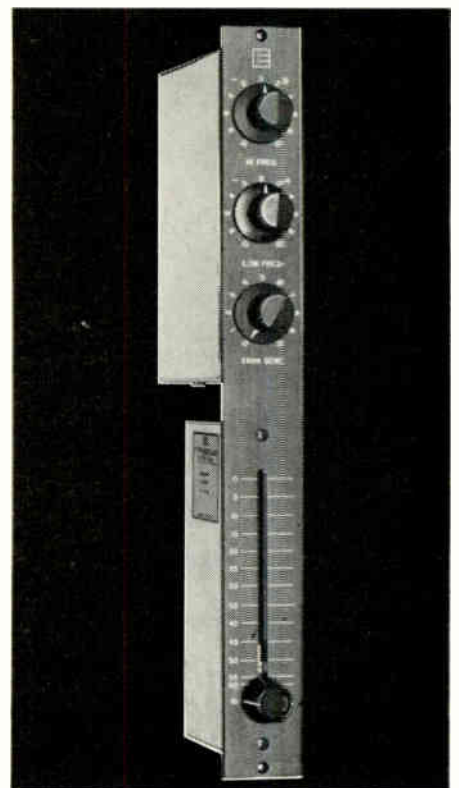
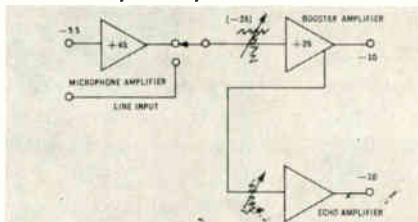
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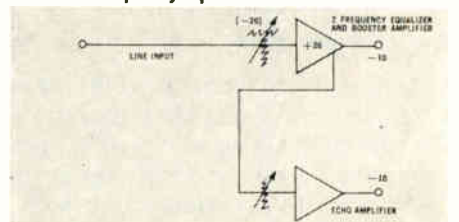
209L Line Level Input



309L Line level or microphone input.



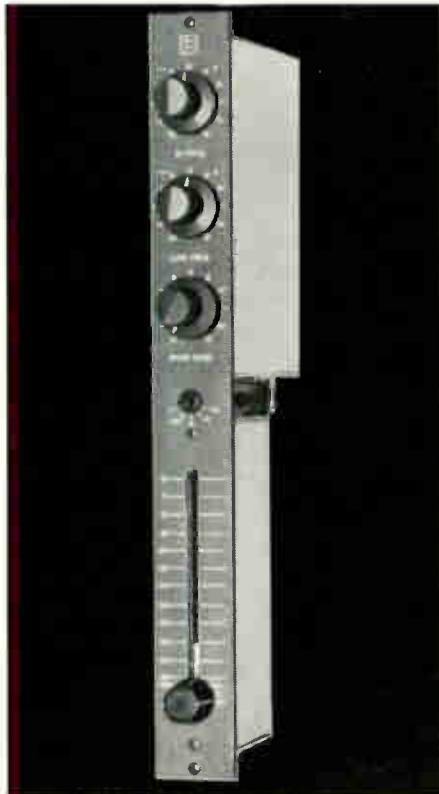
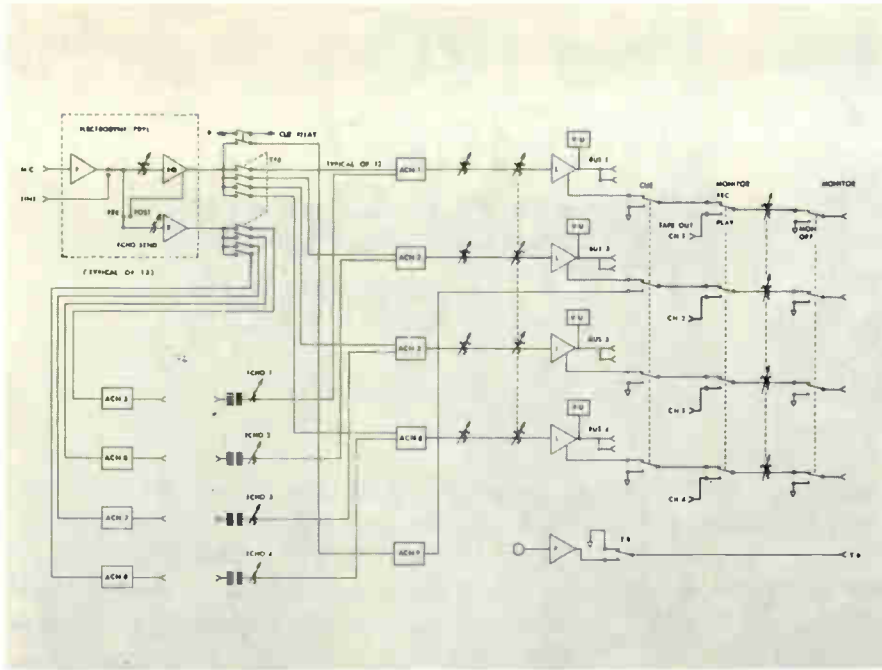
409L Line level or 2 frequency equalization.



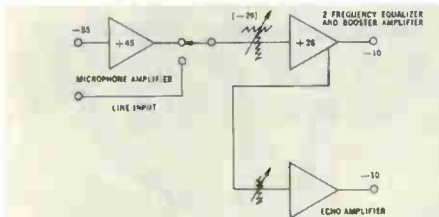
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TYPICAL ELECTRODYNE INPUT MODULE CONSOLE APPLICATION

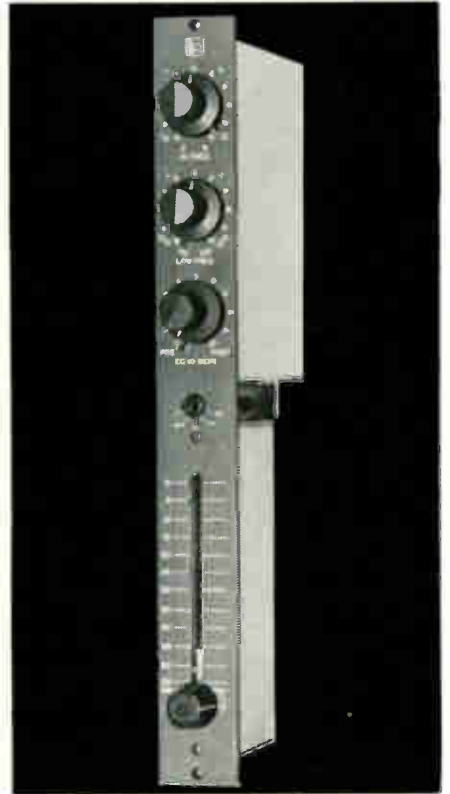
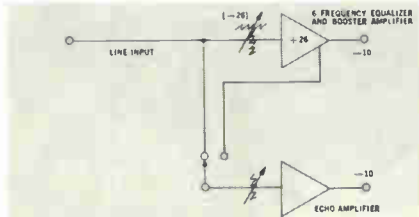
ACC-1204 AUDIO CONTROL CONSOLE



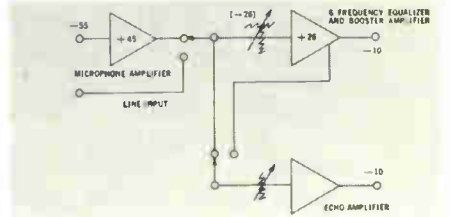
509L Line level or microphone input,
2 frequency equalization.



609L Line level input,
6 frequency equalization.

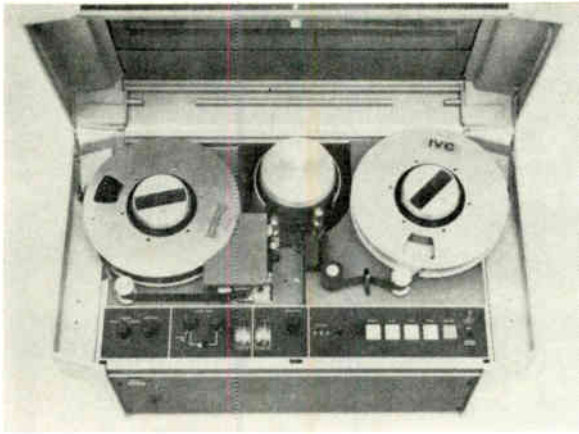


709L Line level or microphone input,
6 frequency equalization.



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The IVC One-Inch Helical Scan VTR Format

By Eugene R. P. Leman and
Donald F. Eldridge

One of the most recent helical scan VTRs to appear on the market is the model IVC-800, produced by a new company, International Video Corp. Its performance as a color VTR was a hit at NAEB (see BM/E, February 1968, p. 48), and it will make a fast impact on the market since both Bell and Howell and RCA have been announced as distributors. RCA will put its own nameplate on it. This article was adapted by the authors from a presentation made at NAEB.

BEFORE THE DEVELOPMENT of the IVC-800 video recorder began, design goals were established based on a survey of video recorders then on the market and on the needs of many users and would-be users. These goals, established in February 1966, were as follows: 1. Ability to record full NTSC color signal in its original form with 4.2-MHz bandwidth with excellent signal to noise ratio; 2. Recorder must be portable—small, lightweight, also capable of being rack-mounted and remotely controlled; 3. Design should use a minimum amount of tape and offer 100-percent tape interchangeability with all other IVC recorders; 4. Recorder should be highly reliable and easy to service. The achievement of these design goals called for substantial departure from formats and techniques used in other video recorders then available. Thus was born the IVC format.

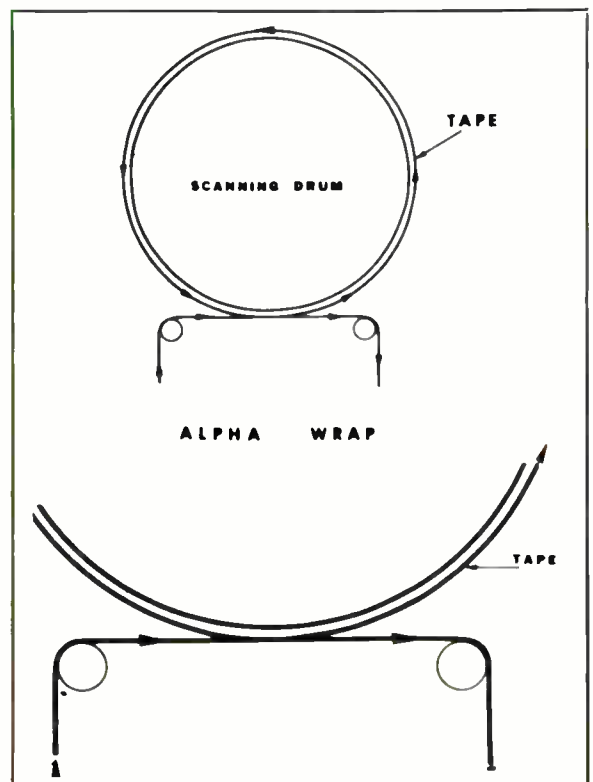
Many of the design goals can be met only if the tape speed is significantly lower than that of other recorders (see Table). Several methods are used to achieve a tape speed of 6.9 inches per second without loss of video performance. Whereas many recorders use a substantial portion of the tape width for audio control track information, IVC records video information over the entire width of the tape. To accomplish this, a unique method was devised which allows the recording of the control and audio information in the same area as video information without any interference or crosstalk between signals. The use of the alpha wrap (Fig. 1) further contributed to efficiency of tape use because it minimizes the time during which the head is out of contact with the tape. If the forward tape speed is lower, the video writing speed of the rotating scanning head must also be lower. The 723-in./s writing speed chosen for this recorder is fully adequate for the recording

Mr. Leman is vice president and technical director and **Mr. Eldridge** is president of International Video Corp., Mountain View, Calif.

of a 4.2-MHz bandwidth when modern ferrite video heads with very small gaps are used.

Pulse Interval Modulation Replaces Fm

A new patented modulation system, pulse interval modulation (PIM), is used to achieve a significant improvement in signal to noise and frequency response compared to widely-used frequency modulation. The use of the foregoing techniques to provide low writing speed allow the recording of one hour of video information on an 8-in. NAB reel containing 2150 feet of 1-in. tape. The combination of small reels and small scanning drum size allows the total width of the recorder



to be kept down so that it may be mounted in a standard relay rack or in a lightweight portable carrying case with a total weight of only 57 pounds.

Scanner Provides Air Bearing and Good Time Base Stability

To permit the recording of NTSC color without resorting to either pilot tone systems or converting the NTSC signal to another color system requires sufficient time-base stability in the reproduced signal to allow recovery of a color signal using the information contained in the color bursts. Since the burst occurs only at the rate of one per scan line, any velocity change during one line will produce a hue shift in the color which it is not possible to correct since that change cannot be anticipated.

To achieve this time-base stability in a recorder utilizing a 360° alpha tape wrap, it is necessary to use an air bearing to make the tape flow smoothly around the drum. The air bearing is generated by the rotating member of the scanning assembly which carries the video head. The air is applied to both the top and bottom portion of the tape passing around the scanning assembly. Without this air cushion, the tape would tend to stick to the drum surface providing intermittent motion instabilities.

Another important innovation is in the location of the capstan. Most recorders pull the tape around the scanning assembly and provide a small amount of hold back tension at the entrance to the scanning assembly. The arrangement has the

disadvantage that it acts somewhat like a self-energizing brake. In the IVC format, the capstan is placed before the scanning assembly and serves to meter the tape at a precise speed onto the scanning assembly.

Tension is provided by the takeup reel. This technique results in a smooth and undisturbed tape movement across the surface of the drum providing better tape speed control with less torque from the capstan drive motor. The use of the 8-in. NAB reel with its relatively small ratio of inside to outside diameter permits accurate speed control without the use of a tension servo.

Several Features Ease Interchangeability

Tape interchangeability between recorders has been extremely difficult to achieve in the past. In designing the IVC 800, the various factors contributing to interchangeability were analyzed and steps were taken to optimize each one. The video head, upon replay, must precisely scan the track previously recorded by a different head on a different machine. The longer the track, the more difficult alignment becomes. The low tape speed and small drum diameter produce a track just under twelve inches long, substantially less than most other recorders.

The distance between tracks is also important. This "guard band" prevents pickup from an adjacent track if the head is misaligned due to tape stretch or other factors. The IVC 800 uses a video track width of 6 mils and a guard band of 3.6 mils, larger than any other helical scan recorder, (Fig. 2). To maintain tracking, only fixed guides, mounted perpendicular to a reference surface are used, rather than movable conical guides. Fixed guides cannot change adjustment through normal wear. They, incidentally, provide a simple and easy

Fig. 1 (left). IVC recorder alpha wrap, rather than omega.

Fig. 2 (below). Tape format of IVC-800.

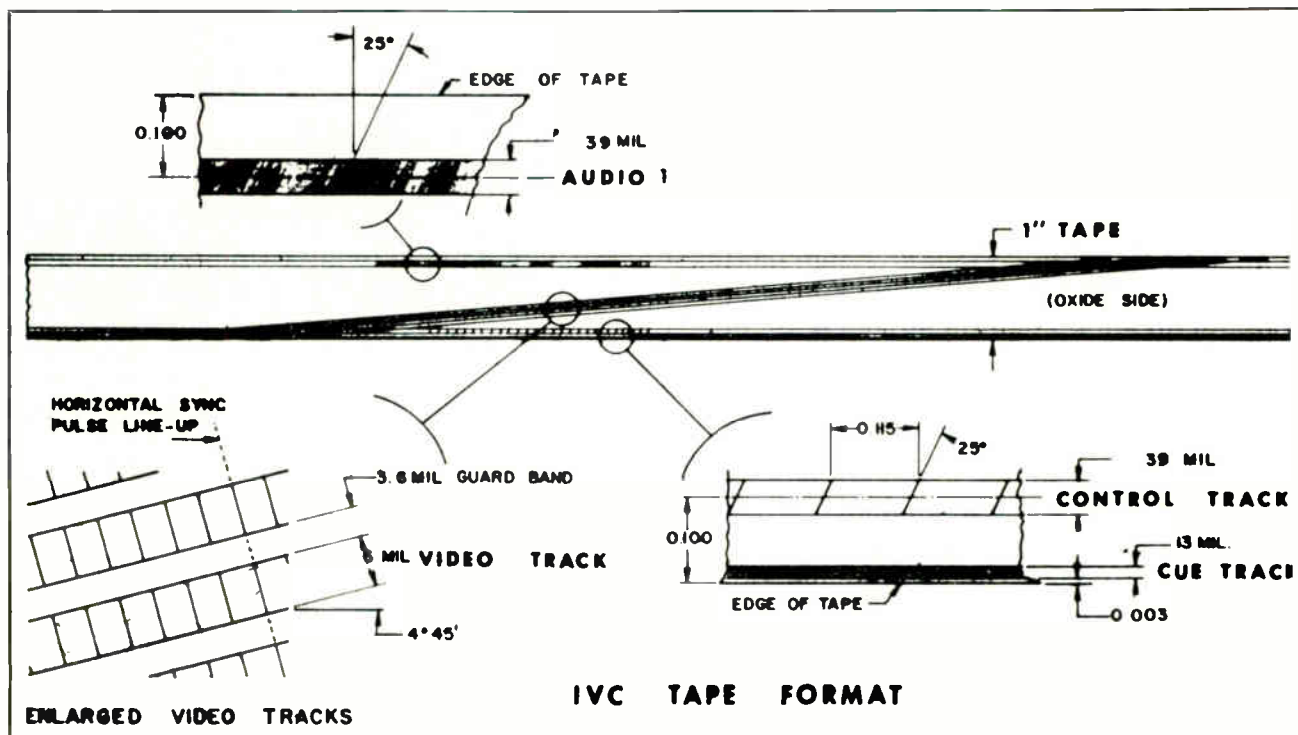


Fig. 3 (Right top and middle). No flagging is apparent in the scan lines. Typical playback waveform shown with cue channel.

Fig. 4 (Right bottom). Video head is cartridge mounted and pre-aligned, and can be replaced in the field by inexperienced personnel.

tape threading path.

It is important to be able to check in the field whether a particular recorder is properly adjusted for interchangeability. A novel feature of the IVC format allows a tape to be played back upside down. This is possible because of the edge-to-edge recording and the symmetry of audio and control tracks. This allows self-checking of the alignment, since any mistracking error will be doubled and thus readily observable, (Fig. 3).

Among the design features contributing to reliability are the use of a rotating transformer rather than brushes to carry the recording signal to and from the video head, the fixed guides, the use of dynamic braking, and fully interlocked controls to prevent accidental tape spillage or breakage. Only with interlocked, relay-type controls can a recorder be reliably operated from a remote location, such as in many studio and dial-access applications.

Reliable vertical synchronization is achieved by placing the crossover dropout *after* the vertical sync pulse, rather than *before*. This prevents triggering of the vertical sweep by noise occurring in the dropout. A novel method is also used to suppress noise during the crossover gap: the noise itself is used to gate the output amplifier off. Thus, during any loss of carrier, no noise burst will appear on the television screen.

Even with maximum reliability, service is required because of normal wear and accidental damage. Modular construction is used throughout, both for mechanical and electrical subassemblies. The video head is cartridge-mounted and pre-aligned, so that it may be replaced in the field by inexperienced personnel without any alignment procedures, (Fig. 4).

Another service feature is the easy conversion from monochrome to color: a single circuit board is plugged in. After this conversion, any color material previously recorded may be played in color, since the monochrome unit records the entire color signal but cannot reproduce it. This "updat-ability" is a feature available only with the IVC 800 video recorder.

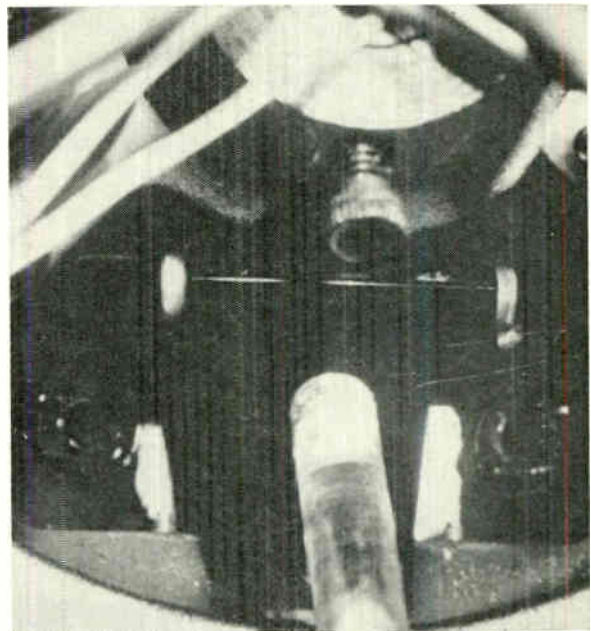
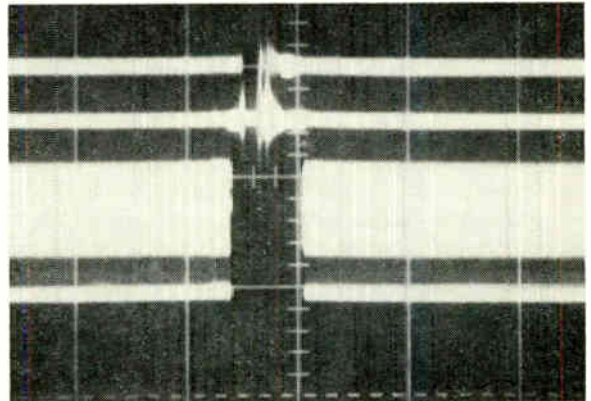
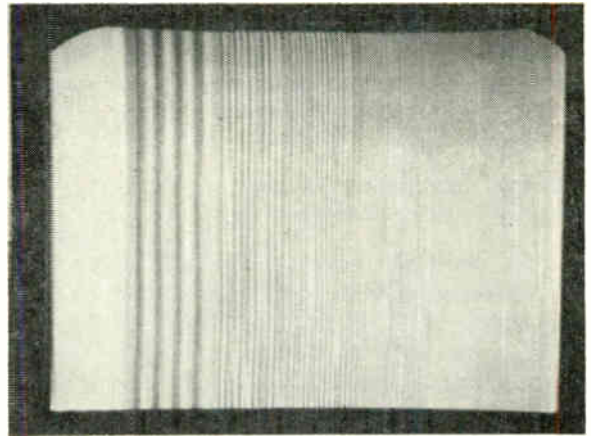
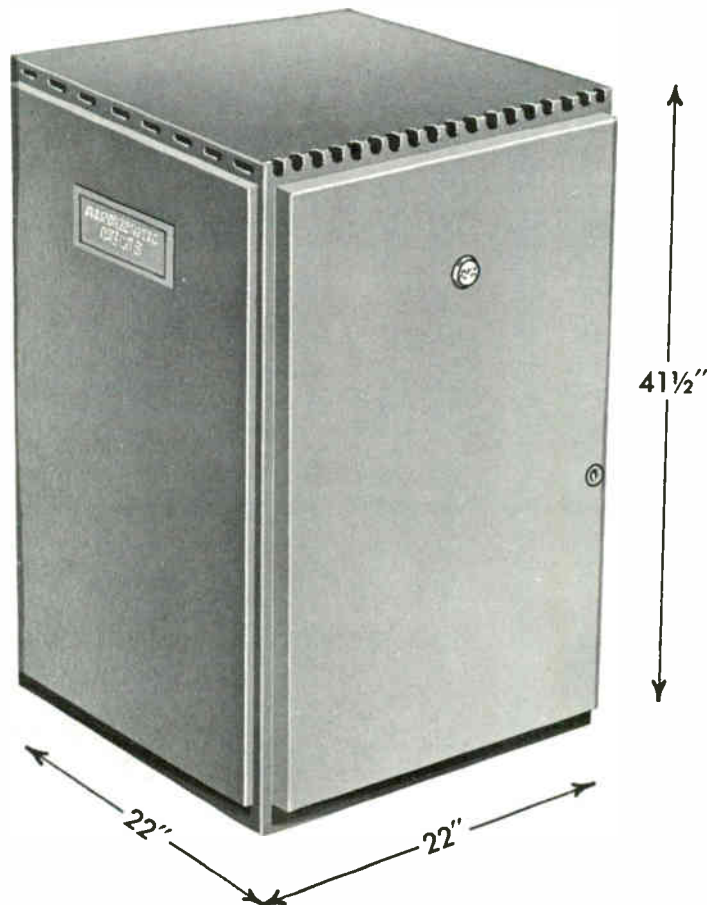


Table. Writing speed of various helical scan recorders.

	IVC 800	Amper			Sony		PI-3V PI-4V	Moreko EL 3401	Dage DV300	Wallema VTR150
		VR 660	VR 7000 VR 7500	VR 2000	EV 200	PV 120				
Tape Speed - ips	6.91	3.7	9.62	15	7.8	4.25	7.5	9.0	5.91	7.5
Writing Speed - ips	723	640.3	1000	1550	590	740	631.5	1086	618	180
Number of Video Heads	1	2	1	4	2	1	2	1	2	1
Wavelength for Peak White (Microinches)	111	136.2	182 154	155	122.9	148	126.3	252.6	12.74	100
Recorded Video Track Length (Inches)	11.94	6.756	16.65	1.8	9.89	12.38	10.41	18.57	10.20	3.13
Video Track Width (Mils)	6	7.5	6	10	6.2	7.1	8	6	5.91	15
Video Guard Band (Mils)	3.6	2.1	2.67	5	3.4	2.2	2	1	1.77	5

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Planning With A Flair



The jazziest looking station in Wisconsin or the World's Fairest radio station are two ways of describing WCCN-FM-AM. President Howie Sturtz II is always either planning ahead or around—if there are obstacles in the way.

WHAT NEWSPAPERS and newswire services are calling "The Jazziest Looking Radio Station" in Wisconsin, is the building pictured here. The Wisconsin pavilion of the New York World's Fair is now the permanent home of radio stations WCCN-FM-AM in the central Wisconsin community of Neillsville.

Initially, *BM/E* thought it might be interesting to "throw" into this report on planning and modernizing a few photos showing how to convert a pavilion into a radio station. Upon learning more about WCCN's history and President Sturtz's restlessness in pushing forward we present the whole story pretty much as unfolded by Sturtz.

Neillsville, a city of only 2750 population, got its first radio stations back in 1957 when WCCN received a construction permit as a 1000-W daytimer on 1370 kHz, following an enthusiastic free-for-all over the frequency. WCCN settled itself in main floor studios on highway 10 in downtown Neillsville.

Two years after WCCN's beginning, in 1959, they traded their only slightly used Gates 1-kW transmitter back in when a construction permit enabled them to increase power to 5 kW. In 1962, WCCN applied for and got permission to increase their antenna height to 326 feet, which helped considerably to increase the range of the a-m station.

In 1963, WCCN lost their 6 A.M. sign-on because of interference on the channel assigned to a Toledo, Ohio station. "We were broken hearted," President Sturtz said, "because we serve a rural

area, and when it snows here, you know it!" Bent on doing something about it, WCCN waited for the freeze to lift on fm channels. Neillsville was not included in the FCC assignment of fm channels but immediately petitioned and was granted a Class A channel 288. WCCN-FM went on the air with 3000 W in 1965. The 1-kW Gates fm transmitter was squeezed into the building originally built only for the Gates BC-5-P-2 transmitter.

Without waiting, WCCN then set out to get a Class C channel with 100,000 W of power on fm. An engineering exhibit was submitted through Charles Brennan and Associates, Consultant Engineers in Milwaukee. The exhibit called for moving 9 channels in 5 states, which would in the end give all assignments a similar or same frequency channel and yet WCCN would get channel 298. The FCC accepted the change in assignments and WCCN immediately built on the channel. The new transmitter selected for use was the Collins Model 830-F-2A 10-kW transmitter fully transistorized and with provision for stereo. Much more was done than that at the time, however. Two Gates cartridge recorders were also installed.

A new transmitter building, a most elaborate structure which features an 8-foot concrete base to avoid flooding under any circumstances, was built. The building is bomb resistant, has all under floor wiring channels, features electric heat, and automatic electrically operated ventilators, and is finished with limed oak paneling. Outside, an elaborate set of neon-filled call letters that operate by time clock during the evening hours, greet



View of 326-ft Collins 37M-11 a-m tower with isolation coupler in foreground. The 11 bays of fm antenna are mounted at the extreme top of the tower.



Building on Neillsville's north side, made of Bethlehem steel with copper screen under entire floor structure. Arc lamps on roof light tower structure at night.

The Move in 13½ Hours

On Saturday, April 1st, WCCN-FM & WCCN-AM signed off the air (early) at 7 P.M. instead of the usual 10:30 P.M. Three first-class engineers were on hand: Charles E. Marvin, WCCN chief engineer, Richard Hanneman, chief engineer at WDLB, Marshfield, Wisconsin, and Ray Deitzler from WEAU-TV, Eau Claire, Wisconsin. By 9:30 P.M. the old studio was stripped and the engineers were busy reinstalling it all at the Wisconsin Pavilion. (Already installed was a new McMartin amplifier and speaker system and the new Gates custom built console.) In addition to the three engineers, WCCN had a carpenter, an electrician, and at least a dozen other men who worked at least part of the evening and morning doing the nontechnical chores like lifting, and replacing screws, etc. The entire WCCN staff helped as well as many advertisers.

By 8 A.M. the following morning, WCCN-FM and WCCN-AM were fully operative and ready to go on the air with such accessories as 3 turntables and 2 Ampex 601's already hooked up. The console was completely in operation, and both cartridge tape recorders were working. Some remote lines were not ready, some switching was lacking, and the building monitors, which are a separate circuit, were not in operation until 2 days later.

There was a severe rain storm that night about 1 to 5 A.M., and unfortunately the station couldn't get any audio to the transmitters. Careful checking revealed that lightning had interrupted the telephone loops from the studios to the transmitter. It must have been an unusual circumstance. It has never happened since. But by 8:30 A.M., April 2, WCCN was on the air, 13½ hours after it signed off from the old location. Wire services were available instantly.

motorists along highway 73, 250 feet away. The fm antenna consists of 11 bays of rings (see pictures). At night, the tower is attractive to motorists passing by and citizens who look north from the city. The tower is flood lighted with two powerful arc lamps that completely illuminate the red and white structure from top to bottom. Cartridge recorders were added to the studio at that time.

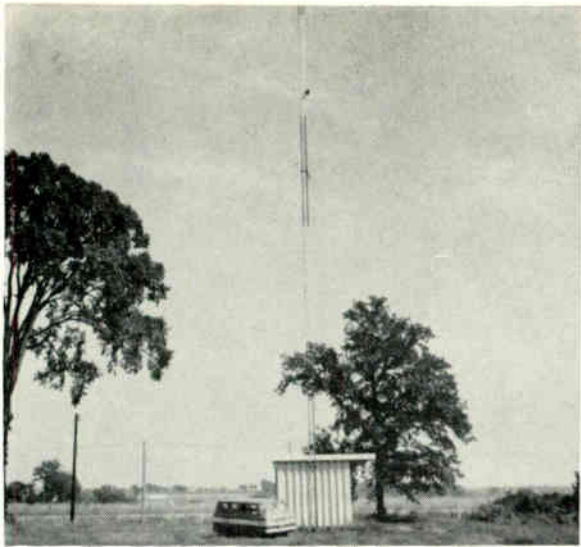
Enter the World's Fair

Only months after putting the 100,000 W of fm on the air, WCCN went into another expansion program. President Howie Sturtz II, who explains, "I always get nervous when things quiet down," discovered that the Wisconsin Pavilion of the N.Y. World's Fair had been salvaged by a Boscobel, Wisconsin, blacksmith, Ivan Wilcox. After trucking it back to Wisconsin in 5 semi trucks, Wilcox found that there was no support to reconstruct the building in his home town, so he put it up for sale.

Bidding against 30 other Wisconsin corporations and individuals, WCCN was successful, and on November 15, 1965, they became owners of the one of a kind building of national and international fame. The eye-catching structure was reconstructed on station-owned land and foundation. The reconstructed pavilion has a full basement with the building mounted on 12 concrete piers 18 feet high. The building is approached at the main floor level by bridges over a beautiful rock garden that contains a flagstone walk, pools, three electrically lighted fountains, and wishing wells. The purchase price was \$41,000.

There are 5 offices in the finished basement and an engineering room which contains broadcast equipment not necessary to the main floor. Also on this lower level are display cases leased to various advertisers.

Underground out back is the heating and air



Separate 150-ft fm receiving tower has side-mounted Marti and top-mounted type for receiving Farmer's Union On The Air fm network from WEAU, Eau Claire.



In addition to standard studio equipment, WCCN's lineup of gear includes: weather instruments, frequency and modulation monitors, remote control, fm receiver, etc.

conditioning plant. The four gas fired furnaces each have their own control zone in the building and each has its own Carrier air conditioning unit. Also in the heating room are the remotely operated dairy display cases, refrigerated compressors, a 400-A electrical service entrance for the building, and 19 time clocks that regulate the maze of lights inside and out automatically. There are 57 spotlights outside alone.

On the main floor, WCCN has two broadcast studios, a main lobby which contains a cheese house and gift shop and plenty of room for expansion. The main Studio B in which 90 percent of the broadcasting originates features a new custom built walnut finish console with three Gates turntables. The Gateway console facilitates 3 mics, 3 turntables, 5 recorders, and a patching panel enables many other loops to be brought up to the board. The console also has switches for Mutual Network, the Marti remote broadcast equipment, and fm programs from other stations. A UPI news machine is located on the main floor behind a wrought iron railing. A mezzanine is located above the broadcast studios and contains three administrative offices, with red carpet, and walnut paneling.

The more than 30,000 visitors who have viewed the pavilion since early May enjoy watching the station in action through huge soundproof windows. The walls are 12 inches thick and completely soundproof. Both broadcast studios feature red carpeting as does most of the building. Floor channeling will enable the station to install most any kind of future equipment with never a wire showing. Announcers face the No. 5 fairway of the Neillsville Country Club which borders the station property on two sides.

Another substantial investment by WCCN includes a Marti mobile unit added one year ago. To make the Marti extremely useful, WCCN purchased a boat trailer (photo on p. 64) and then

added a crank up telescoping tower that extends to 50 feet mounted on it. They simply pull into a ball park, or other community function, place the antenna on the tower, extend a pipe to 15 feet, then raise the tower upright and crank it into the air. Back at Neillsville, the signal from the Marti is received by a special antenna atop a 150-foot tower, erected for this purpose. The signal is remarkably clear, and has enabled WCCN to send basketball games back to the station for a distance of 50 miles. Also atop the 150 foot tower is an fm antenna that receives the Farmers Union on-the-air network program at 12:45 noon weekdays. This fixed tuned receiver picks up the signal from WEAU-FM, which is re-broadcast to other stations on the network across the state. A special relay installed by Chief Engineer Chuck Marvin at the receiver kicks out the fm receiver when the Marti is turned on (which is not, of course, when the network is on the air). WCCN has one car equipped to operate the Marti on battery.

WCCN attributes much of its success in this small community to its complete dedication to serving the local needs of the area. WCCN is at most every worthwhile local event. This year alone, it did extensive remote broadcasting of 4 hours or more from the community celebrations at Withee, Greenwood, Loyal, Alma Center, Granton, Merrilan and, of course, Neillsville. WCCN carries almost 100 local ball games on fm each season—all sponsored.

WCCN broadcasts from 6 A.M. to 10:30 P.M. 7 days a week. The a-m programming duplicates the fm programming during those hours the station is allowed to operate a-m. Sturtz says the future is in the fm. The station has worked hard to get an over 90 percent fm set penetration in this rural market. Farmers have fm radios in their barns, fm radios in cars, and fm portables. The fm set penetration is largely the result of a relentless



Trailer-mounted crank-up antenna facilitates remote operation. Last 20-ft section isn't extended till distance from antenna shown on p. 63 exceeds 25 miles.



This is WCCN's original Cheesemobile that carried world's largest cheese to the N.Y. World's Fair, and kept the 17 $\frac{1}{4}$ -ton golden giant refrigerated there for two years.

Financing the Expansion

BM/E asked president Howard Strutz II how he was able to finance such a project. Could his small 2750-population town supply the needed revenue? His answer:

Our radio stations are located in Neillsville which is the county seat of Clark County. Clark County is an agricultural county, with cows outnumbering people 4 to 1. Nevertheless, we have 32,000 people in Clark County and this is their only daily advertising medium and their only radio station. WCCN-FM-AM did \$127,000 volume in billing last year. We do not trade out anything at anytime with anybody, so there is no time trade to add to this.

Financing a project of this size in a city as small as Neillsville is never easy. We were at it for 6 months, all the while the building was under construction (1 year). The final arrangement involved bank-participating loans with 5 banks in the local area each taking a piece of it. The largest participant was Neillsville Bank, and the loans ranged from \$70,000 down to \$10,000 per bank.

Our loans are for 6 percent simple interest and the financing called for every bit of collateral that was available, even personal holdings, such as home, insurance, cars, etc.

WCCN is owned by Central Wisconsin Broadcasting, Inc., and I, as president, hold

90 percent of the stock. Wayne Grap, secretary and sales manager, owns the other 10 percent. I am 37 now and Wayne is 29 years of age.

We believe (at least I do) that the Wisconsin Pavilion, having been viewed by 13 million visitors who went inside the Wisconsin Exhibit at the fair, is an emblem of the Dairy Industry. We have formed still another corporation called the World's Fairest Cheese and Gifts, Inc. This corporation is branching into the gift cheese business. We started 5 months ago with a cheese and gift shop on the main floor of the pavilion opposite the broadcast studios. We have now completed the design of 21 different gift packages of Wisconsin cheese all under our own label. I should add that jellies and honey and maple syrup are included. We are mailing 25,000 brochures on our World's Fairest Cheese to selected names from more than 40,000 fine people who have visited us these past 5 months.

Financing continues to be our most difficult problem. I would think that we're probably trying to go too far too fast, and we have to forego many projects that we feel are good or important. We hope that through the cheese business we will be able to boast one of Neillsville's largest industries 5 years from now: As industry grows so will radio and we expect to be able to add to our own facilities as we have in the past.

2-year campaign or radio spots selling fm sets through local dealers. A participation package was sold to the local dealer, all the fm set sales going to him. At one time as many as 54 dealers on the air were advertising fm sets for sale. The campaign helped get fm listeners and at the same time more than \$5,000 in spot radio business was realized from the dealers.

WCCN has a staff of eight, plus maintenance people dedicated to doing what they can for the listeners. Sturtz says. "We carry the 'live from N.Y.' programs (Mutual) on WCCN but we also hunt for lost puppies, cows and rare blood types."

Future plans at WCCN, when the pain of building the pavilion has subsided, include a special production studio for taped spots and programs, stereo, and more standby equipment to avoid any transmission interruptions. WCCN applied recently for a constant sign-on as a result of the FCC's recent ruling on pre-sunrise sign-on. WCCN will broadcast with 50 W of power prior to sunrise, if permission is granted.

WCCN is a showplace that is proud of its name, the World's Fairest Radio Stations. Sturtz adds, "radio people are always especially welcome here."

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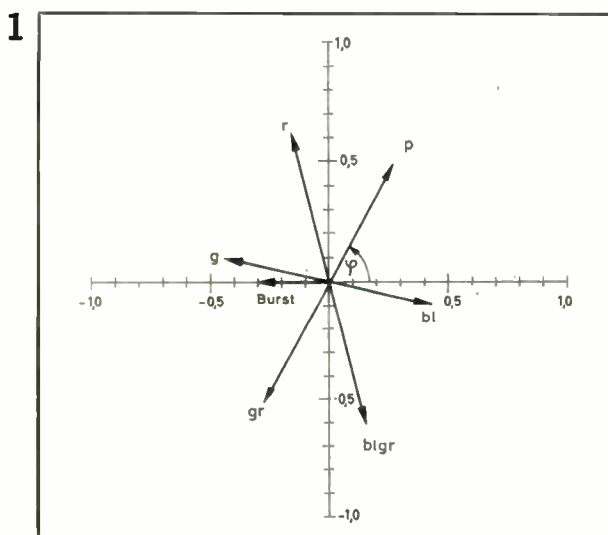
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at NAB

Simultaneous Video

By Rudy Feldt



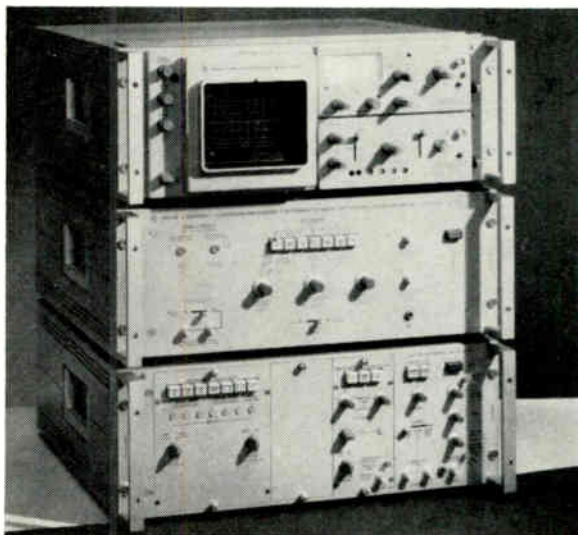
The stringent requirements of compatible color television transmission have created a strong need for measurement techniques which combine high sensitivity and simultaneous display of video phase and gain differentials. One solution: A new high-resolution differential phase/gain meter.

COMPATIBLE COLOR TELEVISION has imposed heavy technical responsibilities on broadcasters in the United States. The need to minimize any significant variations in the primary luminance signal and in the color subcarrier has led to a growing demand for instruments with extreme accuracy and greater flexibility.

Particularly valuable from the broadcaster's point of view is a method of keeping constant check on both phase and gain differentials. Adjustments of either of these two factors can produce degradation in the other unless both are monitored continuously.

The ability to measure relatively minute signal variations has become more important with the development of elaborate transmission systems that span continents and oceans. Small variations occurring in each of hundreds of subsystems can add up to very serious variations throughout the overall system.

Various technical means have commonly been



Author Feldt is an electrical engineer with Rohde & Schwarz.

Fig. 1. Vector diagram of double modulated subcarrier for various 100 percent saturated colors. Subcarrier phase represents hue; amplitude represents saturation. The vectors for the various colors differ in length to prevent overloading the luminance range.

Fig. 2 (Top). Closeup of differential phase/gain meter, Type PVF. (Bottom) Test assembly for determining differential phase and gain distortions of chrominance subcarrier. Starting from bottom, video test signal generator SPF, differential phase/gain meter PVF, and precision oscilloscope OMTF.

Phase And Gain Display

employed to measure phase and gain differential but in most cases these techniques are makeshift and have proven less than satisfactory. A new solution to this problem is a differential phase/gain meter that combines very high sensitivity with simultaneous display and self-calibration.

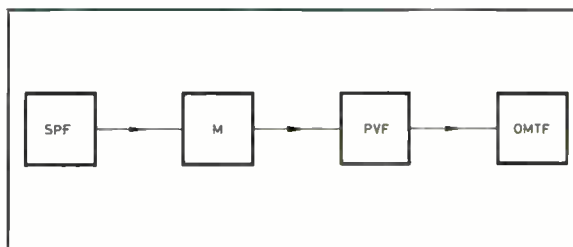
In the early days of color TV broadcasting in the U.S., compatibility of color with existing black-and-white TV systems was generally accepted as a necessity. Therefore, under the NTSC system, which became the accepted color system in the U.S., the radiated color signal had to be suitable for monochrome reproduction on TV sets designed to receive black-and-white. Also, color TV sets had to be capable of receiving monochrome, and the frequency spectrum occupied by color TV had to be no wider than the spectrum of monochrome transmissions.

In the NTSC system, the information content of each picture element is split into luminance, hue and color saturation signals. The luminance signal corresponded to the brightness signal of the monochrome system, and therefore is transmitted in the conventional way. Hue and color saturation, on the other hand, are transmitted on an auxiliary signal—the chrominance subcarrier. This subcarrier is superimposed on the luminance signal and in the NTSC system is transmitted at a frequency of 3.5795 MHz.

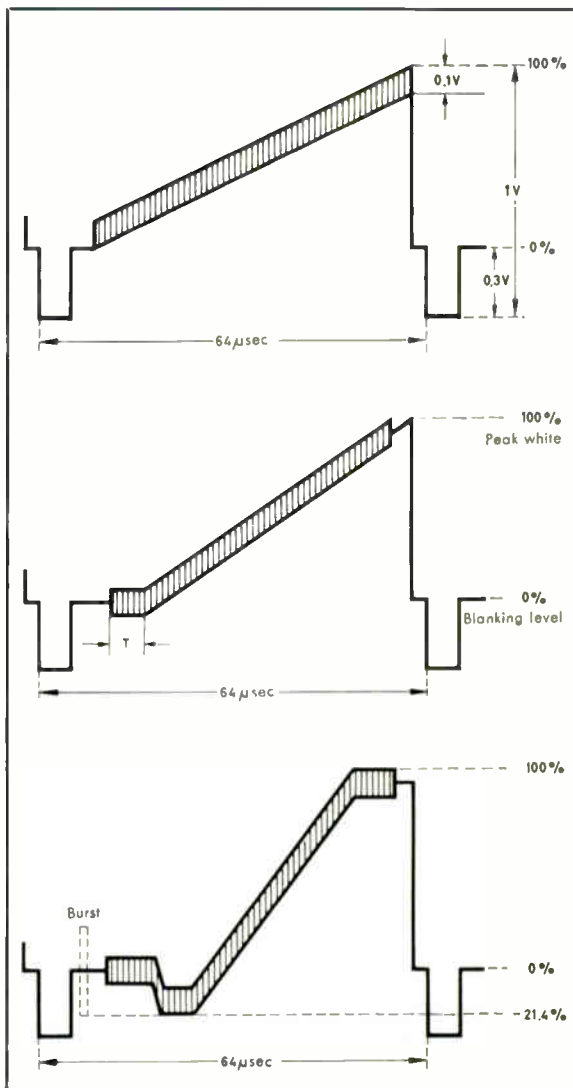
The two elements of the chrominance signal—hue and saturation—are transmitted by modulating the subcarrier signal in two ways: phase and amplitude. Phase variations in the subcarrier when referred to a reference signal correspond to hue; saturation is represented by amplitude (Fig. 1).

Fig. 3. Test arrangement for differential/gain measurements on chrominance subcarrier. (Left to right) SPF video test signal generator, device under test, PVF meter, and OMTF precision oscilloscope.

Fig. 4 (Top). CCIR Test Signal No. 3 for measuring differential phase and gain between 0 and 100 percent of peak white. **(Center)** Test signal with subcarrier initially at blanking level (interval F). **(Bottom)** Test signal covering range 21.4 to +100 percent of peak white. This signal permits measurement of differential phase and gain at levels which include the amplitude swing of the reference burst signal.

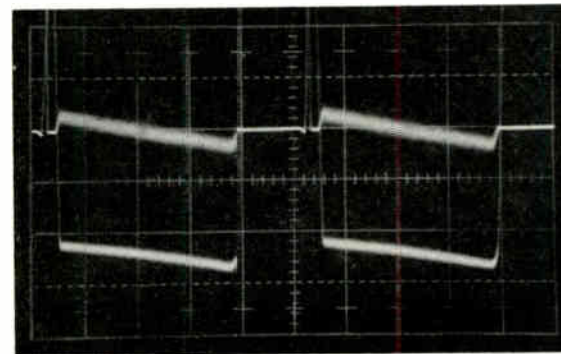
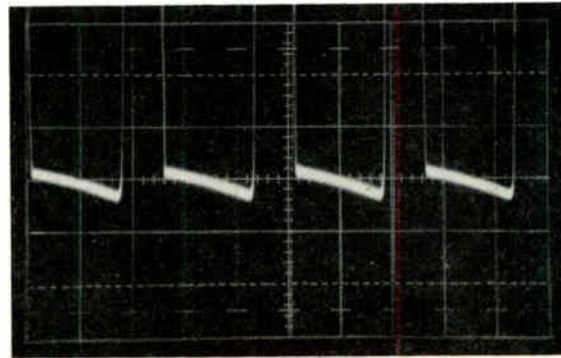
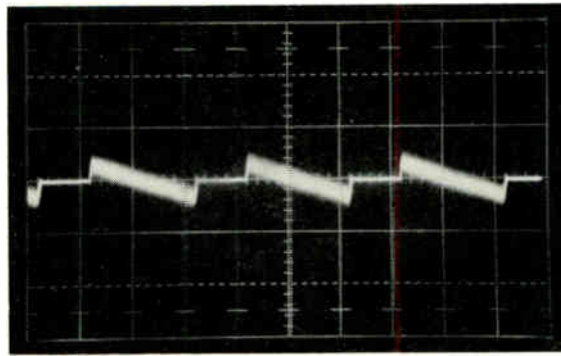


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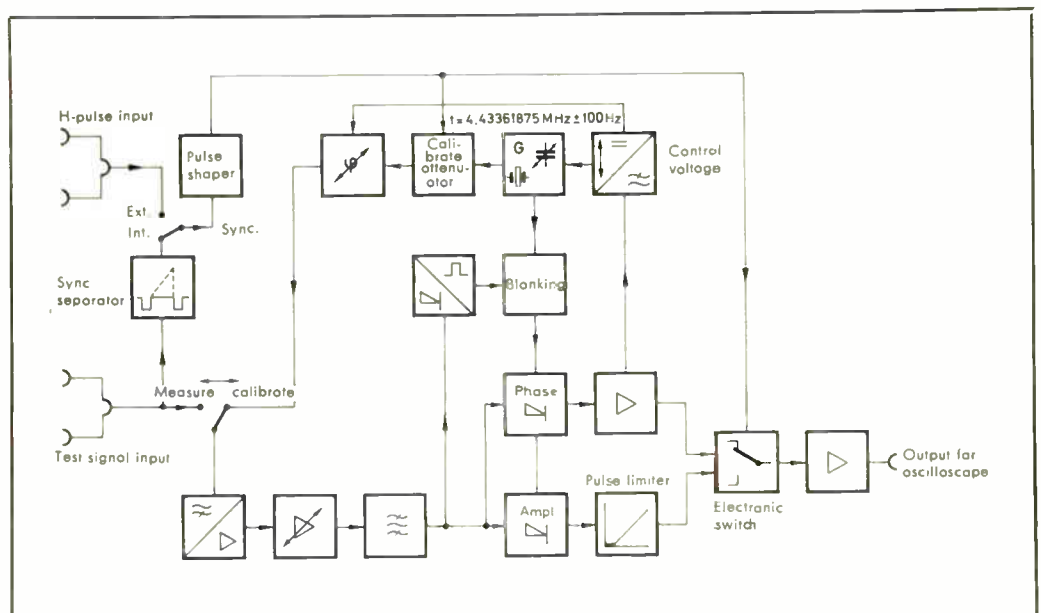


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Fig. 6 (Top). Differential phase characteristic of video test signal generator SPF. Differential phase is 0.15° ; one graticule division represents 0.2° after calibration with 1° line. **(Center)** Gain characteristic of SPF. Differential gain is less than 0.5 percent; one graticule division represents 0.5 percent after calibration with 1 percent line. **(Bottom)** Simultaneous display of differential phase and gain.



(Fig. 5.) Block diagram of the PVF differential phase/gain meter.



geometry of the vector diagram will be disturbed, leading to degradation of hue and saturation. These drive-dependent variations are called *differential phase* and *differential gain*.

Techniques for measuring differential gain are well known from earlier black-and-white engineering. But measurement of differential phase distortion in the transmission of color creates an entirely new problem.

Differential gain distortion is generally caused by nonlinear characteristics of active four-terminal networks, such as tubes and transistors. Differential phase distortion, on the other hand, also involves reactive components within the system. Only a single component within these networks need be dependent on amplitude to produce differential phase in a transmission system containing phase-shifting networks.

Therefore, a very high premium is placed on obtaining precise measurements of differential phase and gain at the component and subsystem level if quality color TV transmissions are to be achieved consistently. And because differential phase and gain are interrelated, it is also important to observe, measure and optimize both factors simultaneously.

In the past, video engineers generally relied on vector scopes for measuring phase differential and waveform monitoring devices for measuring differential gain. Each of these separate techniques, however, carries inherent disadvantages and precludes simultaneous monitoring.

A new instrument for simultaneously observing both differential phase and gain with extremely high sensitivity is a differential phase/gain meter, developed by Rohde & Schwarz. Photographs of the different phase/gain meter and the test assembly, including oscilloscope and signal generator are shown in Fig. 2.

The meter, Type PVF, meets the growing need for high sensitivity with accuracy down to one-tenth of a degree. This means that the unit can detect and measure very small differences in phase and gain which, when accumulated within a large system, can cause serious signal degradation.

For example, the differential phase of a buffer amplifier in a crossbar distributor may be on the order of a few tenths of one degree. Added to other small phase quantities, the differential phase can soar to several degrees.

To meet the need for measuring both tiny and relatively large variations, the Type PVF meter has a range of 0.1° to 60° for differential phase measurements and 0.5 percent to 50 percent for differential gain measurements. In practice, these wide ranges will cover any contingency.

The meter also permits the operator to monitor both phase and gain variations simultaneously.

An oscilloscope connected to the output of the instrument may be calibrated by means of internally-generated calibration signals. Facilities for selecting 1° to 10° as well as 1 percent and 10 percent calibration lines for differential gain and phase measurements, respectively, are incorporated in the PVF meter.

The test signal for the PVF consists of a test signal (sawtooth or staircase) at the scanning frequency on which an rf signal at the subcarrier frequency is superimposed at an amplitude smaller than that of the sawtooth voltage. The test unit then measures any distortion (phase or amplitude) of the subcarrier which may develop when the sawtooth voltage scans the device under test over its full dynamic range.

A detector for phase variations and another for amplitude variations are used in the equipment. The reference voltage for the phase detector is regenerated within the equipment from the measured signal, permitting the test signal source and the Type PVF unit to be placed in different locations. This also permits measurements of loop as well as TV link signals.

By using automatic gain control, the new test unit will accommodate a wide range of input signal levels. Output of the equipment is displayed and evaluated on an oscilloscope (Fig. 3), with an electronic switch permitting simultaneous display.

The actual test signal is not generated by Type PVF meter; it is generated instead by an associated video test signal generator. The simplest test signal is the CCIR Test Signal No. 3 (top Fig. 4), but this can be modified to meet the specific problem at hand (as shown in center and bottom of Fig. 4). To generate the waveform at the bottom of Fig. 4, a suitable video test signal generator is used in conjunction with a special plug-in unit designed for distortion measurements.

Differential phase and gain characteristics of the Rohde & Schwarz Type SPF video test signal generator are shown in Fig. 5, with differential phase of 0.15° and differential gain of less than 0.5 percent. These measurements were made with the waveform shown at the top of Fig. 4. Differential-phase and gain characteristics are shown separately and simultaneously in oscilloscope photographs in Fig. 6.

In using the PVF differential phase/gain meter, the input signal is applied to the input socket and, via a high-pass filter, to the input amplifier. As the voltage applied to the phase and amplitude detector is held constant by a gain-controlled amplifier, the input voltage can vary from 20 to $300 \mu\text{V}$. Residual pulses of the composite video signal are largely suppressed by a Thomson band-pass filter.

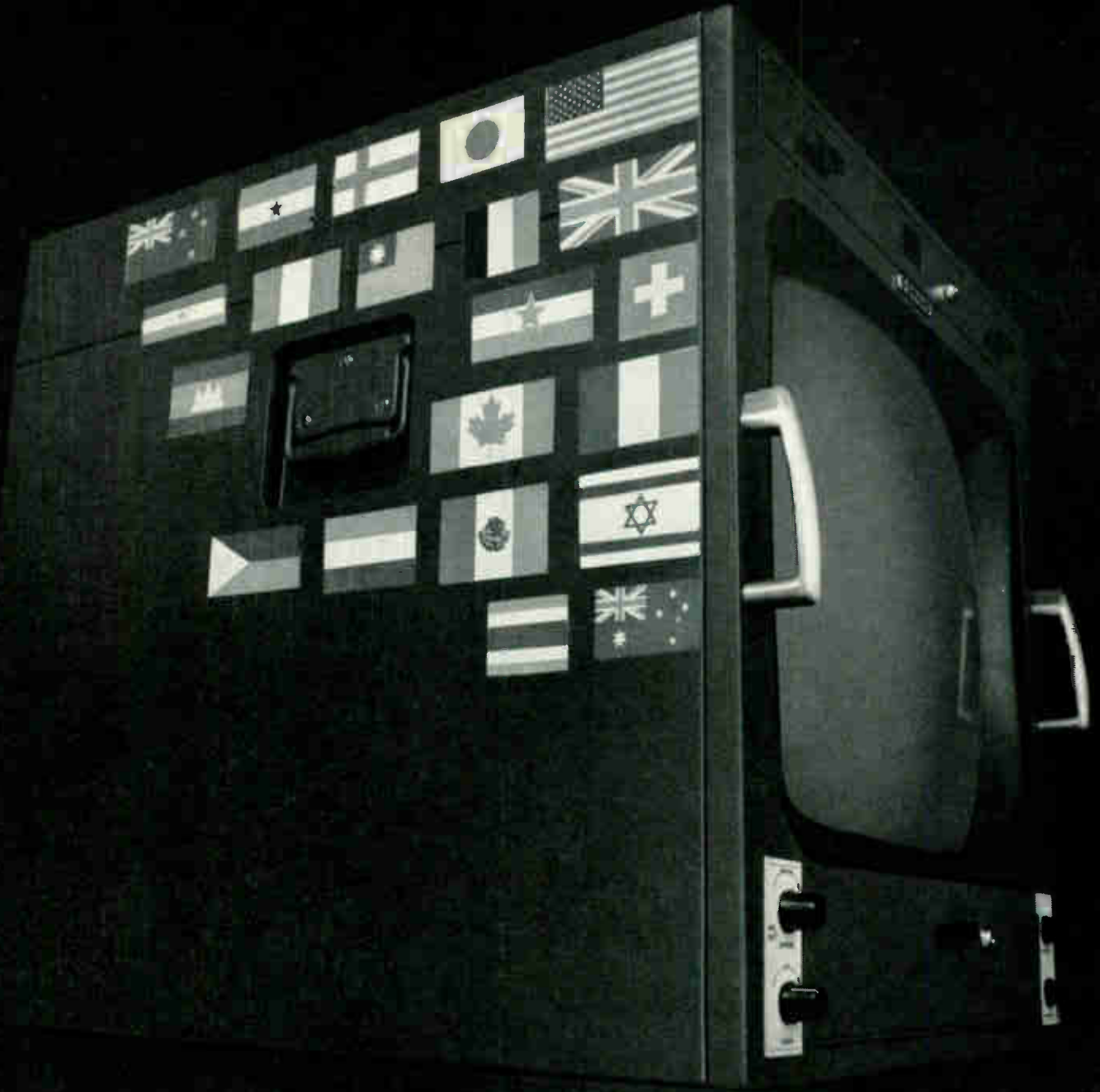
The output of the phase detector in Type PVF becomes zero under two conditions—when the subcarrier input falls to zero during blanking intervals, and when there is no reference voltage. By keying the reference voltage, it is possible to obtain complete suppression of the phase detector output during blanking intervals. This is essential because any elements of the composite video spectrum falling within the Thomson filter passband are not adequately suppressed.

Amplitude demodulation is effected by a peak rectifier which rectifies the rf envelope and produces a pulse output. The tilt of this pulse, when referred to the peak value of the rf pulse envelope, is the differential gain. ●

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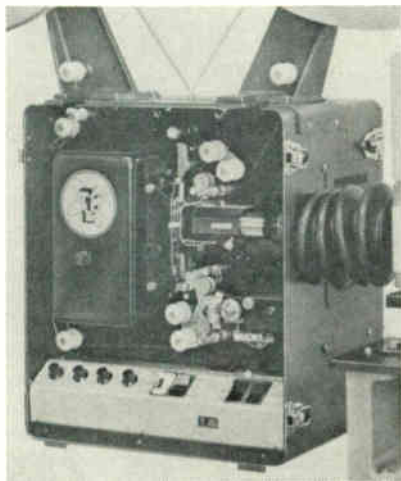
Available from your RCA Broadcast Tube Distributor.
RCA Electronic Components & Devices, Harrison, N.J. 07029.

RCA

BROADCAST EQUIPMENT

Universal 16mm Projector

Model BCP-16 16mm sound projector, made by Technical Materiel Corp., Mamaroneck, N.Y., is the only available projector with switchable 50/60-Hz field rate operation. The projector operates with any TV

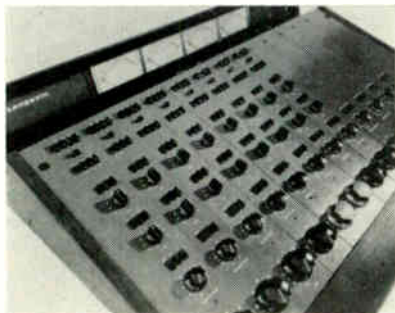


camera in use throughout the world. Other features include: 4000-ft reel capacity, full remote control facilities, and solid-state optical or magnetic sound system.

Circle 100 on Reader Service Card

Sound Mixing System

The AM4A mixer assembly, made by Langevin, Santa Ana, Calif., features "blocks" of pre-wired plug-in modules, designed for sound reinforcement and recording applications, and contain all the active circuitry of the mixer assembly. Low silhouette design of mixer provides operator with a convenient sloping work panel. Overall height is only 7 in. and depth is 27 in. Frequency response (without equalization) is



± 1.0 dB, 20 Hz to 20 kHz at output level of +8 dBm at 1 kHz. An equivalent input noise level of -122 dB can be maintained with a system gain of 60 dB. Source impedance of 250 ohms is the design center. Design load impedance is 600 ohms at a standard output level of +4 dBm or +8 dBm. All system specifications meet ASA and NAB requirements.

Circle 107 on Reader Service Card

Television Film Recorders

Television film recorders, made by W.A. Palmer, Inc., San Francisco, Calif., are available in two models for recording on regular or Super 8mm film. Both models retain features of the 16mm model, including ease of operation and elimination of shutter bar. Recorders are designed to make low-cost, direct transfers of closed-circuit television or videotaped material to 8mm or Super 8mm film, suitable for playback in various types of cartridge-load projectors. Both



models are equipped with Conrac photographic monitor and built-in exposure meter. Components are housed in combination cabinet-carrying case. Price for 8mm recorder with magnetic sound is \$12,600. The Super 8mm recorder with optical sound costs \$13,400.

Circle 103 on Reader Service Card

C-Band Air-To-Ground Fm-TV Relay Links

Solid-state air-to-ground fm-TV relay links operating in C-band with 20-W output and 10-MHz baseband, are available from RHG Electronics Laboratory, Inc., Farmingdale, N.Y.

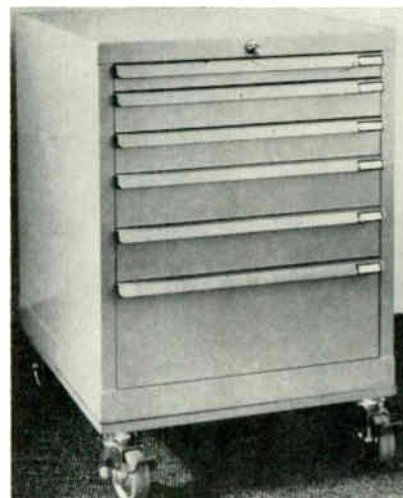


Known as the MSRA Series, these systems are available for operation on 4- to 8-GHz bands. The solid-state design (except for TWT amplifier) provides high reliability and state-of-the-art performance with applications in surveillance, communications and reconnaissance. Video basebands to 20 MHz are also available. Other features include MIL-E-5400 Class II design, high density packaging, and the elimination of heat sinks. Both receiver and transmitter are completely self-contained, and only require a power source to process high resolution monochrome, color TV, or wideband telemetry data.

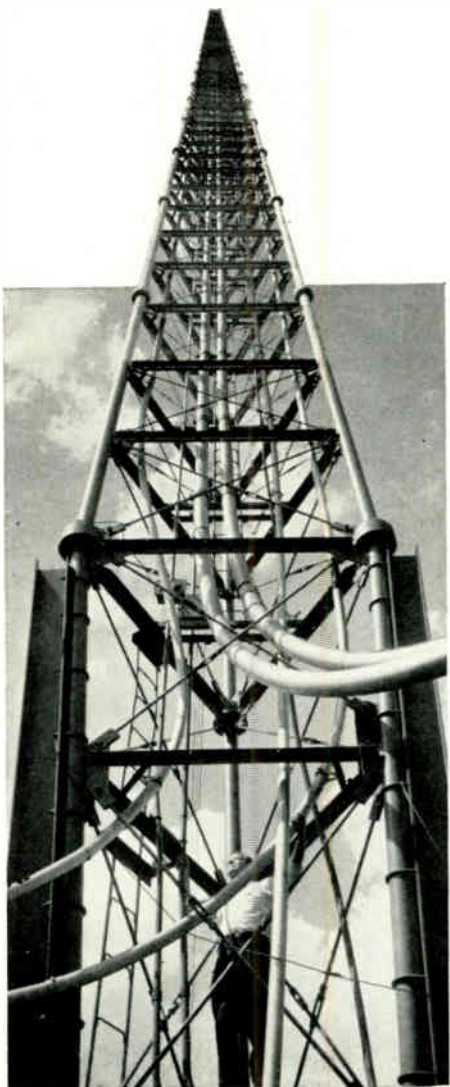
Circle 104 on Reader Service Card

Tool Caddy

Tool Boy units, available from Deluxe Systems, Inc., Newton Highlands, Mass., are mobile metal cabinets with standard drawer arrangements for storing permanently assigned tools, fixtures, parts or materials. Model TB300 has two shelves in addition to the drawers. The drawer bottoms are perforated for easy sectioning to store and pro-



12 years of trouble free performance in this Styroflex[®] coaxial cable installation

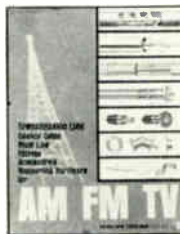


Since 1956 six Styroflex[®] coaxial cable runs have fed the 812-foot tower for WIIC-TV and WWSW-FM in Pittsburgh. A 6¹/₈" cable serves as the main transmission line terminating in the main antenna carrying the combined aural and visual power from a 50 KW TV transmitter to the antenna on top of the tower. A second 6¹/₈" line is used as a spare. A pair of 3¹/₈" coaxial cables connect the 11 KW auxiliary transmitter to separate auxiliary antennas. Another 3¹/₈" Styroflex[®] coaxial cable is used as the primary feed for the FM station, with a 1⁵/₈" cable acting as a standby line.

Styroflex[®] cable has an outstanding record in broadcast applications. Reliability and high power capabilities with uniform, low loss characteristics combine for superior performance. Availability in 1000 foot lengths eliminate the need for numerous connectors that can cause gas leakage problems with rigid line.

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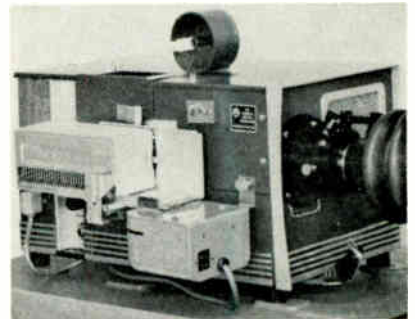
Circle 39 on Reader Service Card

tect contents. One shelf is adjustable on 2-in. centers. The top shelf has a 1/2-in. high retainer on all four sides. A handle is permanently attached to the frame. There are four 4-in.-heavy-duty ballbearing casters, each having 200-lb capacity, and two of which are lockable. Dimensions are 22¹/₂ × 26³/₄ × 32 in.

Circle 105 on Reader Service Card

Sound Strip/Slide Projector

BCPS-1 35mm sound strip/slide projector, made by Technical Materiel Corp., Mamaroneck, N.Y., provides playback of slide commentary

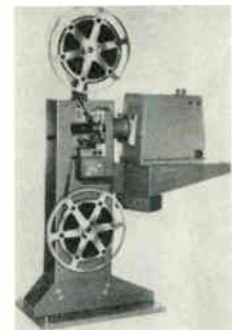


by scanning stationary 35mm film strip, which may be advanced manually or automatically. The projector also shows 2- × 2-in. slides and has provision for full remote operation. BCPS-1R remote control unit and mounting accessories are available options.

Circle 101 on Reader Service Card

Professional 16mm Projector

The FP-16 professional 16mm motion picture projector is designed by North American Philips Co., Paramus, N.J., for permanent installations such as screening rooms, small theaters and school auditoriums. Floor-



mounted column projector has a changeover dowser and an adjustable lamphouse bracket which accommodates a variety of light sources, including a Norelco customized Xenon lamphouse with up to 1600-W capac-



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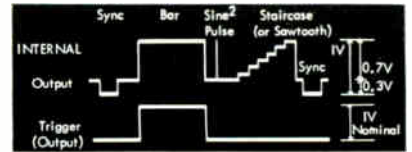
SEE THEM AT NAB - BOOTH 228

SINE-SQUARED-PULSE AND BAR GENERATOR

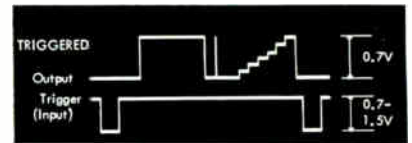


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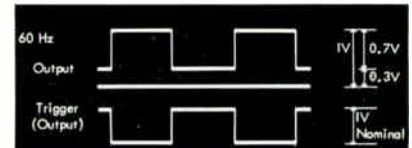
- Sine² pulse, stairstep and bar
- Suitable for K factor analysis
- Xtal derived internal sync. or locks on studio sync. pulses
- Chrominance sine² pulse and stairstep with optional plug-in



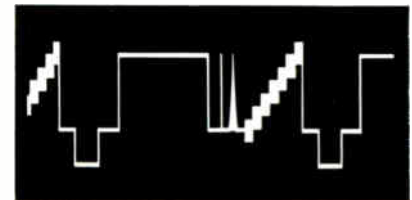
Waveform for K factor assessment. (internal trigger)



Waveform for K factor assessment. (external trigger)



Waveform for I.f. response measurements.



Composite waveform including the chrominance signal super-imposed on the sine-squared-pulse and bar.

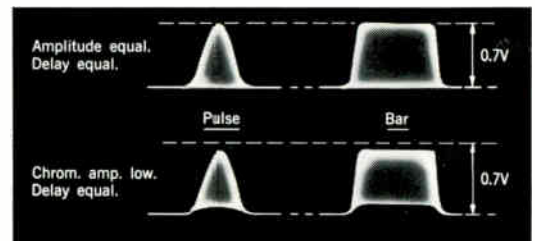
NEW FROM MARCONI INSTRUMENTS

LUMINANCE/CHROMINANCE GAIN AND DELAY EQUALIZATION

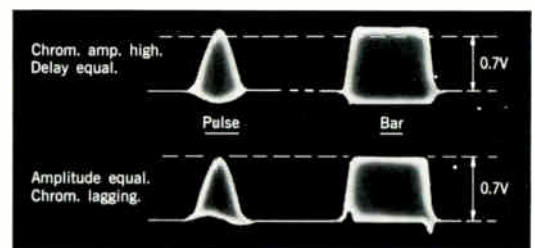


2904/1

- Measures gain and delay inequality
- Gain discrimination 0.5dB
- Delay discrimination 2 nanoseconds
- Visible display of misalignment with scope



Gain inequality can be measured over the range $\pm 3\text{dB}$, and delay inequality over the range 110 nsec lag to 110 nsec lead.



Available Upon Request

Television Transmission Test Equipment which details methods of TV measurements, and presents a new range of TV transmission measuring equipment available from Marconi Instruments.



MARCONI INSTRUMENTS
DIVISION OF ENGLISH ELECTRIC CORPORATION

111 CEDAR LANE □ ENGLEWOOD, NEW JERSEY 07631
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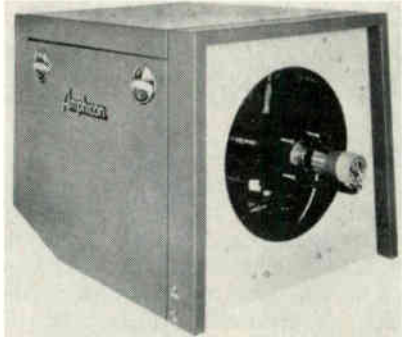
705

ity. The driving and film propulsion mechanism uses a "grooved disc" with 12-tooth intermittent sprocket that consistently engages five perforations. Use of a curved running plate and Delrin running surfaces that are impervious to the deposit of wax, dirt and emulsion add to the smoothness of operation.

Circle 102 on Reader Service Card

TV Projection System

Amphicon 260 TV projection system, made by Amphicon Systems, Inc., Norwood, N.J., consists of a specially developed 6-in. CRT, advanced optics, solid-state circuitry and a wide-band (30 MHz), high-power video



amplifier. System produces a picture with a brightness of 9 ft Lamperts on a 10-ft beaded screen. Horizontal resolution is 1000 lines; horizontal scanning frequency, 525 to 1203 lines. A separate projection head permits maximum flexibility in mounting or placement. Unit is compatible with all existing TV systems, VTRs, cameras, flying spot scanners, uhf and vhf tuners. Projector weighs 148 lb; control unit, 163 lb. Amphicon 260 system is priced at \$11,000.

Circle 106 on Reader Service Card

Uhf Transceiver

A hand-held uhf two-way radio for personal use, called the Compact, has been introduced by Pye Communications, Inc., Mountain Lakes, N.J., a subsidiary of North American Philips Co., Inc. The Compact is a single, lightweight unit with only two controls and a fully retractable 6-in. antenna, and designed for use by field engineers, maintenance personnel, etc. The all solid-state transceiver uses 9-V nickel cadmium batteries contained in a unit measuring $8\frac{3}{4} \times 3\frac{1}{2} \times 1\frac{1}{2}$, and weighing 23½ oz. A special feature is a battery current economy circuit which, without recharging, multiplies battery life many times that expected under normal conditions. Transmitter has rf output of

March, 1968 — BM/E



**COLOR
SPECTACULAR!**



**BIW'S NEW
TV-85C COLOR TV CONNECTOR
ALIGNS PINS, PROTECTS MATED
PARTS...AUTOMATICALLY**

This new concept in outer sleeve design guarantees positive pin alignment; pins *cannot* be bent or damaged by mismating. The double-sleeve design also prevents injury to mating threads and protects against knocks, drops and abuse from studio rolling stock.

Heavy-duty rubber compression gland provides an effective seal at rear of connector. All pins and sockets on the new TV-85C insert are front release, rear removal, and crimp to cable conductors. Woven cable grip and rugged molded boot provides both bend relief and pull-out protection.

Completely compatible with existing 85 pin connectors used for TV, BIW's new TV-85C connectors are machined from 7075-T6 aluminum, and are precision built for trouble-free performance.

Go BIW all the way — connectors, camera cables (American or European), broadcast panels. Write for details.

Cable concepts grow at...

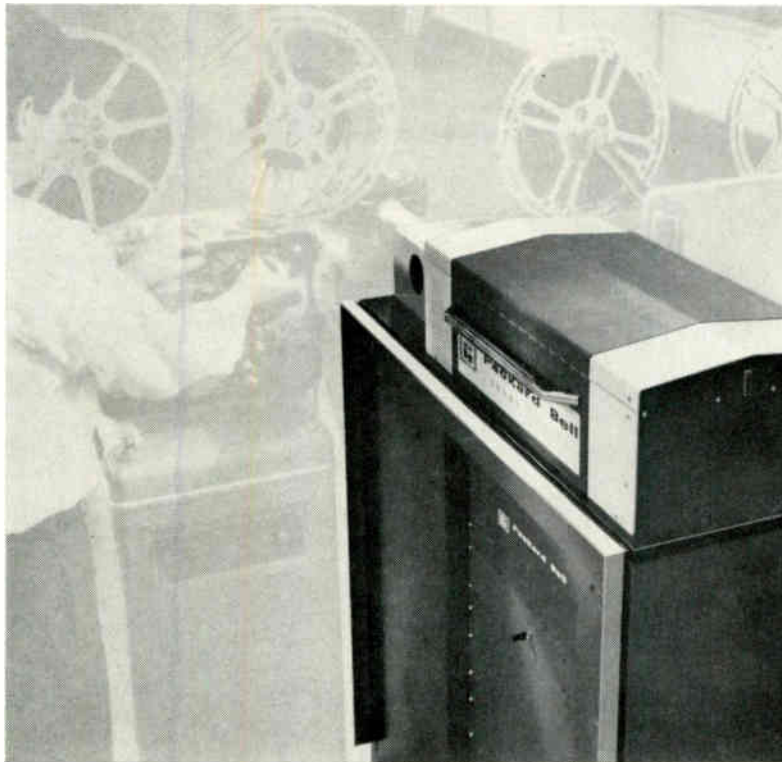


Boston Insulated Wire & Cable Co.

45 Bay St., Boston, Mass. 02125/141 Nevada St., El Segundo, Calif. 90245
118 Shaw St., Hamilton, Ont./International, 1 Place Ville Marie, Montreal, Que.

Circle 41 on Reader Service Card

4-TUBE PERFORMANCE 3-TUBE SIMPLICITY



**Only new Packard Bell
Color Camera for film chains combines all
these high-performance features
in one economical package**

Complete matched system—camera plus optical multiplexer permits wide projector flexibility.

Full EIA/NTSC compatibility obtained with optional plug-in EIA sync modules and encoder.

Unmatrixed monochromatic signal for maximum definition and contrast.

Combination of precision fixed optics and 3-vidicon simplicity provides 4-channel standards of resolution, contrast and ease of registration.

Superior sensitivity—150 foot-lamberts high light-reflectance.

Write today for full information and prices. c88

Packard Bell



Lawrence & Arnold Drive, Newbury Park, Calif. 91320 • Tel: (805) 498-6601

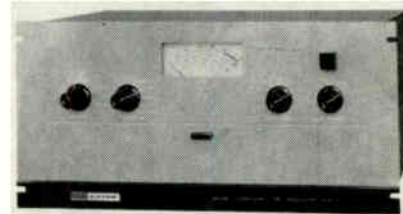
Circle 42 on Reader Service Card



150 mW and the receiver an output of 100 mW into a 2-in. speaker.
Circle 108 on Reader Service Card

Fm Monitors

Fully field tested and FCC type approved stereophonic modulation monitor, Model GTM-88S, made by Gates Radio Co., Quincy, Ill., measures all modulation characteristics of an fm signal in accordance with FCC requirements. Modular silicon solid-state circuitry is used throughout. Provisions have been made to add an adapter to measure SCA mod-



ulation characteristics. Test instruments may remain connected to the monitor without affecting its operation or performance. The left channel instrument output is switchable to either channel by a front panel control. In addition to stereo monitor, Gates offers a monophonic modulation monitor, type GTM-88M, which can be converted to full stereo operation at any time by adding appropriate modules and filters and then calibrating for stereo operation. Each unit is calibrated to specific operating frequency as supplied.

Circle 109 on Reader Service Card

Color Bar Generator/Encoder

Production of the 2600 Series color bar generator and color bar encoder has been announced by Cohu Electronics, Inc., San Diego, Calif. Mountable in 1 3/4 in. of vertical



**Superior's
Video Pairs
produce high-
definition
transmission**

**from studio
to head-end...
from remote
pick-ups
to head-end...
from remote
pick-ups
to studio to
head-end!**

Superior Video Pairs are individually-shielded balanced pairs that eliminate AC hum on origination and maintain studio-quality picture transmission. And in any closed-circuit TV system, video pairs also raise performance levels. Superior Video Pairs. Single pairs or in composite constructions. Ask about them now.

Flexible Video Pairs for patchcords and flexible video leads are also available.

Frequency vs. Attenuation

Frequency	db/1000 ft. @ 68° F	db/Mile @ 68° F
3 MHz	2.9	15.3
5 MHz	3.8	20.0
10 MHz	5.3	28.2
15 MHz	6.5	34.3

Write or call for information and prices to
Superior Sales and Service Division
P. O. Box 2327
Hickory, North Carolina 28601
Phone 704/328-2171



**SUPERIOR
CONTINENTAL
CORPORATION**

Circle 43 on Reader Service Card



The Norelco "Little Shaver" does everything its big brother, the PC-70, can do ...and gets around a lot more.

This is the new Norelco PCP-70 Portable Color Television Camera. We call it the "Little Shaver" for short.

Like its big brother, the PC-70, which is used on the majority of top network live



and taped shows, it employs the exclusive Norelco 3-Plumbicon* tube system that provides the truest color, highest resolution and maximum sensitivity available today.

The "Little Shaver" goes where the action is.

Sports. News and documentaries. Political events . . . just about anywhere a man can go.

The "Little Shaver" is fully compatible with the camera control unit of the PC-70 studio camera. Thus, present PC-70 owners have an even greater advantage in that they can have the versatility of the PCP-70 with



no further expense for control equipment.

Instantly accepted by all the major networks, the Norelco PCP-70 is the portable that gives you the

world's best color television picture.

If you want faithful color reproduction in a port-



able camera, you want the "Little Shaver." For a live demonstration and technical data, call or write.

*Registered trade mark for television camera tubes.



Norelco PHILIPS BROADCAST EQUIPMENT CORP.

299 Route 17, Paramus, N. J. 07652 • 201-262-7300

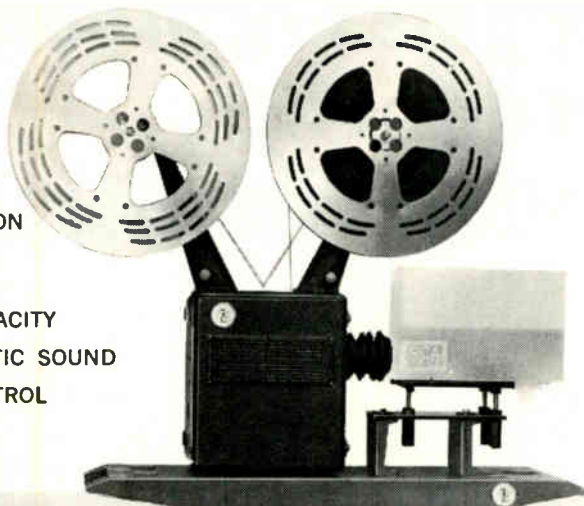
16 mm SOUND PROJECTOR ^{TMC} BCP-16

for BROADCASTING • INDUSTRY • EDUCATION • GOVT. • MILITARY • CCTV • CATV

MULTIPLEXER
OR
UNIPLEX
FILM CHAIN

- RUGGEDIZED FOR MOBILE OPERATION
- 50-60 FIELD FRAMES SWITCHABLE
- 4000 FT. REEL CAPACITY
- OPTICAL or MAGNETIC SOUND
- FULL REMOTE CONTROL

NAB BOOTH
424



Featuring

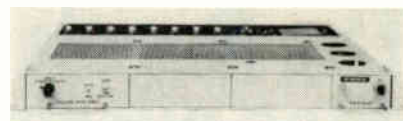
The TMC BCP-16 is a reliable, ruggedly built, light weight, professional 16 mm. sound film projector, constructed throughout of heavy gauge metal, and designed to provide years of trouble free service. The high efficiency optical system is ideally suited to color or monochrome. Every wanted feature, including instant single button preview still-framing, comes as standard equipment, not added optional.

AVIONICS/BROADCAST DIVISION

THE TECHNICAL MATERIEL CORPORATION
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Circle 45 on Reader Service Card

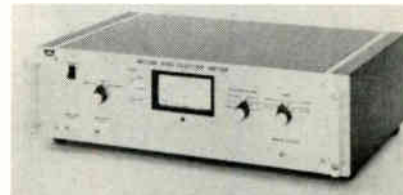


space in a standard 19-in. rack, the 2600 Series is designed to assist television studio engineers in checkout of color equipment. Test pulses to facilitate adjustment of color monitors, encoders and other apparatus are derived from the color bar generator. Video bar outputs are switchable from 100 to 75 percent. Combining the optional color bar encoder with the generator provides an accurate and stable matrix and phasing circuit to generate NTSC encoded color bars. Generator base price, \$600; encoder equipped, \$1595.

Circle 110 on Reader Service Card

Flutter Meter Meets NAB Standards

An economical new flutter meter, offering professional quality and accuracy at low cost, has been introduced by Micom, Inc., San Francisco, Calif. The unit, called Model 8150,



is designed for applications in radio and television broadcasting. Measuring to NAB standards with meter readout, the 8150 features self-checking calibration, with measurement consistency, between an unlimited number of units. A precision 3-kHz test frequency is provided, which can be used for recording and reproducing in the absence of a standard tape. Other features of the meter include: full-scale flutter ranges, 0.03 to 10 percent; demodulator accuracy, ± 2 percent on all ranges; frequency range, 0.5 to 200 Hz; input sensitivity, 5 mV to 5 V. Weighted or unweighted rms measurements are possible. The instrument features automatic input level indication and solid-state circuitry. Price is under \$800.

Circle 116 on Reader Service Card

Two-Way Radios

General Electric's Communication Products Department, Lynchburg, Va., recently added a new dual line of all solid-state fm two-way radios—the Royal Professional Series and the



CATV SALES

- Openings at several levels exist for capable CATV sales engineers. We also have openings for individuals with a CATV technical background desiring the sales field.
- Excellent growth opportunities in a growing company with rapidly expanding activity in the CATV field.
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Circle 46 on Reader Service Card

Instant Audio:

You create your own customized professional equipment with our
Finished Solid-State Circuit Modules.

Make intercoms, line amplifiers, mixers, monitors, turntable pre-amplifiers, stereo amps, language labs, etc. They'll be better, cost you less.

Just create your own electronics with our Finished Solid-State Circuit Modules. Make audio/RF/communications/radio-controlled systems. Quality will be high, cost you less.

AUDIO AMPLIFIERS



AA-100
UTILITY AMPLIFIER
For general purpose uses; and to modulate TR-100 Transmitter (below). Includes volume control and input (low Z) and output transformers.



AA-300
PROFESSIONAL
AMPLIFIER
Designed for broadcast/recording/TV uses. Includes input and output transformers.



AA-400
PROFESSIONAL
POWER AMPLIFIER
When driven by AA-100 or AA-300, a hi-gain 1-watt audio system results.



AA-500
PROFESSIONAL
PRE-AMPLIFIER
Specially designed for broadcast/TV/recording/hi-fi/commercial usage. With any low-level hi-Z input device, they deliver undistorted 5VRMS to drive a hi-Z input power amp. Usable with low-level low-Z mikes if fed by quality input transformer (150 to 50K Ω balanced). To feed 600 Ω lines, use a transformer (2.5 to 600 Ω balanced) in the output stage.

	Model AA-100 UTILITY AMPLIFIER	Model AA-300 PROFESSIONAL AMPLIFIER	Model AA-400 PROFESSIONAL POWER AMPLIFIER	Model AA-500 PROFESSIONAL PRE-AMPLIFIER	Model AA-500R PROFESSIONAL PRE-AMPLIFIER	Model AA-500N PROFESSIONAL PRE-AMPLIFIER
Freq. Resp.	± 3 db, 100-12K cps	± 1 db, 20-20K cps, 200MW ± 2 db, 20-35K cps, 100MW	± 1 db, 20-20K cps, 1W	$\pm 1/2$ db, 20-20K cps	RIAA-Equalized	NAB-Equalized
Harmonic Dist.	<3%, 100-12K cps	<1%, 20-20K cps, 100MW <2%, 20-20K cps, 200MW	<1/2%, 20-20K cps, 1W	<0.5% 20-20K cps	<0.5% 20-20K cps	<0.5% 20-20K cps
Input Z	50-150 Ω (shielded transformer) & 100K Ω	50-150 Ω , or 600 Ω , balanced (mu-metal shielded permalloy core transformer) 2K or 100K Ω unbalanced	500 Ω & 2K Ω	48K Ω (May be used with input transformers)	48K Ω (May be used with input transformers)	48K Ω (May be used with input transformers)
Output Z	500 Ω & 8 Ω (grain oriented transformer) 200MW	500 Ω & 8 Ω (grain oriented transformer) 200MW	4-16 Ω (OTL)	5K Ω (May be used with output transformers)	5K Ω (May be used with output transformers)	5K Ω (May be used with output transformers)
Gain	70db	80db	1/2V for 1W output	70db	70db	70db
Circuit	5 transistors, 1 thermistor	7 transistors, 1 thermistor	5 transistors	4 transistors	4 transistors	4 transistors
Power	9VDC, 50MA	9VDC, 100MA	14VDC, 200MA	40VDC, 5MA	40VDC, 5MA	40VDC, 5MA
Size	5 1/2" L x 1 3/4" W x 1" H	8" L x 2 1/4" W x 1 1/2" H	5" L x 2 1/2" W x 2" H	4 1/2" L x 3" W x 1 1/4" H	4 1/2" L x 3" W x 1 1/4" H	4 1/2" L x 3" W x 1 1/4" H
Weight	3 1/2 oz.	12 oz.	4 oz.	2 oz.	2 oz.	2 oz.
Price	\$7.95	\$14.95	\$10.95	\$23.95	\$23.95	\$23.95

REGULATED POWER SUPPLY

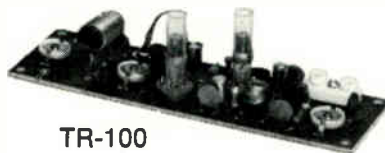
Zener-referenced, delivers highly stable, extremely low ripple DC output of 9VDC with loads up to 200MA; and unregulated 14VDC at 1 Amp. For wherever well-filtered regulated DC is needed. Input: 105-120VAC, 60cps, 5W. Regulation: Line \pm load 5MV. Ripple: Under full load 10MV, p-to-p. Max. Load Current: 200MA, 4 1/2" L x 2" W x 1 1/2" H. Wt.: 23 oz. (with transformer)



PS-300
\$18.95

TRANSMITTER

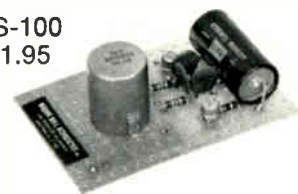
Complete crystal controlled 3-transistor transmitter for Citizens' Band. Factory pre-tuned for any CB channel; supplied with channel 10 crystal. Modulation: CW or AM with external modulator such as AA-100. RF output: 100MW, 50 Ω load. Power: 9VDC, 50MA, 5 1/2" L x 1 3/4" W x 2" H, 3 1/2 oz. Add. CB Crystals: \$3.00 ea.



TR-100
\$10.95

POWER OSCILLATOR

All-transistor push-pull sine wave oscillator, 20KC-150KC, 1% harmonic distortion. Power needed: 18-22V, 100MA. Input terminals permit AM modulation (by amplifiers AA-100, 200, 300). Uses: biasing recorder heads, powering tape erasers, signal generator/transmitter. 5" L x 3" W x 2" H.



OS-100
\$21.95

Please send me the following circuit boards:

Model	Qty.	Price ea.	AMOUNT
AA-100 Utility Amplifier		\$ 7.95	\$
AA-300 Professional Amplifier		14.95	
AA-400 Professional Power Amplifier		10.95	
AA-500 Professional Pre-Amp		23.95	
AA-500N Professional Pre-Amp		23.95	
AA-500R Professional Pre-Amp		23.95	
PS-300 Power Supply		18.95	
TR-100 Transmitter		10.95	
OS-100 Power Oscillator		21.95	
		TOTAL	



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434 Avenue of the Americas, New York, N. Y. 10011

Send postpaid: enclosed is full payment. Send C.O.D.

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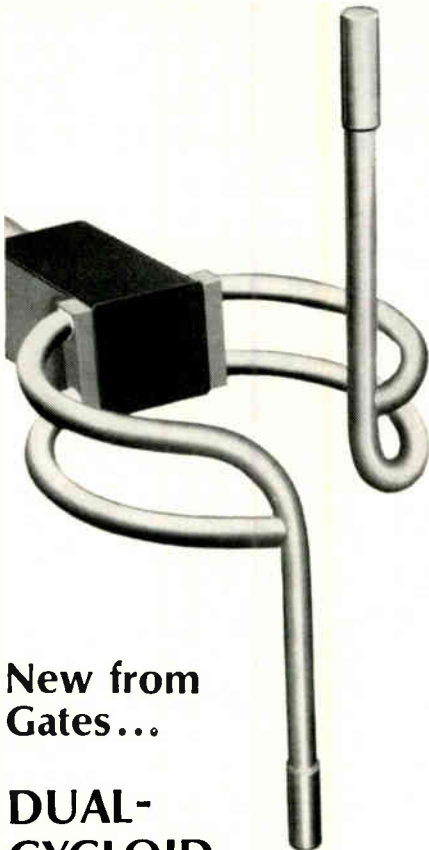
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DEALERS INVITED.

BME-3

Circle 47 on Reader Service Card

The soundest sound in FM
is the new sound of GATES



New from
Gates...

DUAL- CYCLOID CIRCULARLY POLARIZED FM ANTENNA

Now you can have circular polarization without individual horizontal and vertical transmitting bays on the tower.

The new Gates FM antenna combines in a single unit the time-proven features of the individual Gates Cycloid and vertical-type 300G antennas.

Designed for rugged, trouble-free operation. No power divider required. Any number of elements from 1 to 16 may be utilized for maximum flexibility in power gain selection. Special antenna with null fill and beam tilt also available.

The new Gates antenna is ideal for transmission of today's complex FM monaural, stereo and SCA multiplex signals.

Write today for complete brochure.



GATES

GATES RADIO COMPANY
QUINCY, ILLINOIS 62301, U.S.A.

A subsidiary of Harris-Intertype Corporation

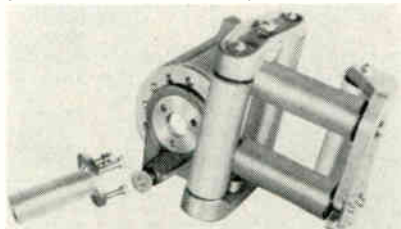
Circle 49 on Reader Service Card



Royal Executive Series—to the GE MASTR Progress line of mobile communications for cars and trucks. The new models are available in 25 to 50 MHz and 132 to 174 MHz. Fifty-W models are available for low band and 35-W units for high band.
Circle 113 on Reader Service Card

Cable Stringing Aid

Model Swivel Fairlead, recently developed by the Telsta Corp. of San Carlos, Calif., features a self-adjusting set of two rollers that provides protection to cable by dividing the



angle between cables as they're strung. The Fairlead may be rotated to assure proper positioning of

the rollers with respect to the material being placed at any elevation.
Circle 130 on Reader Service Card

Spotlight Makes Soft Light

Most powerful addition to 750- to 4000-W family of Softlites, made by Mole-Richardson Co., Hollywood, Calif., is the 8000-W Molequartz Super-Softlite, Type 2621. Accepting



8 individually switched efficient quartz tungsten-halogen globes in a choice of ratings up to 1000 W each. Type 2620 Super-Softlite is designed to permit extremely flexible lighting control without affecting desired color temperature.

Circle 112 on Reader Service Card

PROGRESS IN AN EXPLODING TECHNOLOGY

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- FREE SHUTTLE BUSES between the Hilton and the Coliseum—every few minutes.

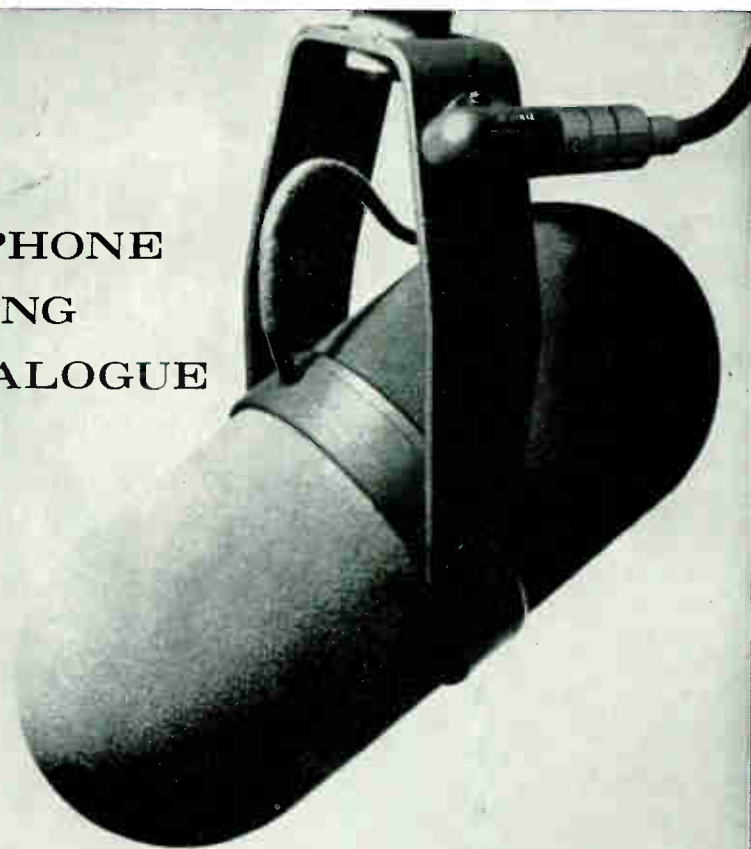
- REGISTRATION—Good all days—General Sessions and exhibits. In and out privileges.—IEEE Members \$3.00. Non-members \$6.00. Ladies \$1.00. High School Students \$3.00 if accompanied by an adult—One student per adult; Thursday only—limit of 3 students per adult.
- REG-IDENT CARD speeds request for exhibitors' literature. Ask for one when registering.
- ESCALATORS/EXPRESS ELEVATORS to the Fourth Floor.



IEEE Exhibition MARCH 18-21, 1968

Circle 48 on Reader Service Card

**THIS BOOM MICROPHONE
IGNORES EVERYTHING
...EXCEPT THE DIALOGUE**



Consistency of sound track quality on an endless variety of locations and sets can be dramatically improved with the remarkable Shure SM5 Boom Microphone. It "hears" the dialogue rather than the ever-changing character of the surroundings.

Because its cardioid directional pattern is uniquely uniform with frequency and symmetrical about its axis, the SM5 is singularly independent of the effects of environment. Even in extreme shooting situations (such as with tight sets, low ceilings, hard walls, low microphone angles, traffic or air conditioner noise and rumble, and changing distance) the SM5 minimizes sound coloration and ambient noise pickup. Equalization

changes—on the set or in transfer—are seldom, if ever, necessary.

The highly effective attached windscreen completely encloses the two-stage mechanical filter, so that there are no external "rubber bands" for the wind to "strum." The absence of response-correcting inductors or impedance transformers assures freedom from hum.

Call on the Shure SM5 to solve your most annoying boom problems!

For additional information, write directly to Mr. Robert Carr, Manager of Professional Products Division, Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Illinois.

SHURE SM5
UNIDIRECTIONAL DYNAMIC BOOM MICROPHONE

SHURE PROFESSIONAL MICROPHONES... FOR BETTER AUDIO



**MODEL SM56
CARDIOID
DYNAMIC**

Extremely versatile in studio, control room, and remote use. Also widely acclaimed for rhythm recording. Bright, clean sound. Exceptionally uniform cardioid pattern gives optimum control of environment.



**MODEL SM33
UNIDIRECTIONAL
RIBBON**

Warm, smooth sound for studio, control room, and scoring stage. Super-cardioid directional pattern. Compact, yet rugged.



**MODEL SM76
3/4" OMNIDIRECTIONAL
DYNAMIC**

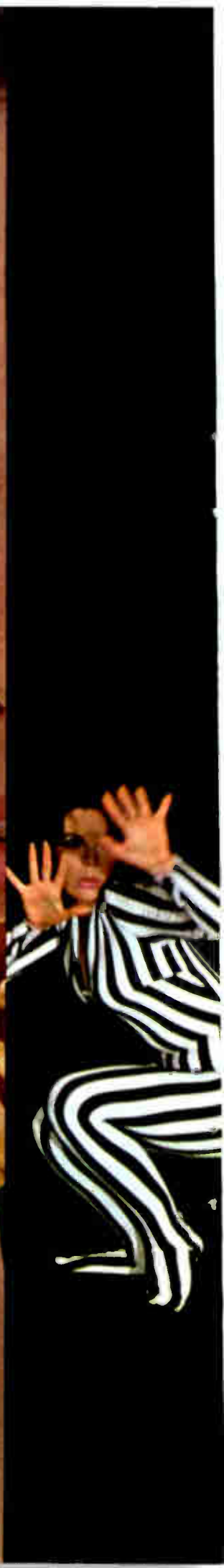
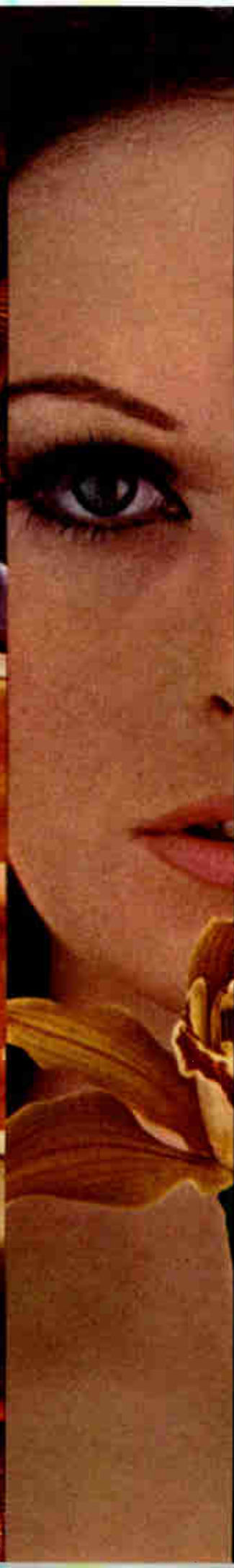
Ideal for interviews and audience participation, yet unusually smooth wide range response (40-20 KC) for critical music reproduction. Instantly detachable from stand. Steel case with Cannon connector.



**MODEL SM50
OMNIDIRECTIONAL
DYNAMIC**

Self-windscreened and pop-free for news, sports, remotes, and interviews. Also ideal for many studio and control room applications. Comfortably balanced for hand or stand use. Natural response.

Circle 50 on Reader Service Card





ELECTROGRAPHY



**Videotaping
has gotten
so good,
it has
a new
name!**

Tape is more versatile than ever!

Everybody knows the key advantages of video tape. You work fast. You see your work as you go. You can be more daring and experimental.

But perhaps you didn't realize how sophisticated the art of videotaping has really become: You can edit instantly... electronically... frame by frame. You can use slow motion, fast motion, stop motion and reverse action. You can go out on location. And you can combine all types of existing footage (stills, film) with new footage.

**Now, the most life-like color yet:
"Scotch" Brand Color Tape Plus.**

"Scotch" Brand Video Tape No. 399 gives you the ultimate in color fidelity. The brightest, clearest, most life-like color ever. Color Tape Plus is so ultra-sensitive, you can use the most subtle lighting techniques. Copies are perfect. Blacks and whites are stronger. And No. 399 is almost impossible to wear out.

So please don't call it videotaping any more. There's now a new name for this complete creative medium... electrography!

Want more facts? Write: 3M Company, Magnetic Products Division, 3M Center, St. Paul, Minn. 55101.



SCOTCH IS A REGISTERED TRADEMARK OF 3M CO.

the look of things to come



A fresh new appearance with the same high quality in service and products. Join us at NAB when we unveil "The New Look" in professional audio products. (If you can't be there, write for our new Products Brochure.)



PARTA

ELECTRONIC CORPORATION

5851 FLORIN-PERKINS ROAD SACRAMENTO, CALIFORNIA 95828

A DIVISION OF COMPUTER EQUIPMENT CORPORATION

Circle 52 on Reader Service Card

← Circle 51 on Reader Service Card

March, 1968 — BM/E

NAMES

IN THE NEWS

Gates Radio Company recently announced the promotions of **George W. Yazell** to the position of field service manager and **Richard A. Powell** to the post of manager of government and export marketing.

Appointment of **Gene W. Duckworth** to the newly-created position of division vice president, Equipment Sales, RCA Electronic Components and Devices, recently was announced by John B. Farese, executive vice president.

Rev. John C. Urban, project director for the instructional television system operated by the Catholic Archdiocese of Los Angeles, has been elected to membership on the Great Plains National Instructional Television Library's policy board.

The San Francisco Bay Area Educational Television Association's 23-member board of directors recently elected **James Day** president of the nonprofit corporation.

John A. Dimling, Jr., has been appointed manager of communication and systems research for Spindletop Research, Lexington, Ky.



Robert A. Castrignano



Rein Narma

Robert A. Castrignano has been promoted to the new position of general manager for EVR systems engineering at CBS Laboratories, it was recently announced by Dr. Peter C. Goldmark, president and director of research.

Rein Narma has been named vice president of Ampex Corporation and general manager of the company's consumer and educational products division in Elk Grove Village, Ill., it was recently announced by William E. Roberts, president and chief executive officer.

The appointment of **Daniel R. Wells** as director of engineering services for CBS Television Stations Division was announced recently by Hal Hough, vice president of program services for the division.

William C. Harley, president of the National Association of Educational

Broadcasters, has accepted an appointment as chairman of the Mass Communications Committee of the United States National Commission for UNESCO. **James A. Fellows**, assistant to the president of NAEB, has accepted an invitation to serve on the Editorial Advisory Committee of a new bi-monthly educational radio and television publication, *Educational/Instructional Broadcasting*.



Lewis C. Radford

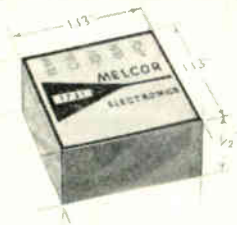


Kenneth B. Schindler

Visual Electronics announces the promotion of **Lewis C. Radford** to national sales manager and the appointment of **Kenneth B. Schindler** to the position of product engineer, video switching systems.

Paul Rust, news director of WIP Radio, Philadelphia, Pa., announces the appointment of Michael McLaughlin to the station's news team.

Kaiser Broadcasting announces the following promotions: **Robert J.**



modules: Our Models 1731 and 1757 audio operational amplifiers are unique in the field. They can be used as preamplifiers for microphones, tape decks and phonographs; as lossless mixers, boosters and line amplifiers. Go from -129 dbm equivalent input noise to +33 dbm output. We have used them in our strip size equalizer, Model AE-20 and in our strip size limiter, Model LC-20 which has a 10 microsecond attack time.

components: A standard line of all silicon transistor, printed circuit construction, slide mount units. In the model designations, the letter indicates the function and the numerics relate to output levels.

- A-24 - Microphone Pregamp or Line Amp, 24 dbm output
- A-40 - Line or Monitor Amplifier - 10 watt output
- C-20 - Strip Size Compressor, one to four channels, 20 dbm output
- EQ-20 - Strip Size Active Equalizer, cut & boost, low & high freq., 20 dbm output
- P-2 - +24 VDC Power Supply, 2 amp output



rack mounts: GE-20 - Versatile Graphic Equalizer • A-47 - 50 Watt Monitor Amplifier with regulated supply • AB-47 - 50 Watt Monitor Amplifier • AB-247 - 50 Watt Stereo Monitor Amplifier • AB-50 - 110 Watt Monitor Amplifier

consoles: Melcor's components are ideal for building up to systems and consoles. Let our experience work for you. Send us your console requirements.



MELCOR AUDIO

Write for literature.



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AMPLIFIERS FOR INDUSTRY

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FARMINGDALE, LONG ISLAND, N. Y.
TEL: 516 MYRTLE 4-5570-1

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Somerville becomes general sales manager and assistant general manager of KBHK-TV, **William L. McGee** has been promoted to sales manager at KBHK-TV, **Ernest J. McDaniel** becomes operations manager of KFOG-FM, **William B. Davis** becomes promotion manager of KBHK-TV, **Anthony L. Cennamo** joins WCAS as program manager, **Clayton C. Dopp** has joined KBHK-TV as sports producer and **John Aaron** has joined KBHK-TV as producer of *Tonight in San Francisco*.



M. M. (Tex) Haertig



Richard M. Smith

M.M. (Tex) Haertig and **Richard M. Smith** have been appointed district sales representatives in the greater New York City area and the Northeastern U.S., respectively, for the General Electric Visual Communication Products Department.

National Center for School and College Television announces the appointments of the **Rev. John M. Culkin, S.J.**, to a second term and

Leslie J. Bishop to his initial term on the Center's advisory board.

Van Saunders has been appointed by WRCH, Hartford, Conn., to direct the station's expanded news facility.

WJAX-TV, Miami, Fla., announces the promotions of **Tony Glenn** to the position of program and operations manager and **Macey I. (Mike) Schaffer** to the position of sales manager.

David Brody has been named manager of the Community Operations Division of Jerrold Electronics, it was announced by Paul A. Garrison, vice president, operations.

Roy F. Hoover, engineering supervisor at KDKA-TV, Pittsburgh, has been promoted to chief engineer, it was announced recently by Glen Lahman, engineering manager.

Mario Alves, president of Riker Video Industries, Inc., announced the appointment of **Seymour Cook** as chief executive officer of the company's wholly-owned subsidiary, Continuous Progress Education, Inc.

David Oppenheim and **Richard Richter** have been named executive producer of cultural affairs and producer, respectively, on the staff of the Public Broadcast Laboratory.



G. Brent Horney



Philip J. Calone, Jr.

The appointment of **G. Brent Horney** as advertising manager of Entron, Inc., recently was announced by John G. Russell, vice president.

Philip Colone, Jr., has rejoined Ameco, Inc., as CATV equipment salesman in the northeast area.

R.A. Kleine, vice president of Rohn Manufacturing Co., and Vulcan TV Mast & Tower Co., Inc., recently announced that **Kenneth W. Lloyd** has been named sales manager for both firms.

The Canadian Board of Broadcast Governors announces the appointment of **Paschal O'Toole** as its Regional Representative for the Atlantic Provinces in Moncton.

Prentiss Cobb Hale has been elected to the Memorex Corporation Board of Directors, according to Laurence L. Spitters, Memorex president and chairman of the board.

How good are your contacts?



Everybody knows that dirty contacts on relays, connectors and module board edges cause erratic operation. But what to do about it? Spray them clean—in seconds—with MS-230 Contact Re-Nu. That's what a major broadcasting network prescribes for its member stations. Contact Re-Nu restores full electrical continuity instantly on all types of contacts.

There's probably a can of MS-200 Magnetic Tape Head Cleaner in your control room now. Be sure MS-230 Contact Re-Nu is there too. Write on company letterhead for free 16-oz. sample. For literature only, use bingo card.

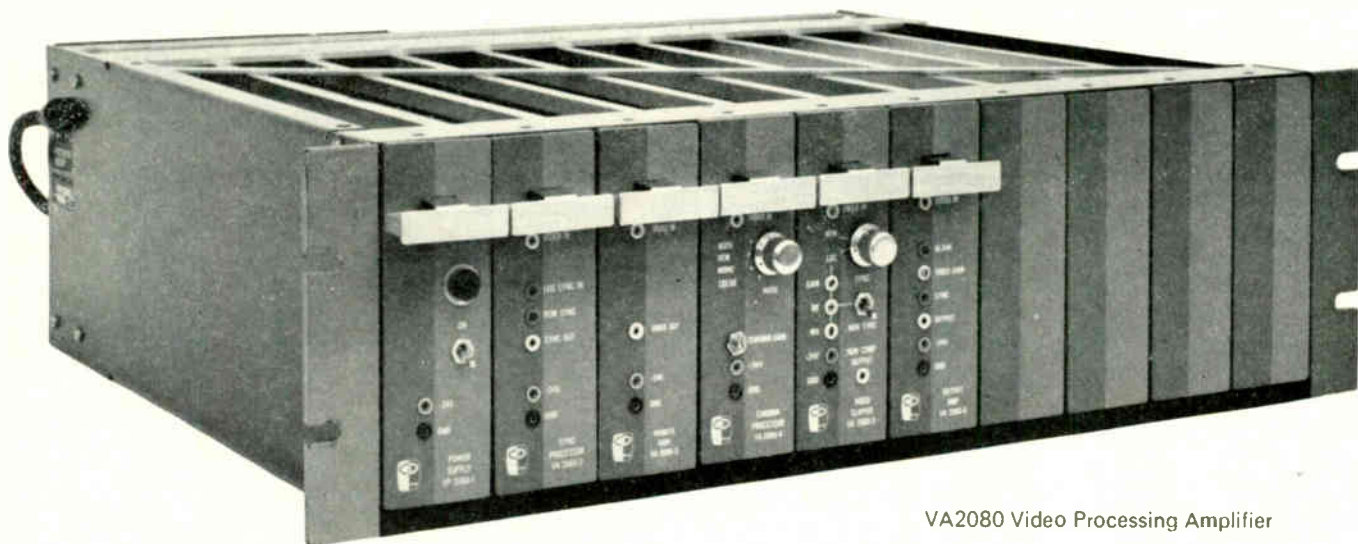


**miller-stephenson
chemical co., inc.**

ROUTE 7, DANBURY, CONNECTICUT
*U.S. and foreign patents pending

Circle 54 on Reader Service Card

Set it- Forget it!



VA2080 Video Processing Amplifier

Once the operator has set the VA2080 Video Processing Amplifier, no adjustment is necessary to maintain stability and crisp picture transmission. Performance of the clipping circuits is unexcelled—maintaining 0.2% linearity to within two IRE units of clipping level. Expandable from monochrome to colour, or from studio to transmitter applications by the addition of modules. Back porch clamping is used on all models—exclusive in this price class.

The initial cost of the VA2080 series is much lower than you might expect—lower than any other proc amp in its class. As to proof of performance, more than 300 VA2080 installations are now in use! Find out more about the dependable, trouble-free VA2080. Write, wire or telephone Central Dynamics for a convincing demonstration.



CENTRAL DYNAMICS CORPORATION

HEAD OFFICE: 903 Main St., Cambridge, Mass. 02139

Circle 55 on Reader Service Card

general interest to children are available. The majority of the evening schedule is contributed by the University of Georgia.

New NAEB Committees. NAEB has created two committees to investigate employment and programming practices in the non-commercial educational broadcasting industry. The Employment Practices Committee will be particularly concerned with a study of the positions of minority groups hold in educational broadcasting today, and to open job opportunities for such groups. The Program Committee will focus on what educational broadcasting can do to expand programming with appeal and meaningfulness to the ghetto population of the country.

\$680,000 Contract to RCA. Clark County (Nevada) School District awarded RCA a \$680,000 contract for broadcast equipment for its educational television system that will make possible the transmission of five programs simultaneously to 86 schools. Included is equipment for originating color

programs from film and television tape for KLVX-TV, a new channel 10 in Las Vegas. By next fall the 64,000 pupil district will add a four-channel instructional fixed television service system for broadcast of educational programs in the 2500-MHz frequency band.

Science Series Available. "Let's Explore Science," fourteen 15-minute lesson series, developed and produced by the Portland (Oregon) Public Schools at KOAP-TV in Portland is available from the Great Plains National Instructional Television Library.

New Marketing Approach. Ampex Corporation, in an effort to give broadcasters the opportunity to evaluate their products in their own studios, has completed a 14,000-mile, three-month, cross-country tour by a completely out-fitted color television van. Personnel from 48 commercial and educational television stations in 39 cities were given the opportunity to operate Ampex high band color VTRs, Marconi color cameras, and professional audio recorders. The new approach resulted in more than \$2-million in color television equipment sales.

LTV Ling Altec acquires Standard Systems Corp. LTV Ling Altec, Inc., Anaheim, Calif., subsidiary of Ling-Temco-Vought, Inc., Dallas, has acquired Standard Systems Corp., Port Washington, N.Y., manufacturer and marketer of institutional intercommunications systems and equipment.

Merger Signed. The Audio Devices, Inc., and Capitol Records, Inc., merger agreement has been signed. Merger is subject to the approval of Audio Devices shareholders and clearances by state and federal regulatory agencies. ●

BUSINESS OF BC

CEC Takes Over Sparta. Through an exchange of stock, Sparta Electronic Corporation, manufacturer and worldwide marketer of professional broadcast products, has become a wholly-owned subsidiary of Computer Equipment Corporation, South El Monte, Calif.

8 reasons why you should accept no substitute for ...

FIDELIPAC® NAB CARTRIDGES

Graphite ribs bear tape roll weight for unequalled operating life; add significant lubrication to tape for smooth intra-roll movement.

Quality control label applied after passing through acceptance tests, for tape draw, wow and flutter, frequency response, etc. (label applied to loaded cartridge only).

Direct force brake spring action insures proper cartridge positioning and correct pinch roller capstan pressure.

Brass center bearing for accurate size and frequent rework.

Guide wire for exit strand gives smooth, controlled life to tape for excellent wow and flutter.

Pressure Pad covered with DuPont Teflon® for lowest possible friction. Low-set foam for excellent wrap constant force and proper head penetration.

Break pawl action assures positive stop for accurate cue-up; holds reel in position during handling.

Individually inserted Delrin corner post for accurate tape guidance. Not dependent upon cover hold-down or other large tolerance rib structure.

**For information:
See your Fidelipac Distributor
or write to us for Bulletin C.**

TELEPRO / Fidelipac Division
INDUSTRIES INCORPORATED / Cherry Hill Industrial Center
Cherry Hill, New Jersey 08034

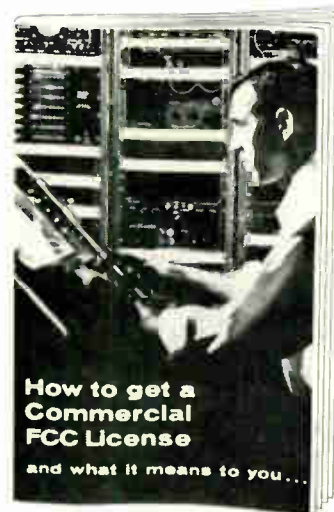
Circle 56 on Reader Service Card

BROADCAST EXECUTIVES—show this ad to the up-and-coming young men on your staff.

Want to move up fast in broadcasting?

This free book may change your life

It takes the mystery out of getting the FCC License you need for security and success



NO WONDER you're interested in a career in broadcasting. It puts you right "where the action is"—behind the scenes of show business, news reporting, politics. You meet famous people. You're the first to know the big news about fires, riots, plane crashes. You get to hear wonderful music. You feel in contact with an audience of thousands.

And one of the most secure high-pay jobs in the field is that of the licensed Broadcast Engineer. He's the key man required on the job by the United States Government

New job opportunities are opening up constantly for qualified license-holders. Many more will be needed to operate and maintain the countless new UHF-TV stations expected to begin operation, now that all new TV sets can receive UHF.

So if you dream of making broadcasting your life work, you need that Government FCC License.

But how do you go about getting it? Where do you apply, and when? How do you get ready for it?

To help you, we have published a 24-page booklet, "How to Get a Commercial FCC License." It tells you exactly which types of licenses and permits are issued by the Federal Communications Commission, and what kinds of electronic equipment each type allows you to operate and maintain.

You will learn which subjects must be mastered for each kind of license. Thirty typical exam questions will give you an idea of the level of training required. You'll be told where and how often the exams are held, and how to find out about the exams held nearest your home.

Frankly, the FCC exams are rough if you're unprepared. Two

out of three applicants fail to pass. Some fail seven or eight times.

But with the right preparation, it's easier than you would imagine. Better than 9 out of 10 CIE-trained men pass the exam with no difficulty. Our record is so good that we are able to promise every student in writing: *after completing your CIE course, you'll be able to pass your FCC exam, or CIE will refund your tuition in full.*

We'll send you a free copy of our school catalog in addition to your free FCC booklet. Then you can see for yourself how thorough our home study courses and teaching methods are. No obligation, of course.

To receive both books free, just mail coupon below. If coupon is missing, write to Cleveland Institute of Electronics, 1776 East 17th Street, Dept. BM-7, Cleveland, Ohio 44114. Do it right now—if you want a solid career in broadcasting, this could be the turning point in your life.

ENROLL UNDER NEW G.I. BILL

All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box in coupon for G.I. Bill information.

MAIL COUPON FOR FREE BOOKS

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1776 East 17th Street, Cleveland, Ohio 44114

Please send me, without cost or obligation, your 24-page booklet, "How to Get a Commercial FCC License," together with your school catalog of license-preparation courses.

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(Please Print)

ADDRESS _____

CITY _____ STATE _____ ZIP _____

ADVANCED COURSE FOR LICENSE HOLDERS. Check box if you already have an FCC License and desire information about our Advanced Communications Engineering Course which has helped many broadcast engineers reach the top of their profession.

Check here for G.I. Bill information.

Accredited Member National Home Study Council
A Leader in Electronics Training...Since 1934

BM-7

"I GIVE CLEVELAND INSTITUTE CREDIT FOR MY 1ST CLASS COMMERCIAL FCC LICENSE,"



says Matt Stuczynski, senior transmitter operator, Station WBOE. "Even though I had only six weeks of high school algebra, CIE's AUTO-PROGRAMMED * lessons make electronics theory and fundamentals easy. After completing my CIE course, I took and passed the 1st Class FCC Exam. I now have a good job in studio operation, transmitting, proof of performance, equipment servicing. Believe me, CIE lives up to its promises. I really enjoy my work and I'm on my way up."

Circle 57 on Reader Service Card

Continued from page 8

most powerful radio station. Power increase will provide coverage area in excess of 15,000,000 people. Announcement was made by Herbert W. Hobler, president of Nassau Broadcasting Company, owners of the station.

Record \$5-Billion Year

The Consumers Products Division of the Electronic Industries Association says that factory sales of consumer electronic products will attain a record \$5-billion in 1967, compared to \$4.7-billion in 1966, and less than \$1.5-billion 10 years ago. Televisions, radios, phonographs and tape recorders and players will account for \$4-billion with electronic kits, musical instruments, hearing aids, etc. making up the remainder.

Reeves Lowers Videotaping Costs

Reeves Sound Studios has established quantity duplication prices on videotape compatible to film, thus opening the national spot commercials market to distribution on videotape. Videotape duplicates, one minute or less, color or black

and white, are \$40.00 for one, down to \$15.50 each for 18 or more. These reductions in addition to those of September 15, 1967 have brought prices for duplicates of one minute or less down by up to 81 percent.

With the addition of Ampex's new VR-2000B, its 14th VTR, and two Norelco Plumbicon PC-70 color cameras to its Airmobile-Video System, Reeves Sound Studios has increased the number of simultaneous jobs that can be shot with the Airmobile-Video System. The system, because of its modular design, has lowered costs of taping spots.

Bid For Master Frequency Agency

Rep. Torbert H. Macdonald (D., Mass.) proposed a master federal agency to handle allocations of radio frequencies.

The chairman of the Communications and Power Subcommittee of the House Interstate and Foreign Commerce Committee told an audience of some 400 electronics executives at the Century Plaza Hotel in Los Angeles, gathered for the Fall Conference of the Electronic Industries Association,

that the emergence of satellite communications would add to the "burgeoning problem" of frequency allocation.

"I believe that our solution to this problem may be the development of a Department of Communications or communications agency growing out of the current office of Telecommunications Management."

Although the spectrum is crowded, Rep. Macdonald said, "no one, it seems, knows whether or not all the frequencies are actually being used.

"There is a great amount of speculation that many frequencies assigned to the Department of Defense."

Rep. Macdonald also called for aid from the electronics industry in solving problems of overcrowding orbital space, recovery of inoperable satellites and intersatellite interference.

TV Homes Set Viewing Records

TV households kept their sets on more last year than ever before and color TV homes watched about an hour more each day than their black and white coun-

CUSTOM LP PRESSINGS

- Fast Service
- Short Run
- High Quality
- Low Cost

We have complete facilities for providing the custom pressings that will enable you to profit from E. T. circulation, sales of LP recordings to local groups, etc. Mono or stereo, 12" and 7". You send us your tapes and label copy—we do the rest.

Write for full information and free manual on custom pressing.

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View Chicago's Loop
from Chicago's Lake

LAKETOWER

Lake Shore Drive at Ohio Street

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250 delightful rooms offering motel informality and convenience with hotel luxury and services

Free inside parking • Free continuous station wagon service to and from the loop, theatres, shopping • Free TV/radio in every room • Free ice dispensers on every floor • Dining Room • Coffee Shop • Cocktail Lounge • Room Service • Automatic Dial Telephones • Individual room controls for air-conditioning and heating • Meeting and banquet facilities.

Singles from \$12. Doubles from \$16.

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3M WOLLENSAK HAS THE OPTICS ANSWERS:



Motorized model.

Manual model.

This is the new 3M Wollensak 11:1 Television Zoom Lens. Available in motorized or manual models. It has a range of 14mm to 145mm. And it's fast— $f/2.2$. Each model is compact and lightweight. And each is American made. Designed with "C" mount to fit all Vidicon cameras. Price: \$1775 for motorized. \$875 for manual. Newest in a line of fixed focal and zoom lenses.

Contact your dealer or write to: **3M**

COMPANY

Wollensak

TELEVISION PRODUCTS

St. Paul, Minnesota 55101, Dept. FMJ -38

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terparts. TvB President Norman E. Cash noted that the growth of color homes increased from 17 percent penetration to 25 percent of all television homes. Annual average of TV usage per home per day increased from 1966's 5 hours and 32 minutes to 5 hours and 42 minutes in 1967.

New Space Weather Camera Unit

\$750,000 contract has been signed

by ITT Industrial Laboratories Division with the Goddard Space Flight Center of NASA for a new device that will provide vital temperature data plus high-quality day and night pictures of cloud cover in the earth's atmosphere. Known technically as a very-high-resolution radiometer (VHRR), it will be used aboard a future TIROS M weather satellite, and later will be flown on the second-generation ESSA series of operational weather satellites. The cam-

era will produce a complete picture map of the world every 12 hours through infrared sensing of varying earth atmosphere temperatures.

RCA Gets \$650,000 Contract And More

Yorkshire Television Ltd., Great Britain, has contracted for \$650,000 in seven RCA high-band color tape systems: two TR-70's and five of the newly introduced compact version of the TR-50. And Taft Broadcasting Company of Cincinnati has recently purchased 10 of the TR-70's. RCA designers describe the TR-70 as a "state-of-the-art" system since it incorporates the latest technology for producing color TV pictures free from technical imperfections.

NAB Engineering Conference Firming Up

The Broadcast Engineering Conference Committee of NAB has drawn up preliminary plans for the year's Conference to be held as part of NAB's annual convention in Chicago. Albert H. Chismark, director of engineering for the Meredith Broadcasting Co., Syracuse, N.Y. and chairman of the Conference Committee, will head up five member award Subcommittee, Leslie S. Learned, v.p. for Engineering of the Mutual Broadcasting System, New York, was named chairman of the Luncheon Speaker Subcommittee.

Audio Engineering Society Sets '68 Meet

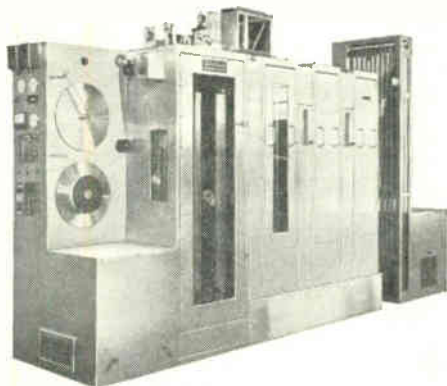
Announcing the Audio Engineering Society's 34th National Convention, Don Davis, convention chairman, issued a call for papers. Among the topics of interest to broadcasters are: Recording, Acoustics & Hearing, Music & Speech and Recording and Broadcasting Facilities.

The convention is to be held April 29-May 2, 1968 at the Hollywood Roosevelt Hotel, Hollywood, California.

Dice Table With Antenna?

The FCC recently demonstrated a prize won by the Maryland State Police in a gambling raid. The demonstration took place in the new Post Office building in Washington and showed the operation of a radio controlled dice table.

FILMLINE Processors are DIFFERENT



They work continuously, without downtime, maintenance problems or lost film. Unmatched reliability and quality have been characteristic of all Filmline processors since 1947.

Filmlines exclusive Overdrive Film Transport System guarantees 100% performance.

CAN YOUR OPERATION AFFORD ANYTHING LESS?

There's a Sensibly Priced Filmline processor for every Need — Portable . . . Spray . . . Color. Here's a partial listing:

Model	Film Type	Process	Film Size	Speeds
R-15TC	Rev. & Neg./Pos.	B&W	16mm	15FPM
RTS	Rev. & Neg./Pos.	B&W	16mm	85-125FPM
R-36	Rev. & Neg./Pos.	B&W	16mm	36-72FPM
R-60S	Rev. & Neg./Pos.	B&W	16mm	60-100FPM
NP36	Neg./Pos.	B&W	16mm	90FPM
S-150	Neg./Pos.	B&W Spray	16/35	160FPM
FE-30	Ektachrome	Color	16mm	30FPM
FE-50	Ektachrome	Color	16mm	50FPM
FE-100	Ektachrome	Color	16 or 16/35	100FPM
FEC-100	Eastman Neg./Pos.	Color	16 or 16/35	100FPM
FEC-150	Eastman Neg./Pos.	Color	16 or 16/35	150FPM
FEC-200	Eastman Neg./Pos.	Color	16 or 16/35	200FPM
FEC-300	Eastman Neg./Pos.	Color	16 or 16/35	300FPM

Custom Units Built To Specification for Any Installation

PARTIAL LIST OF RECENT INSTALLATIONS:

Byron Motion Pictures, Capital Film Laboratories, Color Service Company, De Luxe Laboratories, General Film Laboratories, Guffanti Film Laboratories, MovieLab, Pathe Laboratories, Precision Laboratories

For literature write: BMM-68



See us at Booth 124, NAB Show
Circle 61 on Reader Service Card



Hokushin Telecine projector from Listec.

ing system shown at an NAB convention, including a production switcher incorporating: special effects, double re-entry, automatic sync adding with clamped inputs, add/nonadd mixing system, automatic mix inhibit on nonsynchronous signals, black burst generator and cutbar operation.

- A full line of studio lighting equipment, including several models of variable focus and scoop types, and dimmers will be keeping things illuminated at Berkey Color-Tran's area. A complete overhead grid system will feature Color-Tran's "quartz" line of lighting fixtures and accessories.

Tripods, pedestals, dollies, wall and ceiling mounts, pan and tilt heads, cradle heads and special purpose mounts will give television broadcasters a wide choice of camera mounts from which to select at the Quick-Set booth. Featured will be Models 6475 Gibraltar crab pedestal and the 6245 cradle head.

Listec Television Equipment will display their Vinten pedestal, operating on compressed air and selling for \$2600. Listec also will feature the Hokushin TC-510D telecine projector, incorporating such interesting features as reverse running at full speed, automatic rotation of film loop, automatic replacement of exciter lamps and built-in test tone. The projector will sell for \$12,000.

- The first 50-kW air cooled TV transmitter and the first solid-state fm transmitter in the 250-W and 1-kW levels will be unveiled by Standard Electronics. Other new additions to Standard's transmitter line will be revealed.

- SCA, STL and microwave

equipment will be the themes of the Johnson Electronics, Moseley Associates and Lenkurt Electric displays. IC-8 and IC-20 integrated circuit receivers and the Johnson-Aire IC-1 solid-state tuner will be the highlights of the Johnson display. Also on hand will be a new Johnson-Aire education receiver, a portable type with self-contained speaker, antenna, and provisions for automatic tape recorder accessories.

New from Moseley will be the PCL-303B/C transmitter and receiver companion units, the PCL-202 aural STL for foreign fm applications and the 890- to 960-MHz monaural or stereo STL. Also on hand at booth 223-W will be the Model ADP-101 digital automatic transmitter logger and remote control units.

Two units from Lenkurt Electric—Types 75A and 76—for microwave video transmission will be on hand for inspection at NAB. Type 75A was designed for use by long haul video networks; Type 76, for transmission of color or monochrome video.

- CATV equipment of many descriptions will be on hand at the Dynair display. Several firsts—including a solid-state modulator TV demodulator; a remote switcher fader, a mini series line of amplifiers, a fader, switcher and a speaker; a new long-line video cable transmission system and Series 4000 CATV head end equipment—will be unveiled. Dynair's line of video and pulse distribution equipment, rf and mini-series or rf equipment also will be on deck.

- Delta Electronics bids in the test equipment and rf component categories with the display of Models OIB-1, CPB-1 and CPB-1A impedance bridges and the RG-1 receiver/generator. Delta's RVI high current rotary inductor possibly will be the show's lone tank circuit component on display.

New exhibitors include: Allied Impex Corp.; American Enka Corp.; Belar Electronics Laboratory, Inc.; Craftsman Electronic Products, Inc.; Disan Engineering Corporation; Electronic Engineering Co. of California; Listec Television Equipment Corporation; Marconi Instruments; Nippon Corporation of America; Optical Imports, Inc.; Packard Bell, Space & Systems Division; Scantlin Electronics, Inc.; Spindler & Sauppe, Inc.; Technical Materiel Corporation; TelePro Industries, Inc.; Texas Electronics, Inc.; and Videometrics, Inc.

Justice Department Favors CATV

The Justice Department for the second time has asked the Supreme Court not to decide the United Artists v. Fortnightly Corp. copyright case entirely against CATV. In this instance, as in the other, Justice cites fears of monopoly on the part of three networks and seven theatrical film distributors.

Solicitor General Erwin N. Griswold first asked the Supreme Court to lay the case aside on the grounds that Congress should be given a chance to legislate in the field. CATV copyright liability is a complicated subject, with public interest aspects which can't be resolved satisfactorily in the courts, he maintains. The Supreme Court brushed aside his request.

The current filing reminds the court that it asked Justice Department participation, acknowledges that there should be some liability under copyright laws for CATVs, but urges that the Supreme Court establish an "implied-in-law" licensing concept within the Grade B contours of stations carried by CATVs. What this means is that CATVs operating in areas considered within normal coverage areas of the stations would be free of copyright liability. Griswold's theory is that copyright holders on an implied basis license their work for exhibition in a station's operating area.

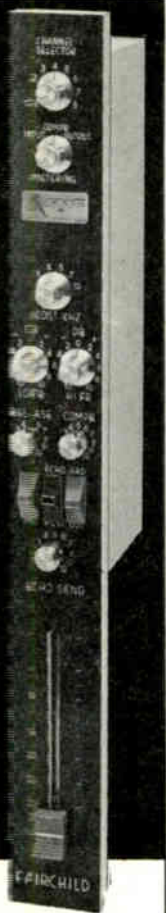
Griswold told the Supreme Court that this one decision would be a good starting point, though it would still leave many thorny areas to be settled by negotiation between CATV and copyright holders and/or by legislation. These would include how to set reasonable liability in non-implied-in-law areas and how to take care of past liability of CATVs, which could be astronomical.

Justice has long looked upon CATV as a possible competitor for the established services, even to the point of originating programs so that CATVs could form a fourth national network.

Seven talent unions and guilds representing screen and TV composers, writers and directors almost immediately assailed the Griswold filing. They said CATV, indeed, represents a performance for profit, often in direct competition with TV stations licensed to perform the works. They added that their artist-members can only get paid out of copyright fees collected by networks and feature film distributors.

From another quarter comes the view that the Supreme Court may not allow the FCC to regulate CATV. Professor Louis L. Jaffe of Harvard expressed in "The Viewer" the opinion that "there is a strong likelihood that the Supreme Court which is competition minded will not be prepared to read the Communications Act as granting authority to regulate CATV."

Build Your Own Multi-Channel Custom Control Audio Console in Less Than One Day



with FAIRCHILD INTEGRATED CONTROL MODULES!

Now at last your audio control problems are solved with FAIRCHILD INTEGRATED CONTROL MODULES. Not only can you have the most complete compact single channel audio control system at a low cost but you can now assemble individual FICM's into one custom audio control console in literally a few hours. In addition the power handling capability of each individual FICM permits it to be used as a console output channel as well as a mike input channel.

Only the advanced design FAIRCHILD INTEGRATED CONTROL MODULE comes with integrated compressor in addition to program equalizer and unique metering circuit. And each FICM is a completely shielded plug-in unit.

Complete mounting shells and accessories are also available and the front panel is available in your choice from the many popular colors offered.

If you are expanding your audio control system or stepping up to more sophisticated audio control equipment consult FAIRCHILD before you take your next step.

FICM FEATURES:

- Input and output amplifiers
- Input level selector
- 8-channel delegation switch (with echo)

Write to FAIRCHILD—the pacemaker in professional audio products—for complete details.

FAIRCHILD
RECORDING EQUIPMENT CORPORATION
10-40 45th Ave., Long Island City 1, N. Y.

Circle 63 on Reader Service Card

BROADCASTERS SPEAK

Sirs:

Paul Schafer mentioned to me the other day that a recent issue of your excellent publication contained a rather fascinating account of current trends of radio station automation.

Having just invested something on the magnitude of seventy-thousand dollars on new automation equipment here, I was quite interested in the article. If you have a reprint, I should very much like to have a copy.

In addition to the article on automation, I have one other favor to ask. Could you please advise us as to how we might be placed on the subscriptions list for *BM/E*?

Keith Trantow
General Manager
KOST Radio
Los Angeles, Calif.

Our September automation issue's on the way, K.T. Our circulation Manager says BM/Es henceforth will be sent to you every month.

Sirs:

I wish to take a few moments to express my appreciation for your magazine. As chief engineer of a 100-kw fm with stereo and an SCA and a 5000 watt a-m facility, I feel your magazine fills a gap that did exist in the broadcast industry. I find *BM/E* entertaining, educational and informative.

We offer a degree in the field of Broadcast Engineering here at Bob Jones University for which I am partly responsible. I feel my students could profit by having access to your publication. I would appreciate your sending a copy to the Bob Jones University Library Periodical Room.

I would appreciate your attention to this matter.

Bill Greaves
Chief Engineer
Bob Jones University
WMUU, Greenville, S.C.

You're on the list, B.G. Thanks for your opinions.

Sirs:

I am a recent recipient of your magazine and have found it extremely valuable for staying informed concerning both engineering developments and changes in FCC rules and regulations. Your descriptions of the facilities of small and medium market stations are excellent. We are moving our studios and these articles certainly help point out the fine points in designing equipment for operators with little technical knowledge as well as giving the engi-

neer an idea of arrangement of facilities for maximum efficiency.

I find, though, many references to back issues of *BM/E* which neither I nor anyone else on the station staff has. Would it be possible for me to obtain back issues of *BM/E*? I currently have the January, March, July, October and November 1967 issues in my personal collection. If you could send me a price schedule on the missing 1967 issues and previous issues I would very much appreciate it. Thank you very much.

Mark Timpany
WCLO, Janesville, Wis.

The copies you need are on the way, M.T.

Sirs:

We noticed in the November 1 issue of *ETV Reporter* a mention of the article "Georgia's Secret In Becoming An ETV Leader," which appeared in your October 1967 issue, p. 34.

Would you be kind enough to send us a copy?

Thank you very much.

Emily N. Barry
Education/Engineering
WGBH-FM-TV
Boston, Mass.

On the way, E.B.

Sirs:

Would you please send me a sample copy of your publication, *BM/E Broadcast Management/Engineering*. My company is extremely active on television and radio programming and merchandising work and our constant contact and liaison with TV and radio stations requires us to keep well up with all aspects of management in this field. Your own publication touches on many of these vital areas and it is for this reason that I would be interested in seeing one of your most recent issues and being able to arrange to receive your publication regularly.

R.A. Becker
North Sydney
Australia

On the way, R.B.

Sirs:

May we request your good office for the complete address of the following:

1. National Association of Broadcasters (USA).
2. International Broadcasters Society.

Your anticipated assistance in most appreciated.

Best personal regards, and season's greetings.

J. de Castro
Radio-TV Federation
of the Philippines
Manila

Thanks for writing, J.C. NAB is located at 1812 K Street Northwest, Washington, D.C. 20006; IBS, Zwallowaan, Bussum (NH), The Netherlands.

LITERATURE of INTEREST

For additional data, circle No. shown on Reader Service Card.

Fixed station antenna (omnidirectional), for operation on 25- to 76-MHz communications bands, is topic of Bulletin 8569 from Andrew Corp. **150**

Fm monitors for monophonic-, stereo-modulation, or frequency monitoring are covered in brochure from Gates Radio. **151**

Large screen TV projection systems is topic of illustrated brochure from Amphicon. **152**

Hf antenna systems available from Keltec Industries are covered in 42-page illustrated catalog. **153**

Fast ramp signal generator is presented in illustrated data sheet from Signalite. **154**

The "Experimenter" for Nov.-Dec. 1967 from General Radio contains articles entitled "A Programmable 20-MHz Counter-Timer Using Integrated Circuits" and "New UHF Bridge with Precision Connectors." **155**

Lenses for 16mm or CCTV cameras are presented with prices and specifications in illustrated brochure from Birns & Sawyer Cine Equipment. **156**

"Remote Voltage Programming of Precision Dc Power Supplies, Part I" is the title of an article in technical bulletin from Trygon. **157**

Public address amplifiers made by Bogen are presented in illustrated Brochure No. 326A. **158**

Chronometer with 1/5-s/day accuracy, operating on 2 flashlight cells is presented in illustrated brochure from Seiko Time Corp. **159**

Taper technique for electrical equipment interconnection is described in 48-page Catalog No. 162 from AMP. **160**

High-density switch/relay catalog (24 pages) from Electronic Controls, includes descriptions of switches and relays capable of switching from 4 to 44 circuits simultaneously. **161**

Learning laboratory system (Model EDC-101), made by RCA Instructional Electronics, is presented in 12-page illustrated brochure. **162**

Proceedings of Public Technical Sem-

inar sponsored by the National Academy of Television Arts and Sciences appear in the Winter Issue of *Television Quarterly*. **163**

Antennas for business and citizens band are presented in Catalog CB-68 from Cush Craft. **164**

Standard test pattern for CCTV is described in "Monograph Number 1" from Video Concepts Corp. **165**

"Industrial Catalog Supplement No. 681" from Allied Electronics presents late product information on semiconductors and integrated circuits. **166**

Voltmeter/amplifier with frequency range of 2 Hz to 200 kHz is described and illustrated in 6-page brochure from B&K Instruments. **167**

"Electromagnetic Compatibility Bulletin No. 6" from EIA discusses grounding of electronic equipment. Bulletin is priced at \$.70; minimum order, \$1.00. **168**

Silicon transistors—more than 350 types—are presented with tabulated specifications in 65-page catalog from Raytheon Semiconductor. **169**

Microwave radio, multiplex, data transmission and related equipment are described in 32-page catalog from Lenkurt Electric. **170**

"Deejays' and Teen Radio" is a reprint from October 1967 issue of *America*, describing the good influence disc jockeys have on teenagers. Reprint is available for \$.35 from WQAM Radio. **171**

Acoustic tile application techniques are described in 12-page illustrated bulletin from Pittsburgh Corning. **172**

Audio mixer (AM4A) using "building block" concept of construction is described in illustrated brochure from Langevin. **173**

CATV cable names, descriptions and applications of 125 cable constructions are presented in "CATV Cable Guide"—a \$1.00, 53-page catalog from Ameco. **174**

Profit package from Ameco contains issue No. 35 of "Tech Topics" and "Business Booster." Articles included are "Above Ground vs Flush Closures for Buried Cable" and "Newspaper Ad Readership." **175**

"Understanding and using Your Oscilloscope" is a 128-page, indexed paperback available from Allied Radio for \$.75. **176**

CCTV camera control unit (Model TMV-707) is described and illustrated in data sheet from TeleMation. **177**

Headphones made by AKG are illustrated and described in foldout pamphlet from North American Philips. **178**

Wire forming tool that cuts or bends wire up to 5/32 in. dia is described in data sheet from Vinkemulder Mfg. Co. **179**

Institutional clocks are presented in brochure from Peter Pepper Products. Brochure illustrates and describes 3 basic models (ac or battery) and 8 clock faces. **180**



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Columbia College Student desires full or part-time work on radio station within reasonable commutable distance of Chicago. Draft exempt. School schedule is workable. Experienced and has third class endorsed. Also graduate of Midwestern Broadcasting School. All around ability in field. Excellent sportscaster. Tapes and resume available. Contact Greg Sherlock, Suite 2105 166 E. Superior, Chicago, Illinois 60611.

Sales oriented-general manager. Columbia University graduate—14 years broadcasting experience—9½ years managerial experience and 4 years general manager of UHF TV indie operations. I have excellent in depth experience in all areas of television operations. Highly interested in relocating with an aggressive-sales oriented TV station, only in major markets. Box 368-2, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Notice . . . major markets . . . this market of 600,000 most successful and sought after personality is looking. I am one of the nation's best air salesmen. My resume will back that up. Ratings, references, family, five years with last station. I believe being a pro is more than a 40 hour week. Box 368-3, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Commercial program manager or related position sought by ETV Program Manager in financially limited advancement situation. Commercial experience in major market, proven organizer, hard working administrator with follow-through, network producer. Prefer West. Box 368-4, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Chief or assistant—1st phone—VHF transmitter, studio, CCTV—Maintenance and supervision experience—Also AM and FM—early 30's—family—No big rush, can wait for right opening. Commercial, ETV or what have you, East only. Box 368-5, c/o BM/E, Blue Ridge Summit, Pa. 17214.

POSITIONS WANTED (cont'd.)

Pro with excellent references and track record seeking general manager position medium to small market. All phases. Sales . . . programming . . . administrator AM & FM markets. Prefer Midwest. Interview at my expense. Box 368-6, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Experienced in all facets of broadcasting (off and on air) including programming, research, writing, advertising, production, direction and administration . . . Seeking relocation with vigorous creative station. Box 368-7, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Experienced announcer—Negro. Authoritative newscaster, bright swinging sound looking for spot as DJ, announcer. Willing to settle. Very reliable and responsible. Box 368-8, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Like some professional dedication? 17 years television. On-air news director, writing, shooting, editing film. Sales liaison and PR. Rockies or western. News VTR, resume. Box 368-9, c/o BM/E, Blue Ridge Summit, Pa. 17214.

News photographer—Approximately two years experience in photography and editing in top seventeen market of country. Age twenty-four. Married. Box 368-10, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Negro announcer, authoritative newscaster, family man, tight board, non-floater, non prima donna. Graduate of New York broadcasting school. Have third class ticket. Box 368-24 c/o BM/E, Blue Ridge Summit, Pa. 17214.

Lively, young beginner—Will do tape show for any Rock or C&W station. Have good equipment and records. Write—Doug Hewitt, 11511 Gravelly Lake Dr., Tacoma, Wa., 98499.

Young experienced television announcer wants to settle southern coastal USA or islands. Weather, booth, sports, news. Box 368-11, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Authoritative newscaster DJ, announcer third class ticket, non-floater, family man. Jazz or popular music. Box 368-12, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Attention—N.Y.C., D.C., Phila. All pro newsmen. Major market background. Network delivery. Hot actualities. In studio-outside. Box 368-13, c/o BM/E, Blue Ridge Summit, Pa. 17214.

TV Production Executive—15 years with Network and Major Film Studio—Desires position with European company interested in producing for the American television market. Box 368-14, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Inexpensive recorded announcer. Send copy. Free audition. Radio Recording Productions, Box 13, Edgemont, Pa. 19028.

Network voice, college. Ten years all phases. Wants TV or Radio News. Box 368-15, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Soul jock—3rd endorsed, tight board. Draft exempted. College training, relocate. Box 368-25, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Kovacs-type TV personality/writer. Brilliant. Funny. Reasonable. Box 368-26, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Negro DJ/announcer. Tight board. Middle of road or jazz format. 3rd phone. Will relocate. William McRae, 522 W. 136th St., N.Y.C.

HELP WANTED

GO SOUTH, YOUNG MAN! Advance rapidly with the most dynamic CATV operation in the Southeast. JCC's expanding Engineering Department now needs employees who can meet and maintain our high standards in engineering, construction, and maintenance. Urgently need Chief Technicians, Cable Technicians, Field Engineers, and Installers. Your experience and ability will determine your starting salary. All systems are "Go" with Cablevision. Rush complete resume or telephone: Jerry Burge, Director of Engineering, Jefferson-Carolina Corporation, P.O. Box 20348, Greensboro, North Carolina 27420. Telephone: 919/272-5625. Time is money! Airmail is faster! Act now!

HELP WANTED (cont'd.)

Looking for experience. Live color, color VTR, and color film with new modern equipment. WREX-TV, Rockford, Ill. has an opening for a first class engineer. TV experience desirable but not necessary. Contact Chief Engineer WREX-TV.

Opportunity to work in all phases of TV technical operation with color-VHF in beautiful Texas resort city. Box 368-31, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Established western manufacturer and distributor needs **SERVICE MANAGER**. Must be experienced in:
Broadcast Studio Equipment, Including VTR Color TV Equipment
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Limited travel. Excellent benefits. Salary dependent on qualifications. Send resume to Box 368-17, c/o BM/E, Blue Ridge Summit, Pa. 17214.

TECHNICAL DIRECTOR required by large MSO headquartered in New York City. Experience required in all phases of CATV engineering and operations. This is a fine advancement opportunity for a seasoned field engineer or system chief technician. Offer opened to anyone qualified. Send resume to Box 368-18, c/o BM/E, Blue Ridge Summit, Pa. 17214. All information held in strict confidence.

ENGINEERS—TV—Sunny California. Discover job security, and a new way of life in California. Have top openings for qualified Maintenance Engineers, especially Video Tape and Live Color Video. Send resume or letter to The AMPS Agency—3924 Wilshire Boulevard, Los Angeles, California 90005. 388-3116
By Broadcasters—for Broadcasters

Ass't chief engineer needed for aggressive UHF station in Nation's Capital area. Must know all types of equipment and be able to take over supervision of engineering department functions. Good salary and opportunity for future advancement. Send resume and references to Box 368-27, c/o BM/E, Blue Ridge Summit, Pa. 17214.

CATV MANAGER WANTED. Ohio town of 35,000. Construction starting now. You start in several months if you have right CATV experience or are excellent salesman who wants to grow with first of series of systems for fast growing broadcasting company. Reply to Box 368-20, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Immediate opening for experienced television engineer with first class license to work with instructional television station. Ability to assume full responsibility for all technical operation of station Dallas, Fort Worth area. Salary open. Send resume to Box 368-28, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Full color station needs engineer with experience and knowledge of RCA tape machine—RCA color camera—also need experienced microwave maintenance engineer first phone requirement—send details to J. W. Robertson, Vice President-Engineering, P.O. Box 1457, Lexington, Kentucky.

CATV CHIEF TECHNICIAN WANTED. Ohio town of 35,000. Construction starting now. CATV experience preferred, but good TV technician willing to be first CATV Chief with fast growing broadcasting company may qualify. Reply to Box 368-19, c/o BM/E, Blue Ridge Summit, Pa. 17214.

First Class men, all levels, for maintenance only. No mike work. If you have experience we will pay for it. If you need experience we will train you. Pleasant operation. East Coast. Box 368-21, c/o BM/E, Blue Ridge Summit, Pa. 17214.

IMMEDIATE OPENINGS — Qualify for any of the following positions: Technicians for RCA closed Circuit Television equipment — Camera men — Maintenance men — Video Tape Men — Video Engineers, RCA Rep. 143-08 94th Ave., Jamaica, New York, or (212) 297-4344.

Salesman wanted: Personable, self-starter who likes people, can become involved in community. Pleasant announcing voice helpful for brief board shifts, heavy selling. Air mail resume to: KSEW, Box 258, Sitka, Alaska 99835.

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Exclusive territory for sale of rapidly expanding line of broadcast equipment requires highly motivated, sales-minded individual with strong technical knowledge of equipment primarily to AM, FM, and TV stations. Leading company with history of high profit and rapid growth.

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WANTED—First Phone licensed engineer to work in South. Must have four to five years experience in TV broadcasting as studio maintenance engineer. Send resume with salary requirements to Box 368-29, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Immediate openings for qualified technicians in all color station. Experience desirable. 1st Class license required. Contact R. L. Renaud, Chief Engineer, WWJ-TV, 622 Lafayette Blvd., Detroit 48231. Phone (313) 222-2182.

Combo man wanted. Accent on announcing, but some basic technical knowledge desirable. Atlantic coast area. Box 368-22, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Announcer wanted, small station with MOR format, local orientation, good equipment, wants self-starter who enjoys being creative. Airmail resume to: KSEW, Box 258, Sitka, Alaska 99835

Top maintenance engineer, installation experience necessary. UHF group has one operating, more building. Box 368-23, c/o BM/E, Blue Ridge Summit, Pa. 17214.

WANTED—Experienced CATV technician to work in South. Send resume with salary requirements to Box 368-30, c/o BM/E, Blue Ridge Summit, Pa. 17214.

Massachusetts 1 kw station has opening for chief engineer. No announcing. Take full charge of technical operations. Contact manager, WALE, Fall River, Mass. 1-617-674-3535.

Large New England radio and television operation has openings for qualified engineers with first class license. Box 368-32, c/o BM/E, Blue Ridge Summit, Pa. 17214.

First class engineer for transmitter, possibly some CATV work. KVG B Radio, Great Bend, Kansas. (316) 452-4317.

SALES REPS WANTED

Sales representatives wanted for CATV products, log periodic antennas, components. John Thomas, Lindsay Electronics, Lindsay, Ontario, Canada. Phone: 705/324-2196.

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AMPEX authorized Sales and Service. New and used equipment for sale. 48 hour service on most repair including head rebuilding. Other professional equipment also available. **ACCURATE SOUND COMPANY**, 15 N. Tyler, San Angelo, Texas AC 915 949-1904.

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Coils, Contactors, Switches, complete ATU systems. Free design if you build your own ATU's. Top quality, lowest prices, fast delivery. No duty. Write for catalogue: Geleco Electronics Ltd., 2 Thorncliffe Pk. Dr., Toronto 17, Ont. 416-421-5631.

Spotmaster portapak 1 cart players (10 of them), with batteries—\$60.00 each. Sell new at \$175. Fully guaranteed. Chicagoland Broadcasters, Inc., 2540 W. Peterson Avenue, Chicago 60645, 312-761-1800.

Ampex 300, 350, 352, 400, 450 users, for greater S/N ratio, replace first playback stage 12SJ7 with our plug-in transistor preamp. For specifications write VIF INTERNATIONAL, PO Box 1555, Mtn. View, Ca. 94040.

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EQUIPMENT, Audio, Broadcast, Video, Bought-Sold-Traded through our national listing. Contact: The Maze Corporation, Box 6636, Birmingham, Alabama 35210.

Ampex 354P, Ampex 300C, Neumann U-47, Presto 6N, Ampex 350 electronics, Ampex 2010 spk/amps. Box 15058, Phoenix, Arizona.

Video tape recorders, slightly used helical scan all makes—Contact "King" 201-687-8810, Box 278, Union, New Jersey 07083.

EQUIPMENT FOR SALE (cont'd)

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GOVERNMENT Surplus Electronic catalog — 25¢. Meshna, Nahant, Mass. 01908.

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SIGNS, NAMEPLATES, LABELS, Decals, Badges, Trophies, Plaques. Seton Corp., Dept. BM/E, New Haven, Conn. 06505.

Professional Electronics Projects — \$1 up. Catalog 25¢. **PARKS**, Box 15265, Seattle, Wash. 98115.

Japanese electronics catalog, \$1.00. Dec. 10639A Riverside Drive, North Hollywood, California 91602.

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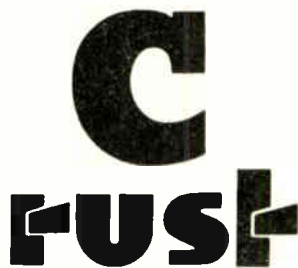
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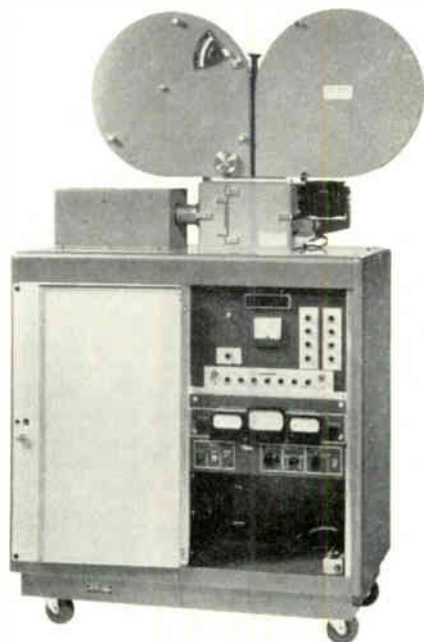
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FROM THE EDITOR

Splitting, Squeezing & Stretching the Spectrum

Land mobile radio users want more of the frequency spectrum; they'd like to get it from the uhf band now allocated to television. Channels 14 to 20 are most coveted since they would be an extension of the 450- to 470-MHz portion of the band that land mobile now uses. The top channels, 70 to 83, are being considered for reallocation but land mobile users are less interested in these channels since equipment isn't available.

That public safety officials, as part of the land mobile service group, need more spectrum is not denied. This is crucial to the war on crime. During the Detroit riots, delays of 15 minutes and a half hour occurred because the limited police channels were tied up.

NAB President Vincent T. Wasilewski has said, "If policemen and firemen must have additional spectrum space to function effectively, this is one thing. But, the need of every delivery truck driver to communicate with his home office seems less pressing."

Mr. Wasilewski asked for valid research to prove that land mobile currently is effectively using its allocations and the AMST and the NAB charges that the report by the Advisory Committee on Land Mobile (commissioned by the FCC) is unbalanced and contains erroneous information.

In rallying broadcasters to take up the battle of saving their space, NAB has arrayed before them as enemies AT&T, auto manufacturers, mobile radio manufacturers, the NAM, the U.S. Military establishments, and the President's Office of Telecommunications Management, among others. The NAB hopes to win some points with the President's Task Force Committee (which will study the feasibility of a wired system of communication) and has not yet declared this group an enemy. It is likely the House Small Business Subcommittee will recommend an encroachment on broadcasters.

We, too, have rallied to the clarion call of Mr. Wasilewski, the AMST, ACTS and *Broadcasting* magazine. We should remind the public of the value and contribution of this present system and not let it be "torn apart" or "destroyed."

In the process of thinking about the problems, we pulled out a spectrum chart. To our surprise, it took us quite a while to spot any portion allocated to industrial use. Public safety allocations are miniscule. The 32nd Annual Report of the FCC declares that of the 25- to 890-MHz band (the only frequencies suitable for mobile communications) 60 percent is allocated to TV and fm broadcasting, 34 percent for government and government-shared use, and 6 to 7 percent divided among aviation, maritime, amateur, citizens and the land mobile services. Only 4.7 percent is apportioned to the mobile services. Into this limited space, the FCC reports "are packed over 2¼ million transmitters, with applications for new ones pouring in at the rate of 15,000 per month."

The majority of these applications are for major metropolitan areas. The ACLM has proposed channel splitting within the current land mobile spectrum and channel sharing on a compatible geographic basis within the TV spectrum. This sharing would take place on unused channels. Should the tests under way prove this feasible, this would appear to be a creative solution and not disruptive to existing service.

In our desire to preserve the status quo, we should guard against the same bias of which we claim ACLM is guilty.

James A. Lippke

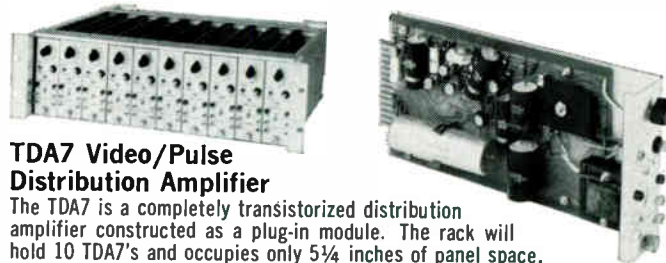


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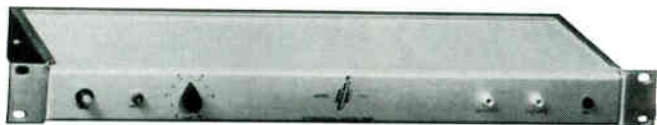


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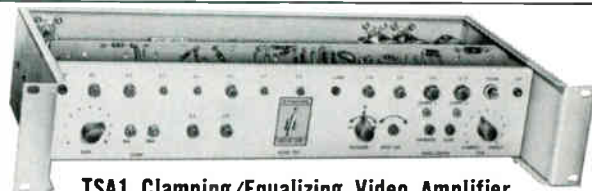


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