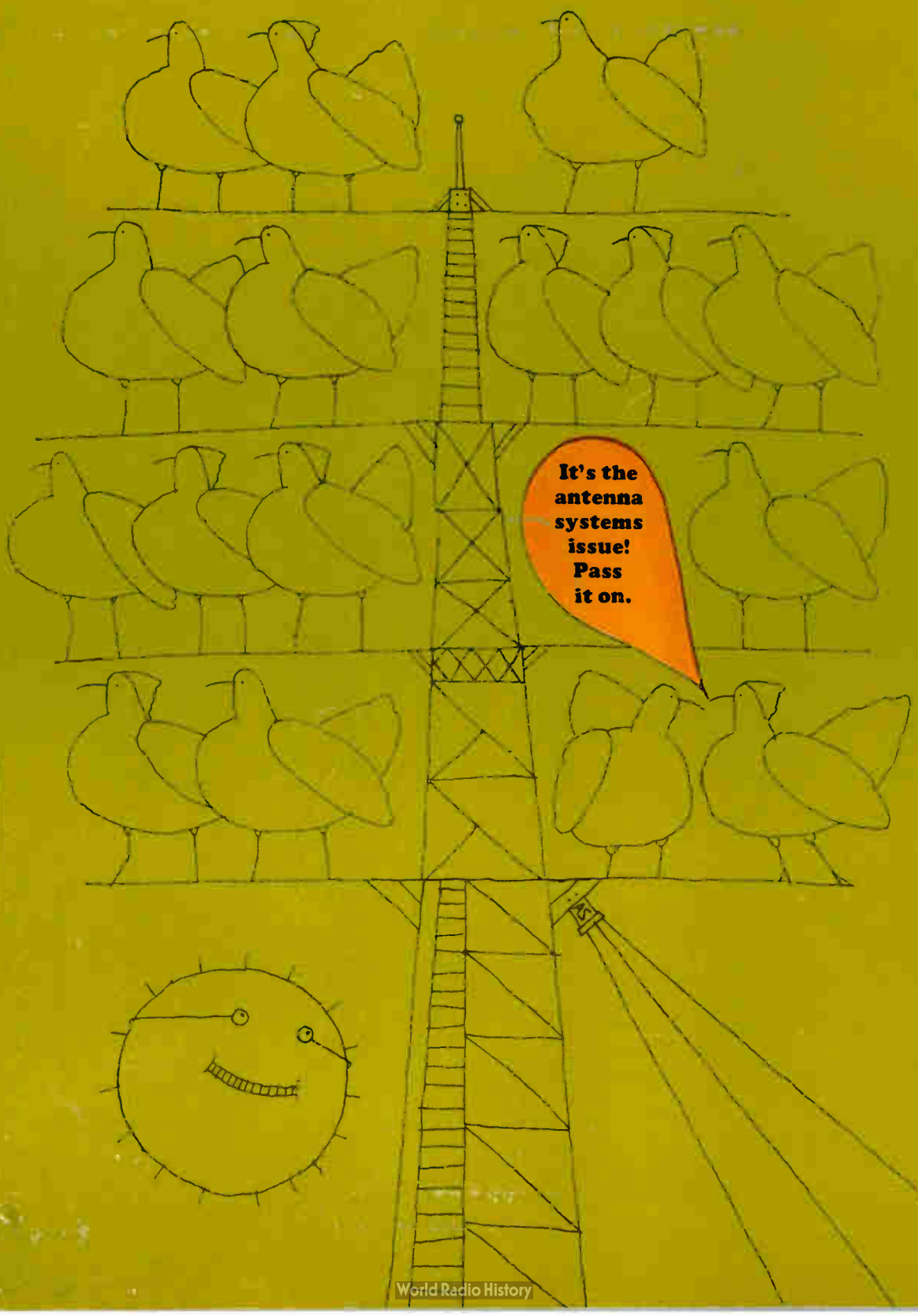
A MACTIER PUBLICATION / JANUARY 1967

BM/E

THE MAGAZINE OF BROADCAST MANAGEMENT/ENGINEERING



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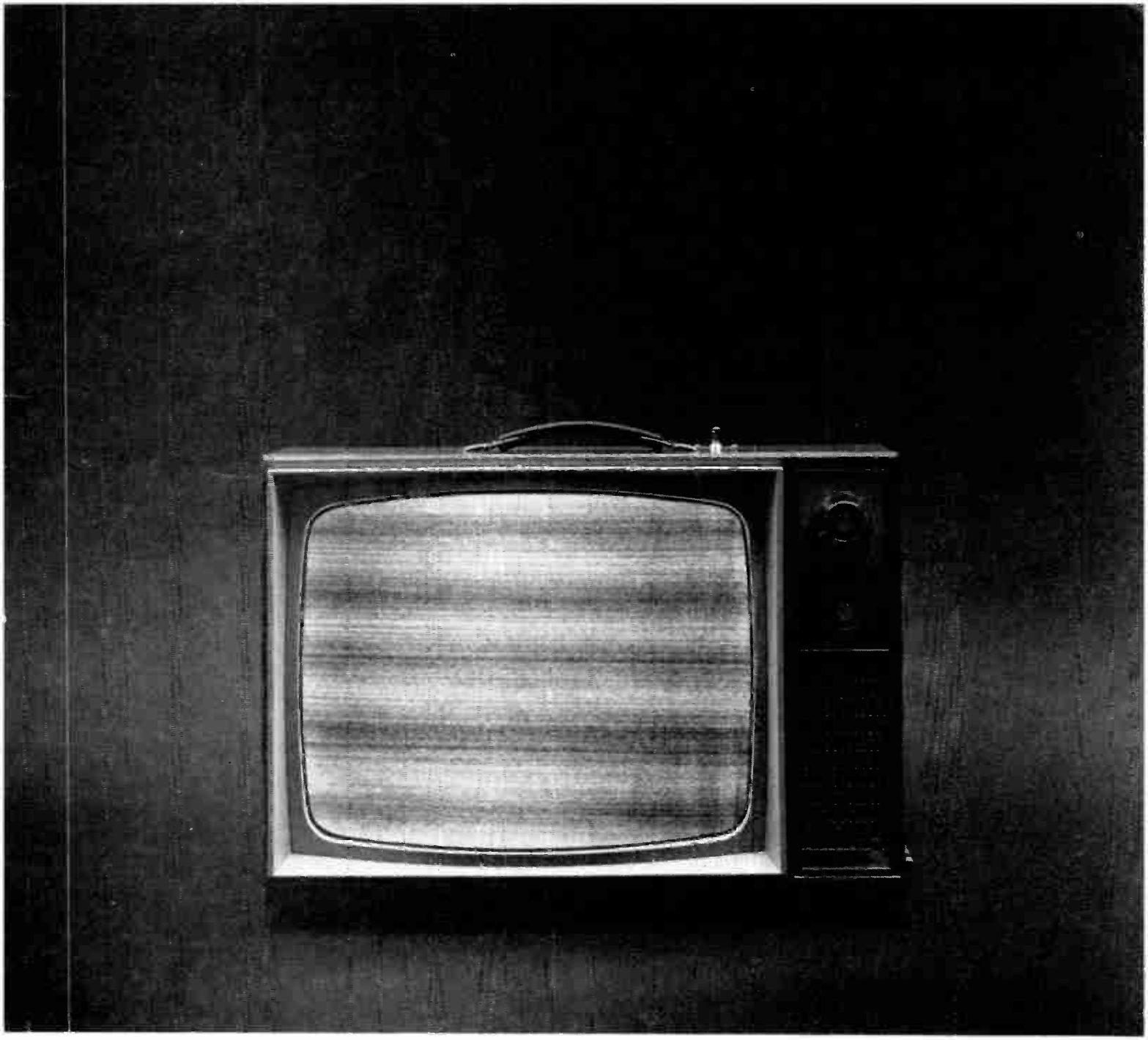

This kind of programming costs you money

You're in business for one reason: to make a profit.

Anything that takes away from your profit-making is your enemy. That's why you're way ahead when you choose Lenkurt microwave transmission equipment for your CATV or ETV system.

For instance, there's our 76 TV microwave relay system that has become the standard of the industry, due to its outstanding performance, ease-of-maintenance, and economical operation. 76 TV is designed to handle monochrome or color transmission and lets you insert and drop programs with ease at intermediate locations.

There is also Lenkurt's 75A, the ideal backbone microwave relay system. Because of its non-demodulating heterodyne repeaters, 75A delivers clear, sharp monochrome and color TV pictures regardless of distance, terrain, or weather.

Lenkurt microwave systems have proved themselves in virtually every situation. From high on Freel Peak in Nevada where 76 TV brings in a sharp high-resolution picture (even when snow levels reach 20 feet), to an ETV closed-circuit system at the University of Kansas Medical Center. And our 75A has been transmitting high quality pictures for a number of CATV networks in New York and Pennsylvania.

And remember, when you buy Lenkurt equipment, you are buying more than hardware; you are purchasing Lenkurt's heritage and reputation for quality and continuity.

It all comes down to this: when you're thinking about microwave transmission equipment, for any application, think of Lenkurt. We'll show you how to improve your picture — both TV and profit. Write or call Lenkurt Electric Co., Inc., San Carlos, California. Other offices in Atlanta, Chicago, Dallas, and New York City.

LENKURT ELECTRIC

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS GT&E

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JANUARY 1967/VOLUME 3/NUMBER 1

BM/E

THE MAGAZINE OF
BROADCAST
MANAGEMENT/
ENGINEERING

"It's the antenna systems issue, pass it on." It's not for the birds, though; it's for station engineers. Artist Art Suddith advises the birds definitely will not affect the ERP and field strength of the fine articles inside.

Would you believe that *Hertz* is in the driver's seat? Would you believe that Hertz equals cycles-per-second? Would you believe that the FCC, Bureau of Standards, NAB, et al, are adopting the Hertzian line? Beginning with this issue, BM/E is switching to the Hertz standard (sorry 'bout that!). From here on we will use Hz for cycles-per-second, kHz for kilocycles, MHz for megacycles, and GHz for gigacycles. We don't like it, but feel we shouldn't continue to use terms no one understands anymore.

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Use these FREE postage paid cards to receive more data on new products and literature described in this issue.

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Timely reports on events, companies, and people.

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BROADCAST INDUSTRY NEWS

Radio Production Service

Stallion Arts Inc., Valley Stream, N.Y. (4 W. Mineola Ave.), has announced a new service to radio stations, contracting the production of local announcements and program formats for as little as $2500 per year. A staff of male and female voices has been assembled to handle orders within 12 hours of receipt of copy or fact sheets. The firm, headed by Gene Ladd, is now syndicating programs and services to about 65 stations, and also provides consulting and production services to several ad agencies.

Manpower Recruit Problem Topic At NAB Meet

Roy E. Morgan, president of the Association for Professional Broadcasting Education and exec. v.p. and general manager, WILK, Wilkes Barre, Pa., told radio and TV executives at the 3rd NAB Fall Conference in Denver that the industry faces a difficult job in recruiting personnel because of its increasing manpower needs and the fact that broadcasting "is not the glamour business it once was." He said the industry may need another 7,000 people by 1970 in addition to the more than 101,000 persons now working directly in broadcasting.

The personnel turnover rate also "places a burden on management," Mr. Morgan pointed out. In radio, it is estimated at 33% a year; in TV, it is 28%. Much of this is caused "by personnel moving from one station to another," but at the same time, he emphasized, "a growing number are moving out and into other employment areas." Mr. Morgan noted that the best and closest source of future broadcasters is the 5,269 students enrolled in broadcasting courses in 132 schools. "Even if we could get all of them, it is doubtful if we can fill our needs."

To attract more young people into the field, Mr. Morgan said broadcasters and educators need to work together to create industry advisory committees and in-service training programs, and to set up the systematic recruitment of better high school students to college broadcasting majors.

ITV Courses Offered

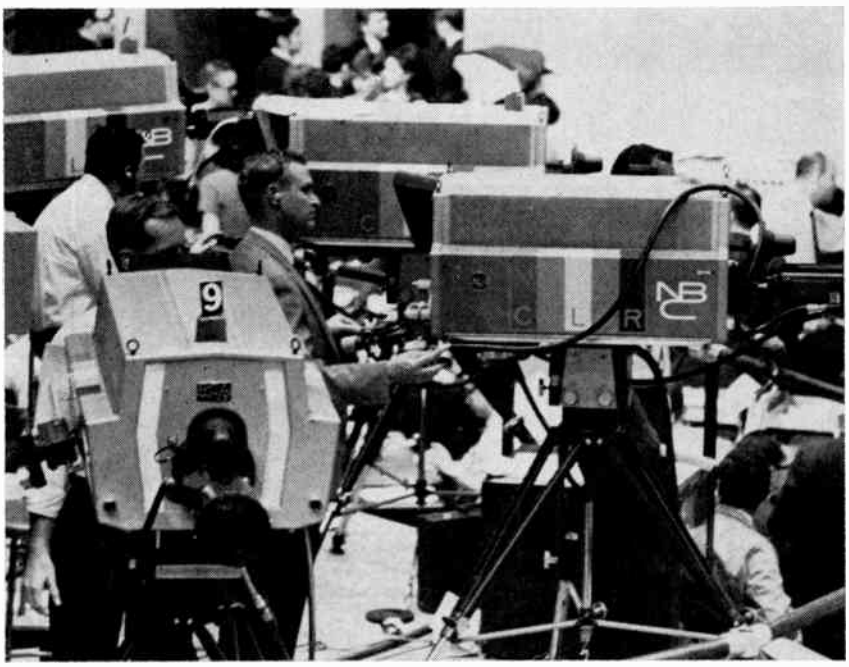
More than 80 recorded instructional television courses, available for lease by U.S. schools and educational institutions, are described in a catalog published by the Great Plains Instructional Television Library, U. of Nebraska, Lincoln. The 92-page publication contains summaries and outlines of video-taped courses offering varied instruction in many subject areas from elementary to collegiate level. A special college section includes 31 courses from Chicago's TV College; there is also a special section on the Library's collection of 98 historical Ford Foundation ITV kinescopes.

CATV System Rebuilds

A contract for reconstruction of CATV distribution facilities in Taft, Cal. has been awarded to Anaconda Astrodata Co. A 600-subscriber extension will be added to the 1800 subscriber system. Plans also include new service drops for existing customers. The system began operation in 1953.

AES Convention Set

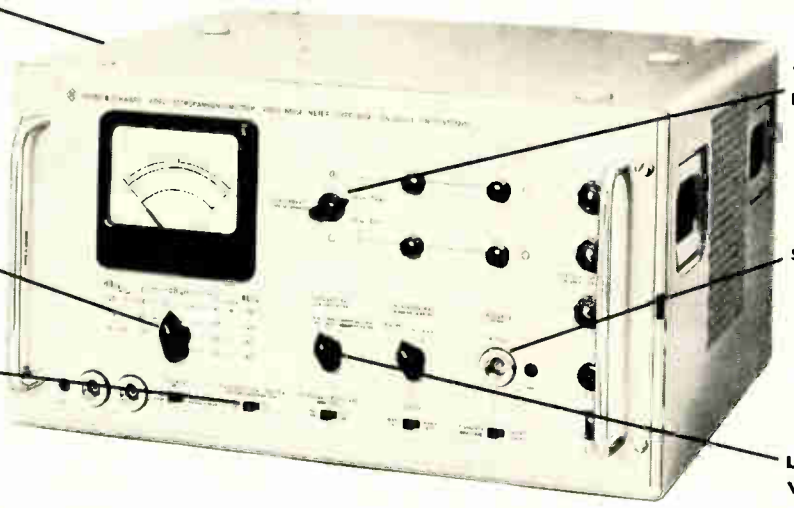
The 32nd National Convention of the Audio Engineering Society is scheduled for April 24-27 at the Hollywood Roosevelt Hotel. More than 35 exhibitors will showcase new products, and more than 50 specialized presentations will be delivered in seminar sessions.



An election night scene at NBC's Studio 8-H in New York. Five TK-43 cameras (only 4 visible) were used in the ballot report, the first time so many of the new RCA color cameras had been used in a single origination. Two will be installed in NBC's "instant news" studio in New York; the other three will be assigned to other studios.

NEW!

IMMEDIATE DELIVERY
FROM STOCK
$3,995



TYPE UPSF

VIDEO NOISE METER

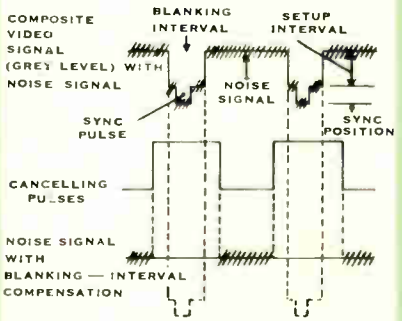
FEATURES

- Meets requirements of all U.S. black and white and NTS color systems
- Measures noise voltage in the presence of sync and blanking pulses
- 7 Measurement Ranges: 1/3/10/30/100/300/1000mV
- Input impedance: 1MΩ shunted by 30 pF, or 75Ω bridging

APPLICATIONS

MEASURE VIDEO NOISE VOLTAGE ON:

- TV Cameras
- Film Scanners
- Video Tape Recorders
- Radio Links
- Coaxial Lines
- TV Transmitters
- TV Receivers
- TV Transposers



Principle of noise-voltage measurement with H or V internal blanking

Type UPSF Video Noise Meter is designed to measure the unweighted and weighted noise voltages of TV transmission systems. It has the unique advantage of measuring low level components in the presence of high level horizontal or vertical sync and blanking pulses (see line drawing). The UPSF meets the requirements of all U.S.A. black and white and NTS color systems. A bandstop filter adjusted to the color subcarrier frequency (3.58MHz) prevents any residual color subcarrier in the test signal to be picked up. In addition to supplying true RMS value 0.3 mV to 0.3V (full scale deflection) it also can provide peak-to-peak value of 1 mVpp to 1Vpp (full scale deflection). The UPSF can also be used as a conventional broad band VTVM.

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Circle 7 on Reader Service Card

"News" Book

"The Newsroom and the Newscast," edited by Sheldon Peterson (Time-Life Broadcast), and containing 43 presentations from the 1966 Conferences, is available from the Radio Television News Directors Association. Price is $2.50. Get one!

CATVs Merge

Jackson TV Cable Co. and Cascade Television Co., both of Jackson, Mich., have merged their systems. Included in the newly merged operation are Knorr Broadcasting Co., licensee of WKNR Dearborn and WKHM Jackson, and Time-Life Broadcast, Inc.. licensee of WOOD-TV-AM-FM Grand Rapids. The new firm is known as Jackson TV Cable Co., and is using the cable network already installed by that firm. A contract between Cascade and Michigan Bell for a duplicate cable network in Jackson will be terminated.

CATV Seminars

A series of technical seminars and meetings, intended to acquaint CATV system operators and their technical staffs with advancements in equipment technology, are being offered by Craftsman Electronic Products, Inc. Meetings are scheduled in Manhattan (N.Y.C.), Independence, Kan.. Denver, Oklahoma City, and Oroville and Fairfax, Calif.

NAB Calls For Continued CATV Battle; Urges Industry to Challenge Advertising Criticism

Broadcasters must continue their fight for regulation of CATV because "not only is the battle far from over, but the outcome is still in doubt" said NAB President Vincent T. Wasilewski in a luncheon address sponsored jointly by NAB and the International Radio and Television Society at the Waldorf Astoria in New York. Mr. Wasilewski said that to relax now in the CATV battle would be "a serious strategic error." Although the FCC has established "fair and reasonable rules" governing CATV operation, he said it has granted waivers from those rules. In addition, the FCC staff talks of granting mass waivers. "If that view prevails," the NAB president said, "it is obvious that the rules, arrived at after long and exhaustive debate and based upon public interest considerations, will be seriously compromised."

Discussing recent criticisms of advertising at high government levels, Mr. Wasilewski said such remarks "go to the very heart of the role advertising plays in our economy." While one group charges that advertising confuses, deceives and is ineffective, he said, another says it is too powerful and effective. The latter group argues that it may be a major contributor to economic concentration and monopoly conditions and should be counteracted by forcing large companies to limit advertising expenditures to percentage levels set by government. "The shrillness of the criticism has been growing with the inflationary pressures in the economy," Mr. Wasilewski said, noting that "advertising seems to be emerging as a scapegoat, charged with being a principal contributor to higher prices."

NCTA Moves Up

Effective Mar. 1, NCTA headquarters will be moved to One Farragut Square, diagonally opposite present facilities in the Transportation Building at 17th and H Sts., Washington. NCTA has signed a lease for the entire 12th floor of the office building in order to accommodate the burgeoning growth of membership and services required to keep pace with the industry.

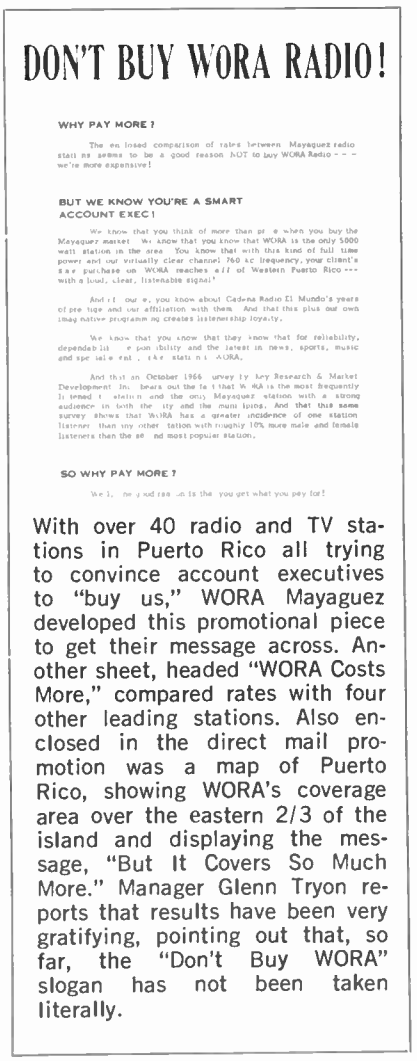
SMPTE Calls For Technical Conference Papers, Schedules Detroit Meeting

SMPTE has issued a call for papers for its 101st technical conference, scheduled at the N.Y. Hilton April 16-21. Session topics will include TV engineering and studio practices, TV and film in medicine and education, space technology, instrumentation and high-speed photography, laboratory practices and sound recording and reproduction. Author forms and information are available from the Society (9 E. 41st St., N.Y.C.). Forms and synopses of proposed presentations should be submitted by Jan. 16.

The Detroit, Chicago, Rochester and Toronto Sections, in cooperation with the U. of Michigan, will hold a joint 2-day conference on Color TV Broadcasting in Detroit, Jan. 27-28, Rackham Educational Memorial Building, Main Auditorium. Hotel reservations are being arranged at the Park Shelton.

EIA Publications Index

EIA's engineering dept. has updated its Index of EIA and JEDEC Standards and Engineering Publications to include over 300 technical documents. The 22-page index listing includes test charts for color chips, color registration, gray scale overlay and resolution linearity, linear reflectance, etc. Copies are available free upon request to EIA



DON'T BUY WORA RADIO!

WHY PAY MORE?

The enclosed comparison of rates between Mayaguez radio stations seems to be a good reason NOT to buy WORA Radio - - - we're more expensive!

BUT WE KNOW YOU'RE A SMART ACCOUNT EXEC!

We know that you think of more than price when you buy the Mayaguez market. We know that you know that WORA is the only 5000 watt station in the area. You know that with this kind of full time power and our virtually clear channel 740 kc frequency, your client's dollar purchase on WORA reaches all of Western Puerto Rico --- with a loud, clear, listenable signal.

And if our price, you know about Cadena Radio El Mundo's years of prestige and our affiliation with them. And that this plus our own imaginative programming creates listenership loyalty.

We know that you know that they know that for reliability, dependability, prestige and the latest in news, sports, music and special events, the station is WORA.

And that an October 1966 survey by Key Research & Market Development Inc. bears out the fact that WORA is the most frequently listened to station and the only Mayaguez station with a strong audience in both the city and the municipios. And that this same survey shows that WORA has a greater incidence of one station listener than any other station with roughly 10% more male and female listeners than the second most popular station.

SO WHY PAY MORE?

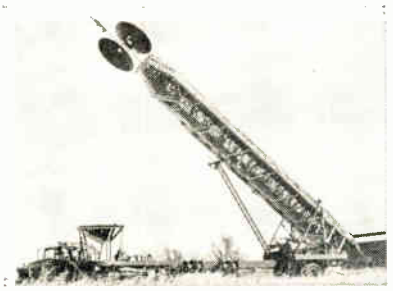
Well, the explanation is that you get what you pay for!

With over 40 radio and TV stations in Puerto Rico all trying to convince account executives to "buy us," WORA Mayaguez developed this promotional piece to get their message across. Another sheet, headed "WORA Costs More," compared rates with four other leading stations. Also enclosed in the direct mail promotion was a map of Puerto Rico, showing WORA's coverage area over the eastern 2/3 of the island and displaying the message, "But It Covers So Much More." Manager Glenn Tryon reports that results have been very gratifying, pointing out that, so far, the "Don't Buy WORA" slogan has not been taken literally.

ANDREWS QUICK-ERECT TOWERS

Another First

Trailer has its own power unit and is completely self-contained. It can carry transmission lines, reflectors, etc.



Trailer carries its own base plate. Earth type expansion anchors are used for guys. No concrete necessary. Reduces erection time to a minimum.

CHECK THESE OUTSTANDING FEATURES:

▪ Towers can be erected in the following times. 100′ — 1½ hours; 200′ — 2½ hours; 300′ — 3½ hours. ▪ Erected in sections for safety and efficiency. ▪ Sections are held permanently in place by special safety locks. ▪ Tower may be raised, locked into place, tensioned and lowered from ground level, no climbing necessary. ▪ Selected heights at 3′ intervals. ▪ Any wind load requirement up to 50 PSF (110 MPH).

Stacked sections are pulled upright by tower guy wire. Rising sections pull remaining guys into place. No extra equipment required. No scaling of tower necessary. All erecting is controlled from ground level. Easily erected by five man crew.

ANDREWS QUICK-ERECT TOWERS can be used for signal relay or camera platforms for sports events, etc. Also for microwave, radio and TV restoration.

90-DAY DELIVERY

Tower may be erected to any height for maximum performance. Complete unit is as permanent as any conventional tower.

CALL OR WRITE

ANDREWS TOWERS, INC.

1420 LAYTON AVENUE • FORT WORTH, TEXAS • 817 TE 1-1222

DESIGNER-MANUFACTURER OF SUPERIOR TOWERS

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Headquarters, 2001 Eye St., N.W., Washington, D.C. 20006.

CBS-TV Buys Color Cameras

CBS-TV has ordered 27 Mark VII color TV cameras from the Marconi Co. The order, which also includes color coding equipment, follows an earlier contract for 6 cameras which has been fulfilled.

Saudi Arabia Buys TV, M/wave Gear

Saudi Arabia's Ministry of Information is planning expansion of that country's TV service to include Mecca and the cities of Medina and Buraida. Included in a $1.5 million contract, awarded to RCA Great Britain, Ltd., is additional studio, transmission, and microwave equipment. Microwave equipment will interconnect Jeddah and Taif, and some transmitters are to be installed in Jeddah for training purposes; installation of all equipment is expected to be completed in 1967.

Kentucky ETV Network Formed

The FCC has granted 11 CPs for ETV station construction to the Kentucky State Board of Education—a record number issued at one time and to a single applicant. By September of this year, the Kentucky System expects to have stations operating in Ashland, Bowling Green, Covington, Elizabethtown, Hazard, Lexington, Madisonville, Morehead, Murray, Owenton, Pikeville, and Somerset. The Covington authorization had been granted previously. The Dept. of HEW has approved matching grants of $916,663 to assist Kentucky in the construction of these stations.

Tubeless TV Camera

A battery-powered, tubeless TV camera, said to be smaller than a man's hand, has been developed by RCA. Arrays of 132,000 thin-film elements deposited on four 1″ square glass slides are used for video pickup. Among the thin-film elements are some that respond to the presence of light and others that perform various circuit functions so that the networks take the place of conventional pickup tubes and processing circuits. A miniature transmitter, separate from the camera and employing conventional transistors, makes it possible to send pictures directly from the camera to a TV receiver. While present resolution, sensitivity and speed are inferior to a conventional camera, these limitations are expected to be eliminated by adopting new circuit ideas and by developing photoconductive arrays with as many as 10 times more light-sensing elements than those used in the experimental model, developed for the U.S. Air Force Avionics Lab, Dayton, O.

National CATV Week

National Cable TV Week will be observed Jan. 30 through Feb. 4th. NCTA President Fred Ford said the observance will be supported by concentrated publicity, advertising and promotion. Support will be enlisted not only from CATV systems but also from manufacturers and suppliers, TV

John Lannan (l), Science and Medical Editor of the Boston Herald Traveler, interviews Air Force Col. Louis C. Kossuth on "Your Health and Your Life," a radio program originated by the National Science Network. The series of 15-minute daily reports are phrased in nontechnical terminology, and this particular program emphasized the need for immediate and proper care of vehicle accident victims by showing basic lifesaving techniques using dummies and color photos.

set makers, and others allied with the growth of the industry.

ETV Gets $16 Million

The Ford Foundation has announced support for noncommercial TV to the tune of $16 million. $10 million is to be used to continue through 1968 a series of matching grants begun last year for community-supported ETV stations and $6 million goes to the National Educational Television and Radio Center for its informational, cultural, and educational program service to 112 noncommercial stations across the country.

Perfects Color Transfers

Acme Film and Videotape Labs, Hollywood and N.Y.C., has perfected a process of transferring color tape to produce broadcast quality color film. Called Acme-Chroma Color Film Transfers, the process is being marketed to networks, stations, ad agencies, educational institutions, etc.

Recording Studio/ Sound Research

Motion Picture Sound, Inc., Cleveland, has opened a commercial recording studio and sound research lab offering creative and technical services to film producers, advertising agencies, etc. The $100,000 facility includes a "Mellotron" sound effects machine capable of producing an infinite variety of taped effects; a 35mm Norelco Cinemascope projector; 16mm Bell & Howell projector, 4-track 35mm recording equipment; echo chamber; Hewlett Packard and Datamatic test equipment; and a "dialogue room" (a floating sound-proof unit floating within a sound-proof room).

Add Q-Tape Dispatchers

Several key market TV stations have purchased white-on-black Q-Tape Dispatchers which superimpose news bulletins, weather reports, sports scores and other information at the bottom of viewers' screens. Stations which recently purchased the unit include WJXT-TV Jacksonville, Fla., KCRL-TV Reno, Nev., KIII-TV Corpus Christi, Tex., KATV-TV Little Rock, Ark., WSB-TV Atlanta, Ga., and WCYB-TV Bluefield, W. Va. The system is manufactured by Q-Tv, Inc., N.Y.C.

INTERPRETING THE FCC RULES & REGULATIONS

Fines And Forfeitures-Up 600% Since 1964

All licensees should be aware of the pertinent portions of the Rules concerning their liability for fines and forfeitures. As adopted on February 2, 1961, Section 10.503(b) (1) (E) reads as follows:

". . . shall forfeit to the United States a sum not to exceed $1,000. Each day during which such violations occur shall constitute a separate offense. Such forfeitures shall be in addition to any other penalty provided by this act."

". . . (3) No forfeiture liability under paragraph (1) of this subsection (b) shall attach for any violation *occurring more than one year prior to the date of issuance of the notice of apparent liability* and in no event shall the forfeiture imposed for the acts or ommissions set forth in any notice of apparent liability exceed $10,000." (Emphasis supplied.)

In other words, the Commission is impowered to impose a *maximum fine of $1,000 per day for each violation!* However, *the total amount of fines assessed*, no matter how numerous, *cannot exceed $10,000.* (Of course, the Commission's power does not end here; it still retains its long-standing authority to designate a license for hearing.)

The Preview Issue (Dec. 1964) contained an article entitled, "FCC Fines Are Beginning to Pinch." Set forth therein was the prediction: "It is clear that the use of forfeitures and fines, as the Commission's primary lever against violators, will become more prevalent and painful in the years to come. Many broadcasters have already felt the poignant sting of this four-year-old Commission tool, but many more remain vulnerable targets by ignoring or overlooking the Commission's policing."

Increase Of Forfeiture Proceedings

An analysis of the number of forfeiture proceedings instituted during the fiscal years 1964, 1965, and 1966, as reported in the Commission's Annual Reports, discloses that there has been an upsurge in the incidents of fines levied on licensees. In 1964, notices of apparent liability were issued to 13 stations. Examples of the most salient consisted of: (1) $2,500 for unauthorized assignments and transfers; (2) $500 for violation of operating log requirements; (3) $250 for failure to make sponsorship identification of paid-for advertising; (4) $1,000 for failure to file time broker contract; and (5) $250 for failure to give sponsorship identification of teaser announcements. During the same year, *forfeitures* were ordered for 15 stations which had responded to previous notices of apparent liability, including: (1) $1,000 for failure to identify sponsorship; (2) $1,000 for equipment and other rule violations; (3) $3,500 for violation of operator requirement rule; (4) $500 for violation of logging requirements rules; and (5) $500 for violation of operating hours.

During fiscal year 1965, Notices of Apparent Liability were issued to 38 stations (compared to 13 such notices in fiscal 1964). The great majority involved AM stations. Of the 1965 total, 19 paid the amounts set forth in the notice, five responded and were permitted to pay lesser amounts, and one was later relieved of liability.

The amount of the forfeitures varied with the number and seriousness of the violations. The largest order during 1965 was $8,000 for lack of control over program content. Other fines assessed over $1,000 included: (1) $5,000 for violation of logging and sponsorship identification rules; (2) $1,000 for violation of first-class operator rule; (3) $4,000 for failure to originate the majority of its programs from its main studio; and (4) $1,500 for failure to reduce power at night as required by its license and operation without a licensed operator on duty.

Other violations leading to forfeitures included numerous instances of failure to employ first-class operators to the extent required by the rules ($500—$1,000) and other violations of the operator rule; several unauthorized assignments of license or transfers of control ($500—$1,000); operating nondirectionally at night and by remote control without authority ($1,000); operating changes of facilities without prior program test authority ($100); failure to keep maintenance logs ($500); broadcasting advertisements involving a lottery ($350); rebroadcast without the originating station's consent ($100); failure to maintain modulation within tolerance ($250 or $500); failure to make required filing of time-brokerage contracts ($500); and failure to make a required sponsorship announcement in connection with a political broadcast ($1,000). A total of $34,150 in forfeitures was paid by stations during this fiscal year.

1966—A Banner Year For Fines

Fiscal year 1966 was marked by considerably greater use of the forfeiture penalty than at any

previous time since the Congress gave the Commission this authority in 1960. A total of 78 notices of apparent liability—up from 38 in 1965 and 13 in 1964—were issued during the fiscal period, representing apparent *fines of $83,125.*

Thirty-one final forfeiture orders were issued for amounts totaling $39,050. Twenty licensees elected to pay forfeitures totaling $8,875 without waiting for issuance of a final order. (As the reader may know, all forfeitures are payable to the U.S. Treasury, not to the FCC.)

Among the most common violations leading to issuance of liability notices were operation without a properly licensed operator, violation of logging requirements, failure to broadcast identification of the sponsors of sponsored programs or announcements, failure to file ownership or financial reports, broadcast of lottery information, excessive deviation from assigned frequency, failure to give proper station identification, unauthorized transfer of control, failure to maintain tower lights, broadcast with excessive power, and rebroadcast of programs of another station without obtaining authority of the originating station.

The 1960 Fine Amendment Reviewed

The 1960 Amendment to the Communications Act (P.L. 86-752, approved 9-13-60) permits the Commission to assess fines upon licensees for "willful and repeated" violations of the Commissions' Rules or of the Act. *Nearly all violations are assummed to be "willful."* Why? All licensees, and their staff and agents, are expected to know the rules; ignorance is no excuse. *"Repeated" has been held to be any violation occurring more than once.* Thus, the statutory mandate that fines be "willful and repeated" offers little or no solace for licensees.

Factors Determining the Size of the Fine

How does the Commission determine the size of the fine? Three of the most important criteria are: (1) the importance of the station in its market; (2) the financial condition of the station; and (3) the past broadcast record of the licensee, including the number of prior offenses.

Forfeitures Levied on Late Filed Renewals

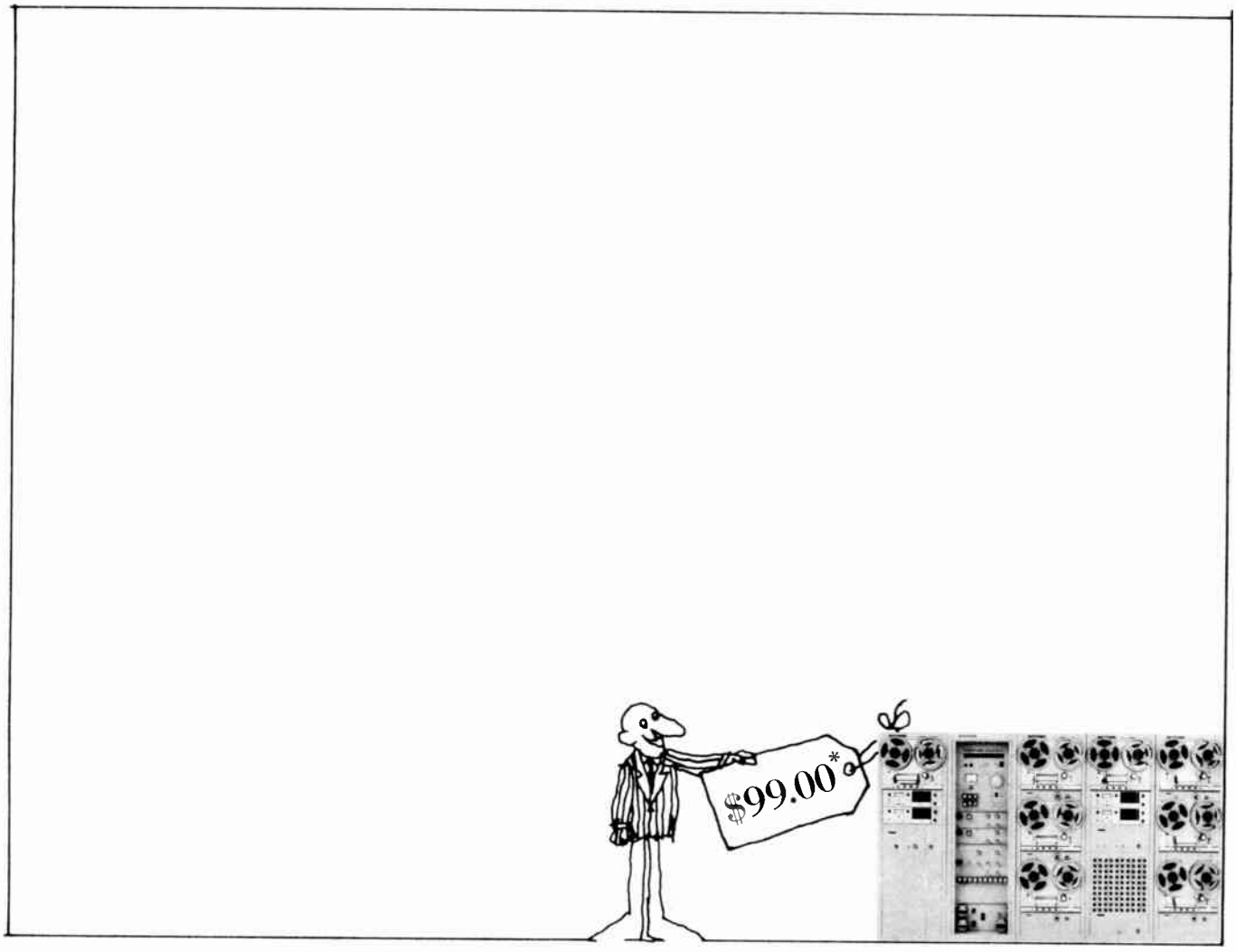
On December, 2, 1965, the Commission announced that, beginning with the license renewal applications due to be filed by March 1, 1966, the Broadcast Bureau would bring to its attention all instances in which broadcast licensees fail to make *timely filing of their license renewal applications* in accordance with the Commission's Rules.

Except in cases where delay is found to be justified, the Commission levies forfeitures for late filing.

Thereafter, the Commission developed a more comprehensive and precise policy with respect to late renewal applications. On March 15, 1966, a Commission Release notified all licensees as follows:

"Licensees are put on notice that it is the experience of the Commission that receipt by

lease?



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the Commission of renewal applications at sometime less than 90 days prior to expiration of the station license *does not provide adequate time* for a complete review of such applications and frequently results in *deferral of action* and the consequent delay in issuance of a renewal until sometime *after expiration of the current license.* Additionally, Section 309 (b) of the Communications Act provides that the Commission *may not grant any* renewal application until at least 30 days have elapsed after issuance of a public notice by the Commission that such application has been accepted for filing." (Emphasis supplied.)

Subsequently, on June 24, 1966, *the Commission issued a forfeiture schedule for those licensees filing late renewal application,* as follows:

(1) $25 for the first through the 15th day,

(2) $100 from the 16th through the 60th day, and

(3) $200 from the 61st through the 90th day.

Commission Delegates Authority to Issue Fines

In 1966, the Commission effected an amendment (x) to Section 0.281 of the Commission's Rules. *This subparagraph delegated authority to the Chief of the Broadcast Bureau as follows*:

"to issue Notices of Apparent Liability in amounts not in excess of $250 under Section 503 (b) of the Communications Act, . . . "

Thus, fines not exceeding $250 may be issued by the Commission staff without Commission approval.

Prior to this delegation of authority, each fine was reviewed by the Commissioners. They considered the merits and amount of the fine. The Commission was proceeding cautiously in this area. When the 1960 Fine Amendment was adopted, there was a dormant anxiety that the authority to fine, if placed in the hands of the Commission's staff, might be abused. This concern was rekindled in 1966, when the Commission gave the Broadcast Bureau authority to levy fines of $250 or less without seeking approval of the Commissioners.

Despite the problems inherent in the delegated authority to fine, the Commission has found its workload too great to accord individual attention by the Commissioners to each fine. The number of violations and violators make such treatment implausible. In actual practice, the decision has worked out reasonably well.

To Avoid Fines By Delegated Authority and Delay Payment

It must be noted, however, that the licensee has not lost access to decision by the Commissioners. For example, if a licensee receives a notice of apparent liability of $100 for a certain violation, he can delay his response for a few weeks and file a letter barely within the 30-day limit, explaining the surrounding circumstances and requesting that the liability either

Collins could sell FM transmitters for 20% less

BUT then they wouldn't be the best in the world

All Collins transmitters could be sold for less.

- Corners could be cut on transformers (narrowing safety margins for continuous operation).
- Less shielding could be used against spurious radiation (sacrificing some degree of stability).
- Standards on components, wiring, cabling and switches could be lowered.
- Collins' rigid testing could be bypassed.
- Meeting proper load conditions could be left to luck.
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- Collins' 2-year warranty could be cut to the 1-year period of other manufacturers.

All these compromises could lower the price—as well as the *quality*, *performance* and *reliability* of the product—about 20%. But then Collins transmitters wouldn't be known for their careful engineering, conservatively-rated components, and precision manufacturing techniques.

Collins gives the broadcaster a discount in the form of quality and service. And that's worth a lot more than 20%.

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be waived or reduced substantially. When such a response is received by the staff, they *forward it for consideration by the Commissioners.* Because the Commission is understaffed, and therefore literally deluged with work, it will take a few weeks before they reply.

At that point, approximately 45 days has lapsed since the issue of the forfeiture notice. Assuming the Commission's action upon your letter-request is unfavorable (either a denial or inadequate reduction in the amount of the fine), you may file *a request for reconsideration.* You have an additional 30 days (from receipt of the Commission's action on your initial request) to do this. By utilizing this second 30-day period, you have legally postponed payment approximately 75 days.

By the time the Commission acts upon your *request for reconsideration,* approximately 90 days will have elapsed. At that point, you have an additional 30 days to make payment. Therefore, when you finally make payment, approximately 120 days will have elapsed.

While the advantages of (1) obtaining a ruling by the Commissioners (as opposed to the staff), and (2) delaying payment for four or more months appear obvious, *there are disadvantages. First,* it is time-consuming, troublesome, and if your lawyer assists, costly. *Second,* it focuses staff attention upon you and your violation; as a "contested" fine, more records will be made and kept on the case; and adverse publicity, in the trade press, may result. *Third,* in the vast majority of cases, you will not induce the Commission to overrule the staff's recommendation. Your initial request and your subsequent plea for reconsideration, in most cases, merely postpones the inevitable.

Courts Reverse FCC Forfeiture Rulings

On the other hand, if your have the funds and proclivity to "wage war" with the Commission over a fine, you may take the case to court. You are entitled to a trial *de novo* (based on the original merits of the case) in the Federal District Court where your station is located.

In two recent cases, decided in January and April 1966, (*United States* v. *Hubbard Broadcasting, Inc.*, 6 RR 2nd 2069 and *United States* v. *WHAS, Inc.*, 7 RR 2d 2055) the licensees were victorious. The fines were set aside because the Court did not agree that the violations were "willful and repeated." Encouraging as the precedents are, few licensees are willing to incur the legal and other expenses necessary to take a fine case that far.

In most cases, the *disadvantages* of requesting a reduction or cancellation of a fine outweigh the advantages. However, there are cases wherein the licensee's reasons may well result in favorable action on such a request.

Arnold Toynbee once observed, "You can't adjust life to law; you must adjust law to life." While his wisdom may serve to admonish federal lawmakers (and rulemakers) to proceed with caution, it is of small solace to the broadcast licensee. In fact, quite the contrary appears applicable; in this instance, the licensee is well advised to adjust his life to the law and the ever-changing Commission Rules. ●

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Directional TV Patterns With Disc-Rod Antennas

A space communication type antenna finds TV broadcast application

by R. D. Bogner

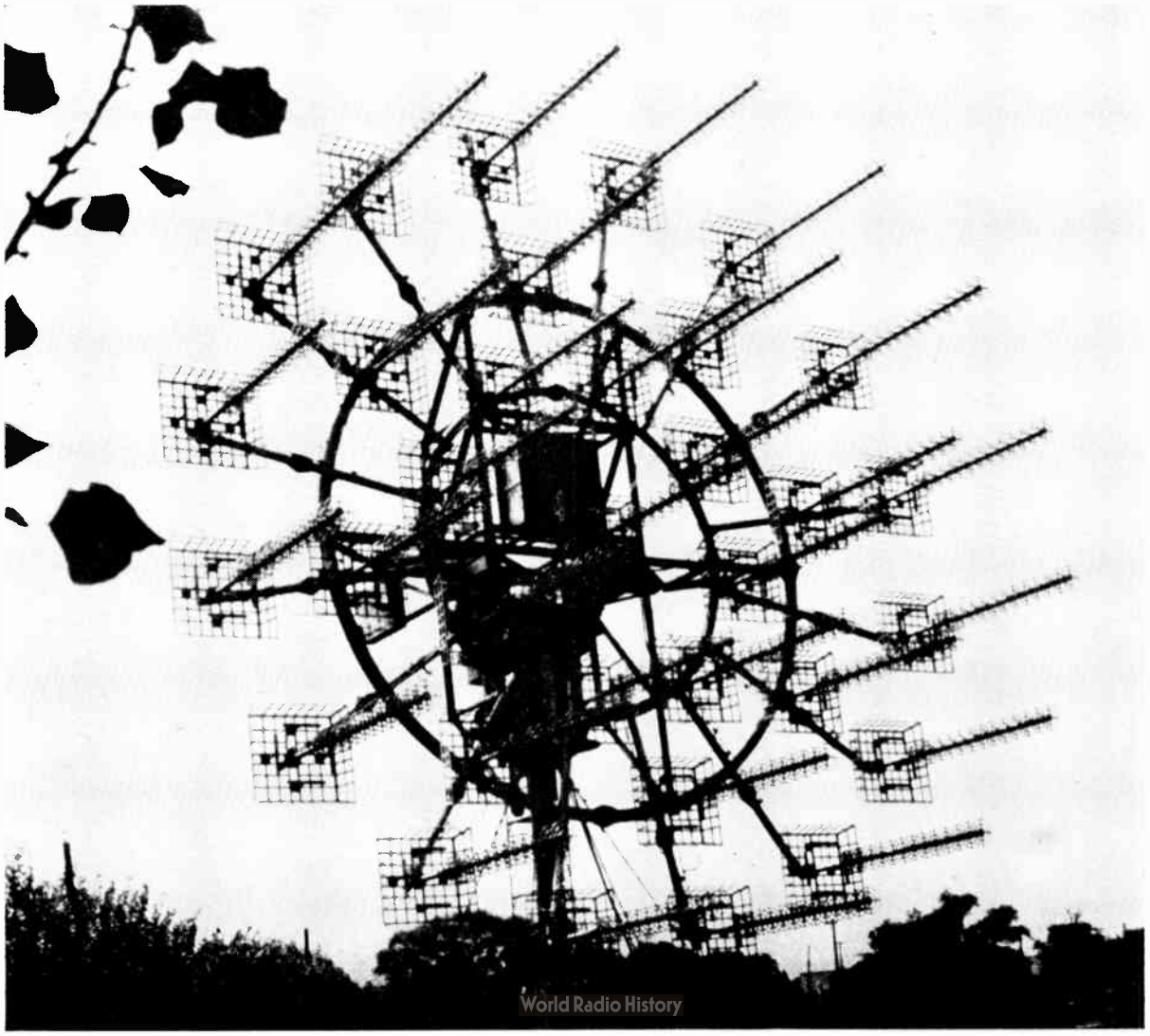
DIRECTIONAL TV BROADCAST antennas are being used in many localities as an economical means of reaching specific population centers from advantageous transmitter locations; the basic concept is by no means new. However, the applicant for Channel 11, assigned to Nogales, Ariz., faced an unusual coverage problem. A very definite null was required.

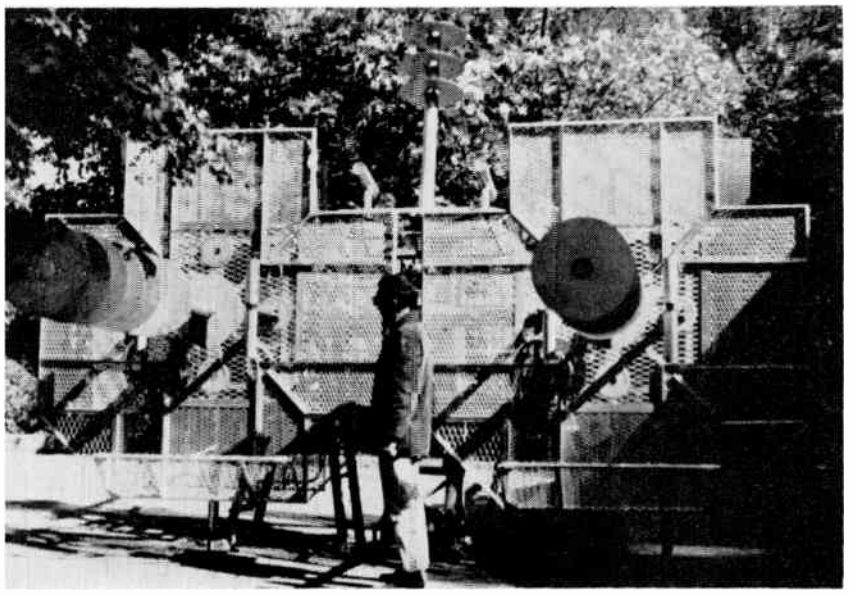
The Nogales applicant desired to transmit from a high location in the mountains between Nogales and Tucson, the only practical means —using reasonable power—of providing good coverage to the entire area. This location, however, placed the transmitter within a few miles of the Smithsonian Radio Observatory, which requires protection to a very low signal level. Moreover, the angular separation between Nogales and the Observatory was as small as 30°, depending on the exact location chosen. An additional complication, not usually encountered, was that the antenna would be located in a National Forest. In granting permission, the U.S. Forest Service limited the actual site to a hidden one which would not be visually objectionable to visitors. To meet the requirements, the antenna had to be capable of providing a very deep, stable and controllable null in the radiation pattern, a small angular distance from a peak or lobe. In addition, it was very desirable that another lobe be placed north toward Tucson, that the level toward the west be maintained near 10 dB below the lobe, and that the signal level toward the Santa Rita mountains be kept generally low to minimize reflections and multipath. A simple means of adjusting relative lobe and null angles was very desirable, since the exact location might be subject to change.

Investigation by Walter Stiles, Tucson, Ariz., KZAZ project manager and engineering consultant, indicated that the several antenna types in general TV broadcast use would require somewhat costly modifications—in some cases, at least—to develop a sufficiently narrow azimuth beam in which a deep, wide, broadband null could exist as close as 30° to a major lobe.

Mr. Bogner is Pres. & Technical Director, Bogner Antenna Systems, Corp., Valley Stream, N.Y.

Fig. 1. Typical disc-rod end-fire antenna used in military and space applications (200 MHz).





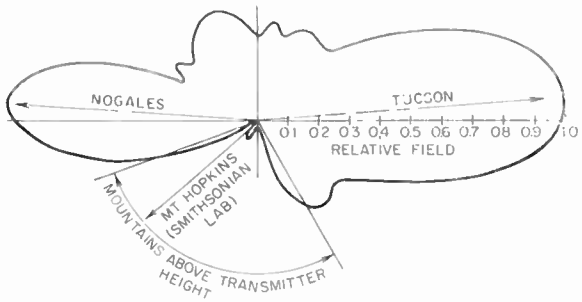


Fig. 2. KZAZ horizontal plane radiation pattern.

Fig. 3. KZAZ antenna used to develop pattern tests.

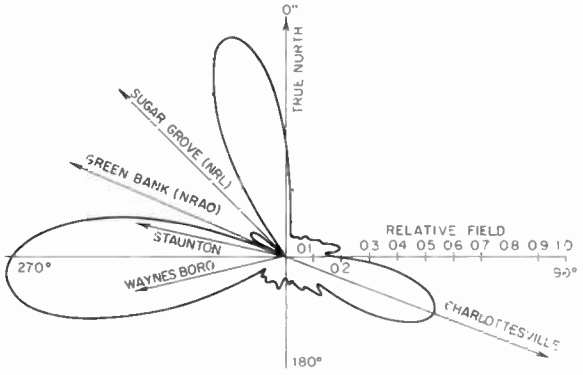
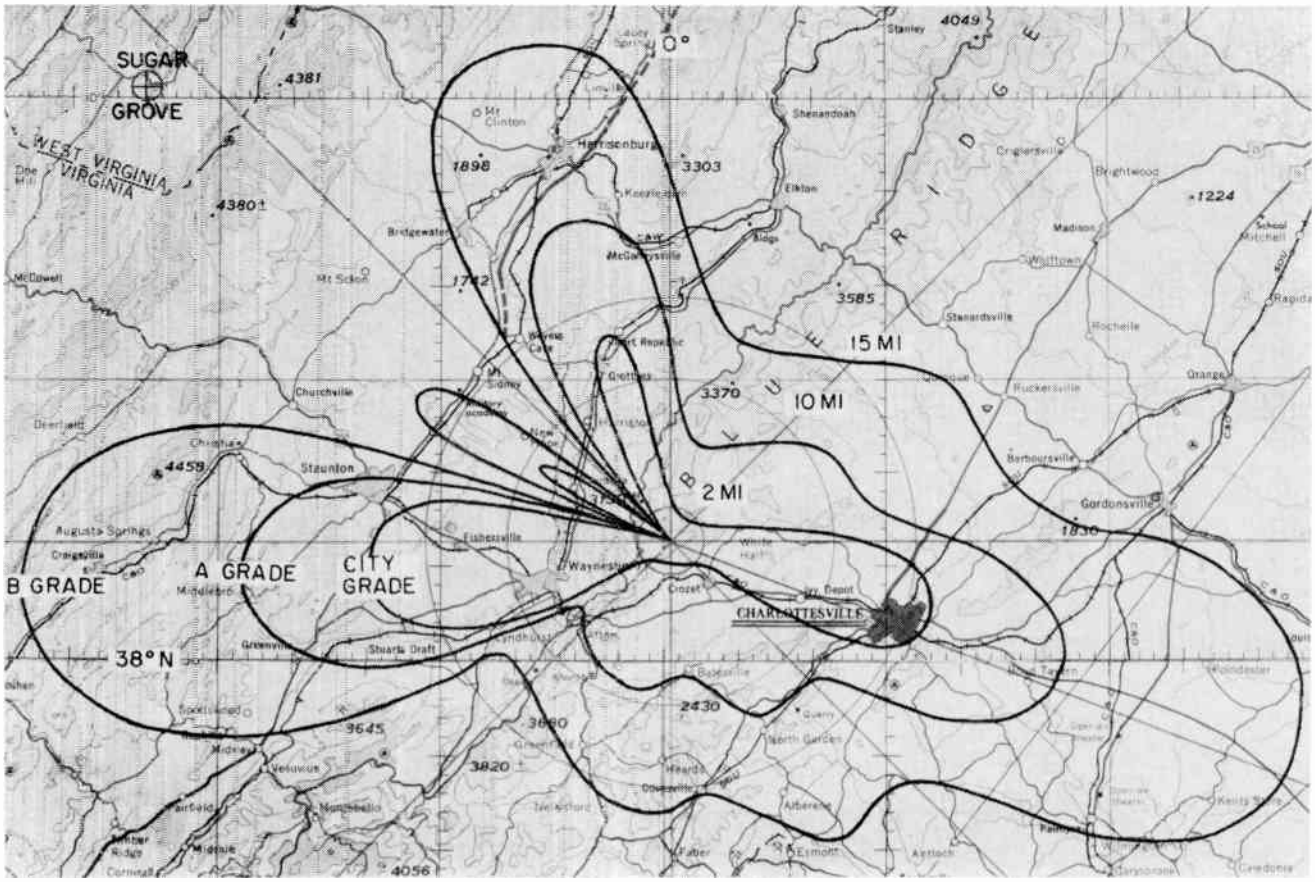


Fig. 4. Horizontal plane radiation pattern designed for Channel 64 (WVIR-TV) Charlottesville, Va.

Fig. 5. City, A, and B Grade contours of Charlottesville.



Application of the "Disc Rod"

Up to this time, the disc-rod end-fire antenna and similar arrays had seen much use in military and space applications because they possessed certain desirable properties, including high gain over a broadband, high efficiency, excellent pattern control, and polarization flexibility. Because many of these antennas, such as the one shown in Fig. 1, operated in the 200 MHz range, existing designs were readily adapted to broadcast use. Mr. Stiles suggested that this be tried for KZAZ.

The antenna constructed for Nogales consists of 6 disc-rod sections; arrays of two each point south toward Nogales and north toward Tucson, and one each points west and east, respectively. The last section is used as a trimmer to maintain the null depth toward the Mt. Hopkins Smithsonian Observatory. Fig. 2 is a horizontal plane radiation pattern showing the deep null toward Mt. Hopkins and the low level toward the mountains as well as the lobes toward Nogales and Tucson. The azimuth power gain is around 5, so that an elevation gain of only about 3 is required to provide 150 kW ERP using a 10-kW transmitter. Therefore, a 16-ft. high antenna is adequate. The signal level toward Mt. Hopkins is more than 46 dB below peak radiation so that less than 4 mV/m is received at the observatory 2-½ miles distant. Fig. 3 shows the KZAZ antenna during pattern tests.

Two Nulls Required in Virginia

At about the same time that the KZAZ applicant was searching for a solution to his problem, a similar—but in some ways more severe—requirement was faced by the Channel 64 applicant in Charlottesville, Va. FCC regulations require that any station in that area protect both the National Radio Astronomy Observatory (NRAO) at Green Bank, W. Va., and the Naval Research Laboratory (NRL) station at Sugar Grove, W. Va. To provide broad area coverage, the applicant had, like KZAZ, chosen a central mountain site which could see Charlottesville to the east, Waynesboro and Staunton to the west, and Harrisonburg to the north.

Overall protection requirements here were more severe. First, two deep nulls were required, about 20° apart. Second, no advantage could be taken of elevation directivity, since the observatories were a long distance away and almost on the horizon. Third, the city of Staunton is only about 10° off the line-of-sight path to Green Bank. Fourth, levels as low as 1 mV/m were the maximum tolerable at Sugar Grove, requiring nulls in the order of 50 dB. However, at the higher uhf frequencies the disc-rod

Disc-Rod Antenna Characteristics

The disc-rod end-fire antenna may be regarded, by way of analogy, as similar in operation to the more familiar yagi with discs instead of thin-rod parasitic directors. Like the yagi, the antenna is used in conjunction with a driver such as a dipole or loop located at the non-radiating end. Polarization of the radiated signal has in all cases the same polarization as that of the driver, and the radiation peak is along the disc-rod axis.

Unlike the yagi, however, the disc rod has high gain and directivity over a large frequency band, and exhibits this gain for any driver polarization, including simultaneous vertical and horizontal, and circular. A large variety of radiation patterns can be obtained easily by adjusting disc spacing and diameter; also, the broad bandwidth and low Q render it insensitive to environmental changes caused by dirt, ice, snow, etc. Arrays of disc-rod antennas have seen considerable use in applications ranging from very high gain pencil beams to omnidirectional patterns.

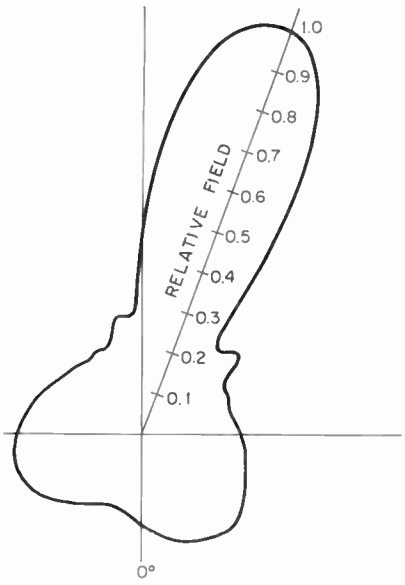


Fig. 6. Horizontal plane radiation pattern designed for proposed Asbury Park, N.J. UHF station.

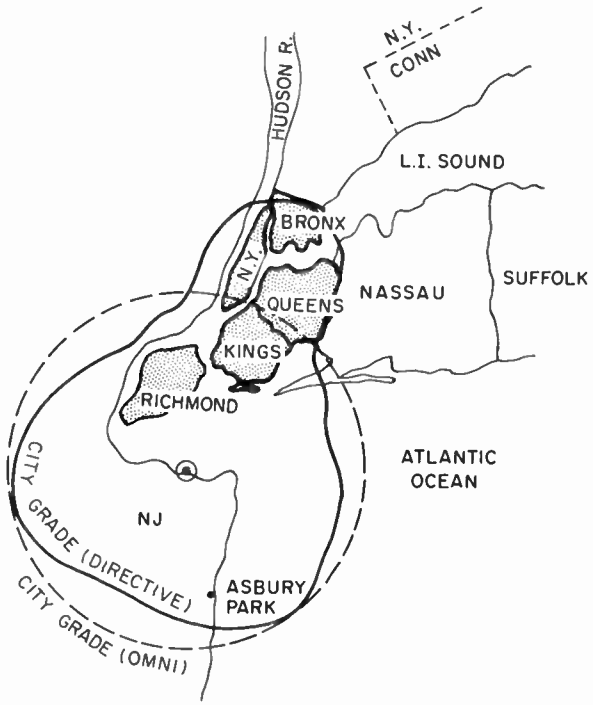


Fig. 7. City grade coverage of Asbury Park station, showing a comparison of directional and omnidirectional disc-rod antenna.

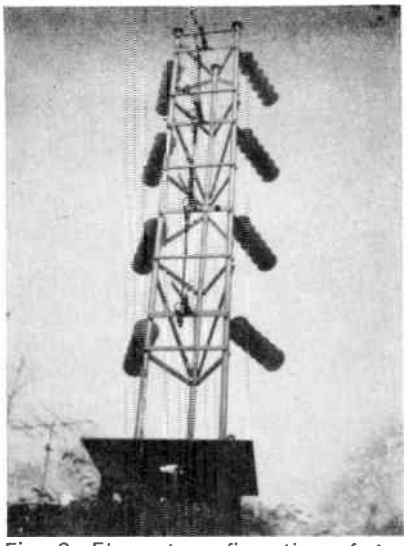
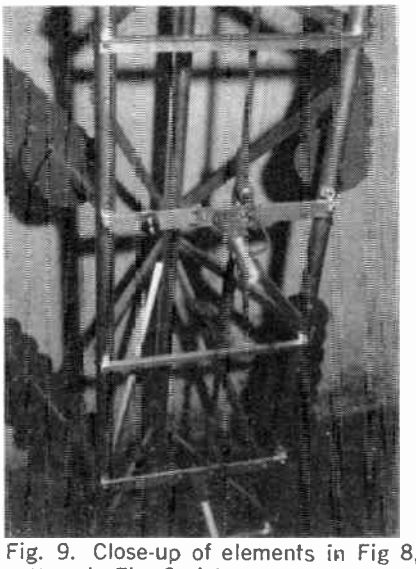


Fig. 8. Element configuration of Asbury Park antenna.



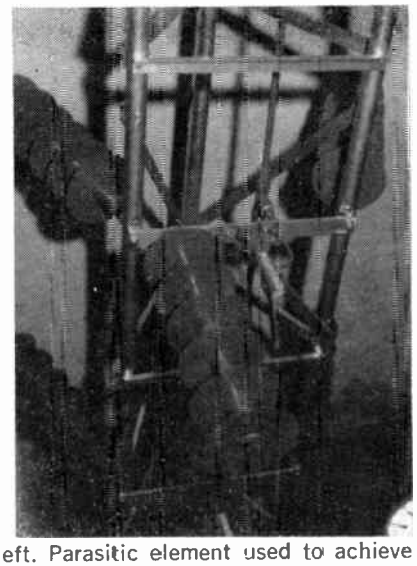


Fig. 9. Close-up of elements in Fig 8, left. Parasitic element used to achieve pattern in Fig. 6, right.

could provide very narrow azimuth beams with reasonable antenna size, and the radiation pattern of Fig. 4 was developed to meet the requirement. The resulting city, A, and B grade coverage contours are shown in Fig. 5, using a 1-kW transmitter to achieve about a 20 kW ERP major lobe.

During the course of the disc-rod design effort for Nogales and Charlottesville, certain other characteristics were observed which appeared to have broadcast applicability. One is the ease of adding vertical polarization to each bay while maintaining the pattern. Consideration is now being given to a request for experimental use of this feature to determine if any coverage improvement results, including variation to circular polarization during part of the test. This can be done simply by changing the relative exciter phase at each disc-rod base. A second characteristic is the ability to achieve high azimuth gain in a simple manner. A number of specific sites were analyzed in detail, and in a large percentage of cases either a substantial coverage improvement for the same antenna and transmitter size, or a large size reduction for the same coverage, resulted from use of high azimuth gain.

One Major Lobe For Asbury Park

One such case for which, in addition to analysis, operating full scale antennas were built and tested was for a proposed uhf station in Asbury Park, N.J., from which it was also desired to cover New York City. Fig. 6 shows the azimuth radiation pattern and Fig. 7 a map of city grade (80 dBu) coverage, comparing a directional and an omnidirectional disc-rod antenna. For both cases, all parameters were assumed to be the same, except azimuth directivity, to allow a meaningful comparison. The disc-rod provides the maximum allowable 5 megawatts ERP compared to 10 dB less, or 500 kW for the omni, both using a 33-ft. antenna length and 25-kW transmitter, 80% line efficiency, a 500′ AAT tower, 5% null fill, and 1° down tilt. The coverage difference results entirely from the fact that the directive antenna has a power gain of 8-1/3 in azimuth and 30 in elevation or 8-1/3 x 30 = 250 = 24.0 dB, while the omni has a gain of 1 x 25 = 14.0 dB. This virtually "no cost" difference in this case more than doubles the population (12 million compared to 5 million) in the city grade contour alone, without violating the FCC 15 dB deepest null rule. For additional comparison, other presently-used directional antennas would have difficulty achieving even a 2 megawatt ERP under this same set of conditions, and, therefore, require more than twice the power (over 50 kW) or more than twice the antenna length (over 66′) to provide 5 megawatts.

The antenna used to achieve this was constructed basically as shown in Figs. 8 and 9a and then modified as in Fig. 9b at each bay. The antenna shown in Figs. 8 and 9a is omnidirectional within ± 1 dB; the normal deep "tower shadow" nulls opposite a V or slot are filled by the pair of disc rods at each bay (in this case a V is used on an 18″ triangular tower). The pattern of each bay is then further shaped by additional parasitic disc rods, as shown in Fig. 9b, to simply achieve the pattern of Fig. 6. For both the nondirective and the directive cases, the antenna consists of a standard tower section with a V and a few parasitic disc-rods mounted on it at each bay. Such construction is inherently inexpensive since the basic load-carrying structure can in every case be a stock size and shape tower, adapted to meet the required patterns by disc-rod adjustment only. The antenna shown in Fig. 8 is only 8-¼′ long, and is one of four such sections planned to form the 33′ total antenna height (length). The vswr was 1.08 maximum over the band, power handling 2 kW per bay, or 32 kW total for this design.

The situations discussed here were indeed difficult. However, it appears that this antenna type may be applicable in many cases where deep pattern nulls are required, or special pattern nulls are required, or special pattern shaping or high azimuth gain at reasonable cost is advantageous. ●

Interference to and from existing stations must be determined before applying for night-time operation. Here are the basics.

By John H. Battison

USING THE FCC'S ground-wave contour graphs it is comparatively easy to calculate daytime coverage. Most station engineers can make a pretty good stab at it after a few tries, but when it comes to determining nighttime contours it appears that many shy away. Admittedly, nighttime contour computations are usually more complicated, however, there is no reason why any competent engineer can't perform his own if he is armed with an understanding of the principles involved.

Daytime Vs Nighttime

Let's consider the differences: In the daytime, we have to consider only coverage—and interference — produced by ground-wave signals. The usual service contour is the 0.5mV/m pattern; the 0.025 mV/m contour is considered to represent interference if it invades the normal service area of a co-channel station. This, however, gives us a 20:1 ratio of desired to undesired signals. Only the radiated signal that travels along the surface, affected by earth conductivity, has to be computed. Ignoring frequency effects, ground-wave attenuation is controlled by the ground conductivity. In the daytime we also have to consider adjacent-channel as well as co-channel interference. At night it is most unusual for adjacent-channel interference to be troublesome at a distance.

Nighttime coverage is computed by using the same ground-wave coverage charts, but the all important interference contours are computed by use of the sky-wave curves. And here is where the problems seem to arise. We'll assume familiarity with the phenomenom of ionospheric radio-wave reflection and the sky-wave effect thus produced. Fig. 1 contains a geometric sketch of this effect. The distance between the transmitter and the distant point determines the critical reflection angle. Section 73.185 of the FCC rules spells out how these curves are used. However, a practical demonstration of the method of presentation may help the reader to better understand their application. The following example is taken from an actual FCC application.

Fig. 2 is a reproduction of an engineering exhibit showing how the interfering sky-wave signal is computed and the calculations presented. It should be noted that while it is not essential to present the data in the manner shown, it is much preferred by FCC engineers and is the most practical layout known to the author. Basic station data is entered on the form and distances to pertinent stations measured and entered on Line 1. The midpoint latitude is then computed by determing the latitude at the transmitter site and also at the station to be protected. The Commission's instructions tell you to use 35°N if the path at midpoint is between 35°N and 50°N, and 50°N if it is above 50°N.

In the case of WEAV, our distance is 355 miles and we use 35°N as the midpoint latitude; azimuth angle is 31°. This data is entered on Lines 1, 2, and 3. We now look at our directional pattern and see that ground-wave radiation is 30. This is entered on Line 4. Line 5 calls for the minimum and maximum vertical field intensities in the direction of WEAV. This information is obtained from the graph in Fig. 3. Curves 2 and 3 (broken lines) can be ignored; curve 1 is used only if 50% signals are being computed. In our case we are interested only in the 10% signal because we are looking at a regional, or Class III station. (Class II stations will be covered later; Class IV stations have a special simplified system). Therefore, we use curves 4 and 5. At 355 miles on the horizontal scale we go up the θ vertical scale until we hit curve 5 (lower angle) and then curve 4 (upper angle). At the distance involved our sig-

Mr. Battison is a consulting engineer based at Annapolis, Md.

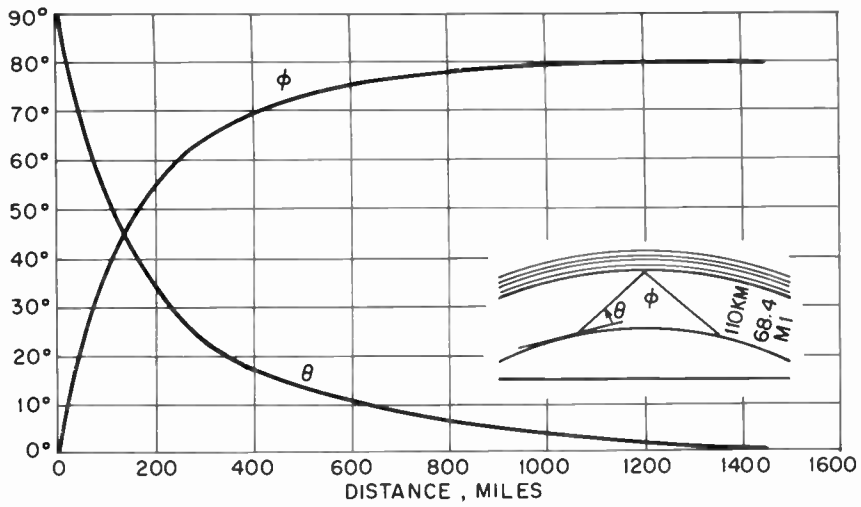


Fig. 1. Two sky-wave propagation parameters which vary with distance. $\phi = \angle$ of incidence at reflecting layer. $\theta = \angle$ above horizon at which radiation occurs.

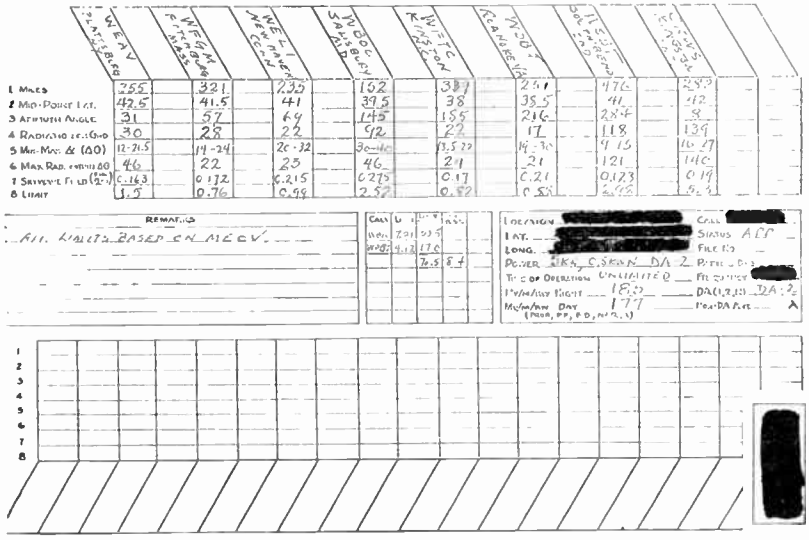


Fig. 2. Engineering exhibit showing how sky-wave signal is computed and calculations presented.

TABLE 1. Computing RSS interference limits on proposed contours.

Station	Limit Imposed on Proposed Signal	Limit Squared	Running RSS
WBOC	7.31	53.5	....
WDBT	4.12	17.0	....
		Total 70.5	8.4 mv/m

Another station radiating a 3 mV/m signal in our direction would not affect our computations since this is less than half our 8.4 mV/m RSS, and therefore, our computations stop here. Suppose, however, that our new interference had been greater than half the running RSS (more than 4.2). In this case the new interfering signal would have come into calculations and would have increased our night limitation.

Data Needed To Compute Co-Channel Interference

- For every station involved: separation in miles, latitude, power, Antenna data (DA or non-DA), height, pattern, and Class (I, II, III, or IV).
- Existing limits of all co-channel stations which might be affected must be determined; data must show the effect of the proposed operation.
- DA vertical radiation in each pertinent direction must be computed.
- Applicants may be required to show how RSS values of existing stations were computed.

nal will have a maximum reflected field intensity lying between these two vertical angles.

Because we cannot tell exactly what this value will be from time to time we take the larger, or maximum value and use this in our computation. Line 5 shows the two values, 12° and 21.5°. Now we need the maximum radiation between these angles. From the DA horizontal radiation pattern we compute vertical radiation at these angles *(see Directional Antennas* BM/E June 1966), select the higher of the two values and enter it in line 6; maximum radiation within $\triangle\theta$ (delta θ), in this case is 46.

Now we got to Fig. 4. Using the horizontal distance of 355 miles, we go up until we hit the 35° curve (top), and read the sky-wave field produced at this distance by a radiation of 100. It is 0.163 which is multiplied by the *ratio* of 100 and the computed 46 mV/m vertical radiation. This becomes:

$46/100 \times P.163 = 75\mu V.$

Thus, 75μV is the anticipated signal produced at WEAV by the proposed station. To find out whether it will interfere with the service contour of WEAV, we must multiply 75 μV by the interference ratio of 20. The answer is entered on line 8 (Fig 2) as 1.5 mV/m. Therefore, operating as stated, the proposed station will produce a signal that would limit WEAV to its 1.5 mV/m contour. Since WEAV's night service contour is already limited to a 8.54 mV/m contour by other co-channel stations, our signal will not enter into WEAV's RSS (Root Sum Square). This term will be explained later; at this point, let it suffice to say that our station will not interfere with WEAV. However, we do have to show these calculations in our application so that the FCC can verify our work. Other stations shown across the top of Fig. 2 can be checked in the same way.

It might be noted in passing that the MEOV (Maximum Expected Operating Value) is always used in these calculations to be sure that *worst* interference conditions are considered in the case of stations using directional antennas. If a station uses a non-directional antenna the process is the same, except that instead of calculating ver-

tical radiation at a particular horizontal azimuth, it is computed by using Fig. 5. If we have a 0.625 wavelength antenna we use the curve on the right. Suppose our angle is 60°. Looking at the effective field produced at this angle we see that it is 30 mV/m. (This is read by noting the graph line cut by the pip of radiation for a 0.625 antenna at 60°. Following this line down to the base at the right side we see that the effective field is 30 mV/m.) Suppose the maximum angle was 40°; the effective field for this angle is shown as only 14 mV/m. Obviously, we use the value of 30 as our ratio to 100. It is interesting to note that had our distance been different, the maximum angle might have produced a higher value, 20°, for example, would have resulted in a value of 59.

Having determined that our new station will not interfere with any co-channel station, we now have to be sure that its coverage pattern will comply with FCC requirements. To do this we must know our night limit resulting from the combined signals of all co-channel stations. The procedure is the same as that described previously, with a few additional difficulties. This involves, at the very least, examination of the co-channel horizontal radiation patterns and preferably their engineering reports to verify existing radiation data. Sometimes, in the case of older stations where the data has not changed for years, it may take considerable searching at the FCC Reference Room before the desired material is recovered from the archives.

Once the basic data is obtained, it is a comparatively easy matter to determine the *limits* each would impose on our signal. Generally, the coverage limit is not the result of *one* other station, but a *number* of stations, and we then have to *add* their interfering signals in a special manner, known as Root Sum Square (RSS), to determine their total effect on our operation.

To find the RSS and ascertain which stations enter into it, we proceed as follows: Determine the highest limiting signal value produced at the proposed site and write it down.

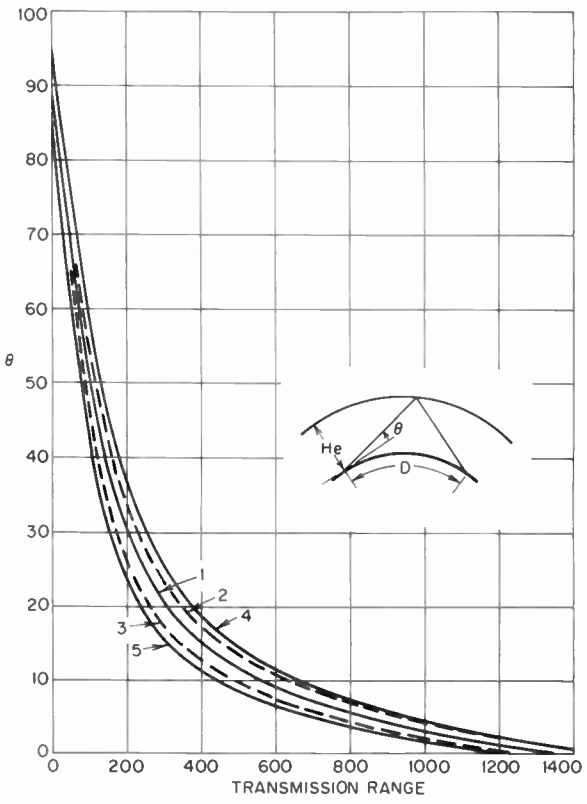


Fig. 3. Angles of departure vs transmission range. Curve 1: θ for 1000 kHz average H_e (for computing 50% signals). Curve 2: θ for 1000 kc maximum H_e. Curve 3: θ for 1000 kHz minimum H_e. Curves 4 and 5, for computing 10% signals, also contain an estimated correction for deviation from midpoint reflection.

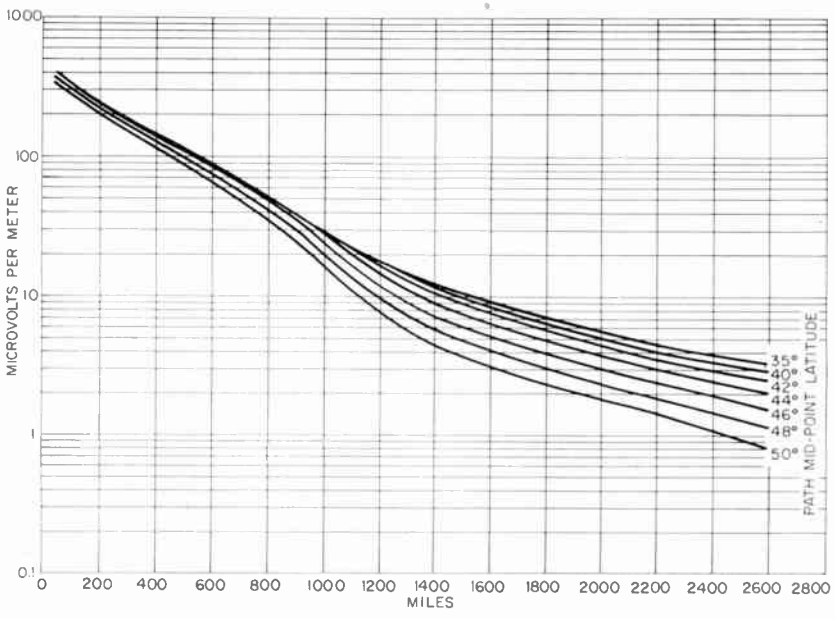


Fig. 4. 10% sky-wave fields from 0.311 antenna radiating 100 mv/m at angle θ, (pertinent to one reflection, 540 to 1600 kHz).

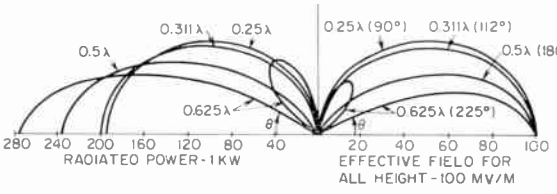


Fig. 5. Vertical radiation patterns for various antenna heights.

Under this, tabulate the remaining signals in order of decreasing magnitude as shown in Table 1. The mathematical effects of squaring, adding, etc., can produce some rather odd situations. For example, it is possible that a new signal can cause others to drop out of the

(Continued on page 64)

...now No. 200 joins the

RCA ships 200th TK-42

"Big Tube" Color Camera

No. 200 went to Kaiser Broadcasting Corporation, one of an order of 15, for stations in Boston, Philadelphia, San Francisco, Los Angeles and Detroit. Others have gone to similar group-owned stations, independent and network-owned stations, U.S. Government and foreign broadcasters.

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Practical Experiences With Dual Polarization

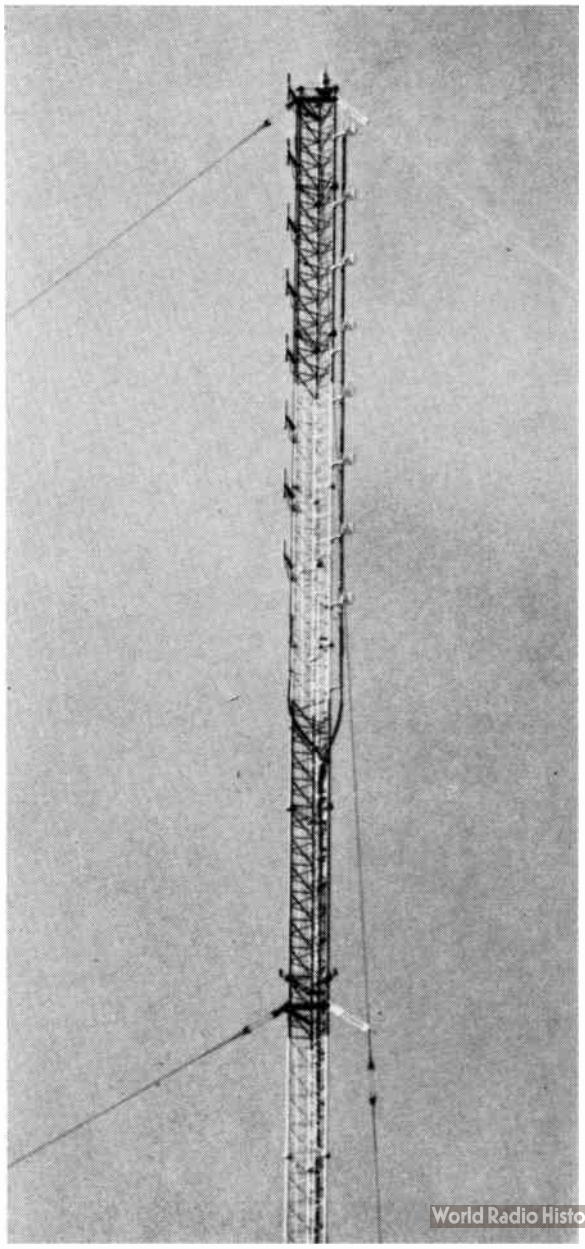
Expediency often nurtures innovation. It has for WPFB-fm Middle, O.

by Maurice L. Myers

WPFB-FM began operation in 1959 with 57,000 watts ERP. A 10kW RCA transmitter fed an 8-element RCA horizontal ring antenna mounted on a 300-foot tower. To get the fm transmission line across the a-m tower base, we grounded the cable at the tower base, providing a good static drain for the combined a-m-fm antenna. To be sure, the fm transmission line could have been tuned with a capacitor. However, we concluded that a full electrical quarter-wave section of transmission line (at the a-m frequency), grounded at the tower base, would give us more operational stability.

Later more sophisticated equipment came off the drawing boards and we were the first station in Ohio and surrounding states to transmit multiplex fm stereo, a mode of operation which opened the door to background music. We installed another 10-kW transmitter in 1963 and made provisions to switch the output of either transmitter to the antenna by a motor-driven transfer switch.

Mr. Myers is Technical Director, WPFB a-m-fm Middletown, WPAY a-m-fm Portsmouth, O. and WSMJ Greenfield, Ind.



Eight horizontal radiators are mounted adjacent to 8 vertical antennas on the tower.

Enter Dual Polarization

With FCC approval of vertical polarization, WPFB-fm decided to investigate the use of such an antenna. Various methods of vertical antenna mounting were considered. Discussion ranged between a stacked adjacent and interlaced vertical and horizontal element configuration. We decided upon adjacent mounting of vertical and horizontal elements. It would not only allow for easier installation, but also provide the maximum height for both vertical and horizontal radiators. Since we had two transmitters and two antennas, we further embellished our project by proposing to feed each antenna from a separate transmitter. With the motor-driven transfer switch, it would be possible to switch either transmitter to either antenna (Fig. 1). Apparently this had not been tried before. Manufacturers and antenna suppliers looked at our proposal with a jaundiced eye, offered no encouragement, and predicted everything but a satisfactory operation. We were not dismayed, however. Instead of the usual power divider mounted near the antenna array, we installed 8 vertical antennas adjacent to the 8 horizontal elements with separate transmission lines running to the transfer switch.

In our scheme of things, both transmitters would be fed by a common exciter. Essentially, both transmitters were alike — one an RCA BTF-10C and the other an RCA BTF-10 D1, using an RCA BTE-10C exciter. There was some question about driving both transmitters with one exciter without an additional I.P.A. To obtain an idea of just what might be required, we tried driving the transmitter 4CX250B I.P.A.'s with just the BTE-10C exciter. For coupling we used a half-wave length of RG-58U coax from each I.P.A. input. Connecting the other cable ends together gave us an impedance of 25 ohms. Then, using a quarter-wave section of RG-58U from the joined half-wave sections (Fig. 2), we obtained a reasonably good match between the exciter and the two transmitter I.P.A.'s. No appreciable amount of retuning or reloading of the exciter or I.P.A.'s was necessary to obtain the usual amount of drive.

After the vertical antenna transmission line was extended to the base of the tower, a check was made to determine the amount of rf energy that might be induced from the horizontal antenna. Using a lead pencil as an indicator, no noticeable amount of rf was present. With the transmission line connected through the transfer switch to the transmitter, no rf energy

was indicated on the power meter of the second transmitter.

The second transmitter was turned on, feeding power to the vertical antenna. Everything appeared to be working fine. At this point, we reached the pinnacle of our antenna project. Arrangements were made to conduct listening tests with an average fm car receiver. By means of 2-way radio the test car directed that the transmitter for the vertical and the one for the horizontal be turned on or off. It was found that when the vertical array was in use, the received signal was stable while the car was in motion. When the horizontal array was in use, the received signal was stable while the car was in motion. When the horizontal was used, fast flutter was quite evident in low-signal areas. With both vertical and horizontal arrays in use, the received signal in the car was definitely improved.

To gain more insight into the characteristics of our signal, we used an fm field intensity meter, a type used by TV servicemen in the early days to check signal levels and antenna placement. To be sure, the meter readings could not be considered as absolute values. The instrument did, however, provide relative readings in microvolts. The field intensity meter antenna was a TV rabbit-ear type, adjusted to the proper length. Our measurements consisted of simply placing the unit atop an automobile and extending the antenna at arm's length, moving in the horizontal and vertical plane. We also measured signals from other stations. Stations with vertical radiators would have, in most cases, equal—if not greater—signal intensity in the horizontal plane.

We know that a good signal is necessary for satisfactory reception of an fm station. It takes an even better signal to overcome noise on a subchannel. Seven percent of our background music customers can be served satisfactorily only with a vertically polarized signal. Locationwise, some are nearby and others more distant. We are aware of only one point in the Cincinnati area where our signal is not listenable with an fm car radio. This cannot be directly attributed to our vertical and horizontal operation inasmuch as this condition existed before we added the vertical elements. This is mentioned only to point out that the added vertical radiation does not necessarily improve reception in all cases. It is quite feasible that the erratic reception in this particular area may be due to absorption or reflection of the received wave.

Replacing a Tower

Last July, tornadic winds destroyed WPFB's tower, including vertical and horizontal radiators. As a temporary measure, we placed into service a 150′ tower with 4 horizontal and 4 vertical radiators. Discounting the signal strength reduction, results were good. To improve our signal, we replaced the 4 horizontal antennas with an array of 8. Again, results were good.

As a new 360′ tower was erected, 8 vertical elements were mounted. To determine what sort of pattern would result we operated with the 8 vertical elements at the upper level of the 360′ tower and the 4 horizontal antennas on the temporary 150′ tower. We were quite sure the WPFB-fm signal remained good since we received no reports to the contrary.

When the 360′ tower was completed, the 8 horizontal antennas were moved from the temporary 150′ tower. During this process measurements were recorded. All were made at the same location, approximately 6 miles away from the station with a clear line-of-sight path to both towers. With 8 horizontal and 4 vertical radiators on the 150′ tower, the vertical signal was about 10% greater than the horizontal. With 8 horizontal radiators on the 150′ tower, the received horizontal signal was twice that of the vertical (no power to vertical antenna). With 8 vertical radiators on the 360′ tower and 4 horizontal radiators on the 150′ tower, vertical signal was 7 times greater than that of the horizontal. With 8 vertical and 8 horizontal radiators on the 360′ tower, the signal was greatest in the vertical plane. We therefore concluded

Feeding Dual Antennas with a Single Transmission Line

by Peter K. Onnigian

Jampro dual polarized fm antennas employ two types of feed systems: (1) a natural power split between vertical and horizontal bays; (2) an uneven power split between individual bays. Antenna type number J4B/4V, a 4-bay horizontal and 4-bay vertical, has an 8-way power divider feeding 4 cables to the vertical antenna and 4 to the horizontal antenna. Therefore, half the power goes to the horizontal antenna while the other half goes to the vertical; vertical and horizontal gain is equal. With Jampro antennas, vertical dipole power gain is always slightly less than the Vee power gain.

As an example of unequal natural power split, let us consider the 10-element J8B/2V—8 horizontal and two vertical—fed from one common power divider. 80% of the power goes to the horizontal and 20% goes to the vertical antenna. This is so because 2 of 10 cables (20%) feed the vertical antenna and 8 cables feed the horizontal antenna. There are also other combinations of natural power splits.

It is also possible to provide unnatural power division by using a power splitter. For example, specifications may call for 8 vertical elements and 8 horizontal elements with 60% of the power going to the horizontal bays and the remaining 40% going to the vertical. This is accomplished by the use of a 60/40 power splitter which feeds two power dividers, one for the vertical elements and another for the horizontal elements. Power divisions are practical to maximum of 80/20. Ratios in excess of this, i.e. feeding less than 20% of the total power into the vertical antenna, are rather difficult because of matching transformer problems.

It is also important to emphasize the fact that Jampro vertically polarized antennas do not have more gain than the horizontally polarized antennas. Therefore, it is possible to have an equal number of vertical and horizontal antennas and a 50/50 power split—usually natural power division— without the use of a power splitter.

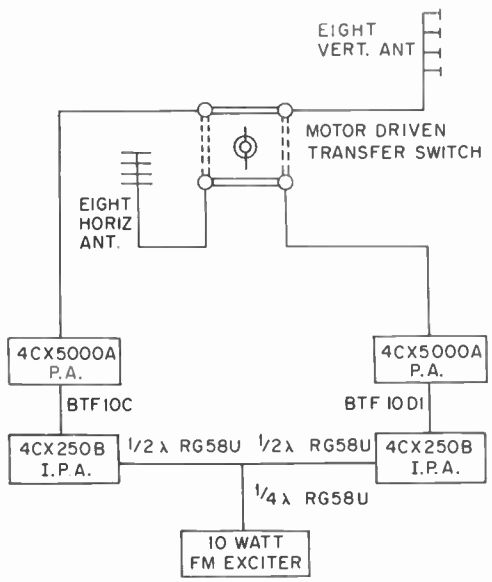


Fig. 1. Block diagram of antenna transfer switch and exciter-IPA connections.

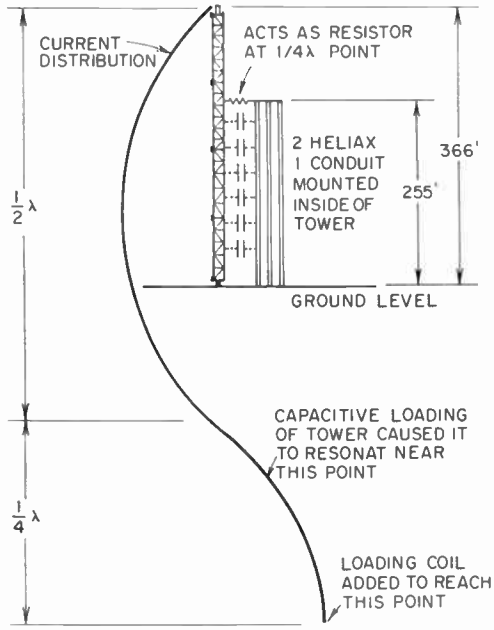


Fig. 2. The presence of the FM transmissions lines and power conduit acted as a capacitor, making AM antenna act as a capacitive reactance.

Effects On A-M Antenna

Installing fm antennas on an a-m tower can have strange effects on the electrical tower characteristics at a-m frequencies—often contrary to preliminary calculations. When erection of our 360′ tower was completed, we proceeded to install the fm transmission lines and lighting circuit.

With the a-m transmitter operating at 910 kHz, a tower of 120° was expected to have inductive reactance characteristics. This, however, was not the case! It measured as a capacitive reactance. In order to achieve resonance, it was necessary to add a loading coil. The "capacitor" formed by the fm transmission lines and lighting conduit loaded the tower beyond the halfwave point (at a-m); electrically, the tower is actually ¾ wavelengths long.

The two 3″ Heliax transmission lines and 2″ conduit (lighting and deicing circuits) were bonded together and grounded at the base of the tower. At the a-m ½-wave point, the transmission lines and conduit were bonded to the tower to provide isolation of a-m and fm antennas and to act as a static drain. With tower lights at the 120′ and 240′ levels, lighting circuits were run back down the tower from the 280′ level where the conduit was terminated.

Obviously, it would be best to make radiation measurements before attaching transmission lines, lighting circuits, etc., to the tower. In our case, these attachments had to be made before radiation resistance was measured. The ¼-wave point was determined to be at about the 255′ level (Fig. 2), where the fm transmission lines and conduit were bonded to the tower. As it turned out, tower current distribution is as shown in Fig. 2. Capacitive effect of transmission lines and conduit caused the tower to resonate at slightly above the ½-wave point; by adding the loading coil, resonance was extended to ¾ wavelength.

that any element spacing combination has no influence on the quality of the received signal.

Transmission Lines

Doubts about the successful conclusion of our program were particularly focused on the phasing problem in the transmitted signal. Uniformity of transmission line length was not the order of the day. Random selection of lengths and spacing registered good and satisfying results. The new installation used two 500′ lengths of jacketed Andrew type HJ8-50A 3″ air-dielectric Heliax transmission line. After the 8 horizontal radiators were installed on the temporary 150′ tower, the vswr was 1:2. Adjustment of the matching transformer resulted in a vswr of 1:1.05. When the same antenna and matching transformer were moved to the new 360′ tower, vswr measured 1:1.75. A vswr of 1:1.05 was achieved by adjusting the matching transformer. With the 8 vertical radiators mounted on the 360′ tower, adjustment of the vertical antenna matching transformer brought about a vswr of 1:1.05. A vswr of 1:1.05 is maintained for the horizontal and vertical antennas. The horizontal antenna was oriented, according to the manufacturer's recommendation, to obtain the greatest radiation in the most desired area and the least over a self-imposed protective area.

We feel that the results of our dual polarization program has yet to reach its full impact. To be sure, the greatest improvement has been in the realm of automobile fm reception, and the automobile industry foresees a glowing future in the market place for the fm radio. Certainly, the accolades received from those who recognize the extended range of our fm signal in automobiles has been most gratifying. Our method of dual polarization is somewhat out of the ordinary, but has proven workable. We were attempting to build a higher plateau of service. We think we have succeeded. ●

CATV Antenna System Design

Here's how to tailor antenna systems to get the most out of available signals.

WHILE IT IS TRUE that CATV signal degradation can and does creep in at literally hundreds of points between the antenna and the subscriber's set, it is doubly true that if the received off-air signal is of poor quality to begin with, no amount of electronic equipment can improve it. In short, what the viewer ultimately sees can be no better than the signal delivered by the head-end antenna. In fact, quality will decrease as distance between the viewer and the head end increases. The CATV engineer is painfully aware of this reliance on off-air signal quality; therefore, a great deal of time and skill must go into choosing an antenna site and designing the antenna system. No two sites are the same; therefore, the peculiarities of each site must be analyzed before actual channel by channel antenna arrays can be calculated and designed.

Factors which affect off-antenna signal quality are not limited to distance, frequency, transmitting and receiving site elevation, transmitter power and antenna gain, terrain profile, and weather abnormalities along the way—although all of these factors are important and must enter into antenna system design. However, there are other important but lesser-known factors which vitally affect system performance, and these are local to the site itself.

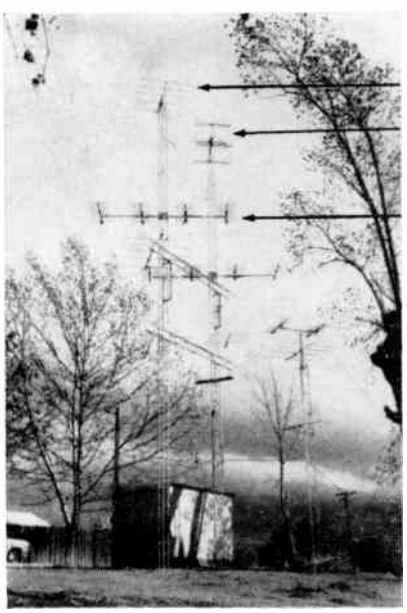
Of all forms of degradation, noise is by far the greatest problem. Noise is at its worst on low-band vhf (Channels 2—6); it is slightly less important on high-band vhf (Channels 7—13) and is virtually nonexistent on the uhf band. Of the various types of noise present, man-made noise is the most serious. Assuming that all decisions relative to site selection and channels to be utilized by the system have been made, factors affecting system design break down into two major and a number of lesser areas of consideration.

Signal Strength

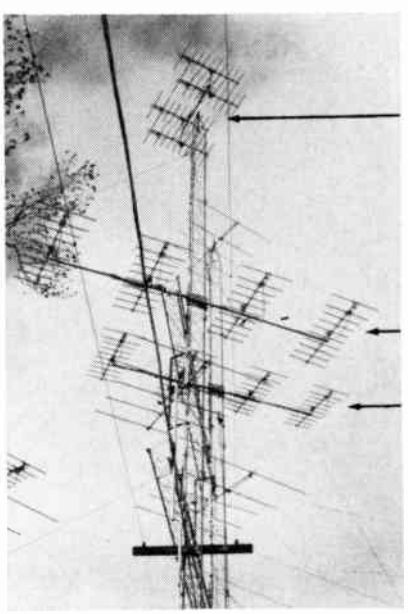
Table 1 indicates *minimum* recommended signal inputs *to the first* head-end amplifier at sites with various signal-to-noise conditions. Table 2 indicates minimum recommended preamp signal inputs with the same signal-to-noise conditions. From these tables it is possible to determine necessary antenna gain. Let's follow these calculations from start to finish on two channels, one high band and the other low band.

Selecting the Array

We will assume our antenna site is located in a medium signal-to-noise area, and that the signal



Head-end site of Placerville, Cal., system. Five-element channel 4 yagi (top arrow). Four 10-element yagis stacked in "box array" configuration for increased gain (center). Four 10-element yagis stacked horizontally to reduce Channel 9 co-channel interference by attaining a sharper frontal lobe (bottom).



Close-up of stacked arrays. Where maximum gain under varying weather conditions is required, best small-array configuration is "box" or "H" shown here for Channel 12 (top arrow). Antennas should be a minimum of ½ boomlength above and/or out from tower for proper lobing; two boom lengths is ideal. Lower two arrows point to two 4-stack arrays designed to reduce co-channel interference (upper is Ch. 7; lower is Ch. 9).

in question is for Channel 4. Fig. 1a shows the test considerations. A reference antenna (a 5-element, Channel 4, 72-ohm yagi) provides 8 dB gain. Long term around-the-clock measurements over a period of several weeks, under varying weather conditions, indicate that the average signal level delivered from the 5-element yagi is 320 μV (—10 dB) at a test height 30′ above ground. However, a signal level as low as 250 μV (—12 dB) was encountered during 5% of the measurements. Table 2 indicates that for a medium noise site, we should have a minimum preamplifier input signal of 900 μV (—1 dB). Since our long term test indicated a 250 μV signal 5% of the time, we can safely assume that this low point signal level can be adopted as our minimum reference. Thus, we have a disparity of 11 dB (—12 to —1) for which we must compensate.

There are two ways to achieve this—more antenna gain, and additional antenna height. If we double the size of the antenna (i.e. from 5 to 10 elements), we can pick up 3 dB additional gain. Signal level is also a function of antenna height. However, if the receiving site is already on an elevated spot, height above ground may be more difficult to measure in terms of additional signal. For example, if the terrain profile between transmitter and receiving site is essentially flat, raising the receiving antenna from 30′ to 240′ might result in a signal level increase of as much as 9 dB. On the other hand, if terrain at the receiving site is already substantially elevated, as shown in Fig. 1b, an increase in antenna height from 30′ to 240′ may produce a very negligible signal increase.

For the purposes of our Channel-4 example, we will assume a smooth-earth situation as depicted in Fig. 1a. Our problem is 11 dB of signal, the difference between the existing —12 dB level and the sought after —dB minimum. By raising our 5-element yagi from 30′ test height to 240′ above ground, we can expect a 9 dB improvement, from —12 dB to —3 dB. By adding a second stack (5 additional elements), we can expect 3 dB additional gain, from —3 dB to 0 dB (1,000 μV).

On Channel 7, a 5-element test

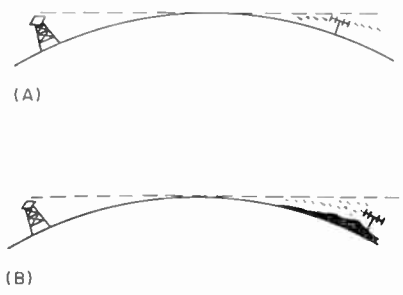


Fig. 1. Over an essentially flat transmitter-to-receiver site path (a), signal level usually can be increased by raising antenna height; 400′ to 500′ towers are not unusual in some locations. With a naturally elevated receiving site (b) actual tower height seldom has any bearing on antenna output.

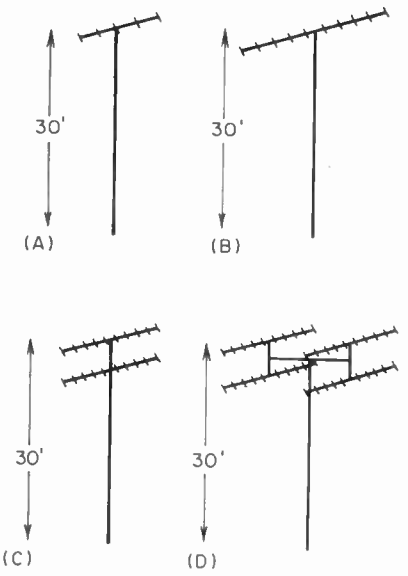


Fig. 2. Antenna stacking increases gain. A 5-element yagi (a) provides 8 dB gain; with a 10-element yagi (b), gain is 11 dB. Stacking two 10-element yagis (c) increases gain to 14 dB; four 10-element yagis (d) yield a 17 dB signal.

Antenna Gain and Height

Antenna Size vs Gain

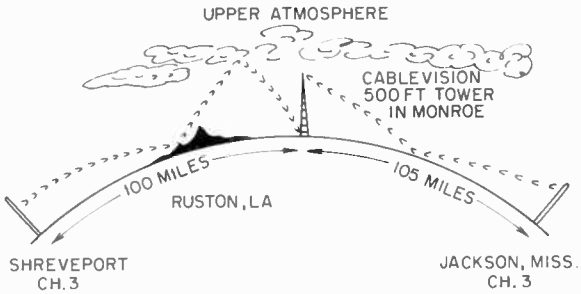
Some manufacturers rate antenna gain to a tuned reference dipole. Most now rate their antennas with a mathematical reference known as an isotropic source. Regardless of basic rating, a single stack antenna has an established gain and it will produce a starting-point signal level. From that starting point, the user can expect to net an additional 2.5 to 3 dB gain each time the size of the total array is doubled.

Antenna Height vs Gain

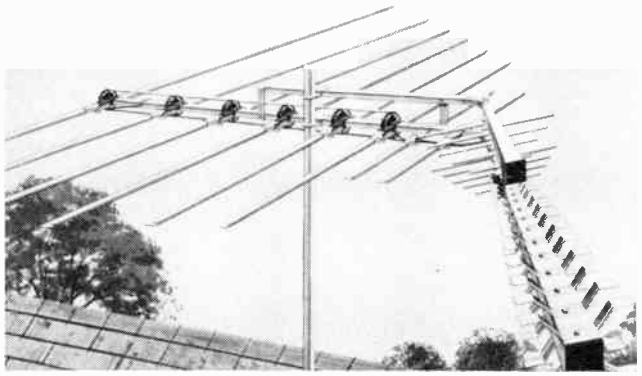
In locations where the receiving site is on relatively flat terrain, it is possible to achieve increased signal pickup by raising the antenna. Tests made by the National Bureau of Standards indicate that the height/gain relationship varies greatly from area to area, dependent to some extent upon ground conductivity in the region. N.B.S. suggests that if you begin with an antenna height of 30′ and increase the height to 60′ you should realize a 3 dB gain, although it may be substantially more, as much as 5 dB in some cases. Doubling the height again will raise the signal level by another 3 dB, and so on. However as the antenna height is raised beyond 200 feet, the amount of increase tends to fall off and is offset to some extent by the increased transmission line loss so that eventually you reach a point where transmission line loss exceeds antenna gain, and the resulting signal delivered to the head end actually goes down as the antenna goes up.

Tropo Scatter Antennas

Tropo scatter antennas are being used for beyond-the-horizon TV reception by gathering TV signals from a large section of wave front and concentrating those signals into a focal point where they are picked up by a dipole antenna. SPADECO parabolics, manufactured by Fort Worth Tower, Ft. Worth, Tex., have gains of 26 to 50 dB and are 80' tall in standard production lengths of 150, 210, and 270'. At several locations, this antenna type has been used to receive weak signals and to eliminate co-channel interference. For example, Channel 9 San Marcos, Tex. is picked up at Hearne, 128 miles away; reception is reported to be snow-free with only occasional short fades. Fades can often be eliminated or reduced by employing space diversity, a principle



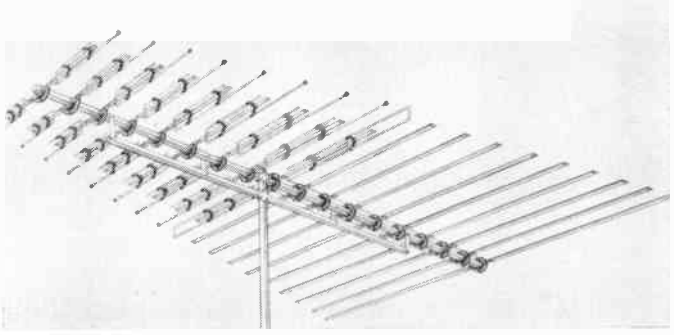
where two separate antennas are spaced 100 to 200 wavelengths apart. The antennas are connected by an automatic switching unit which samples response from both antennas; when one fades, the head-end input is switched to the other.



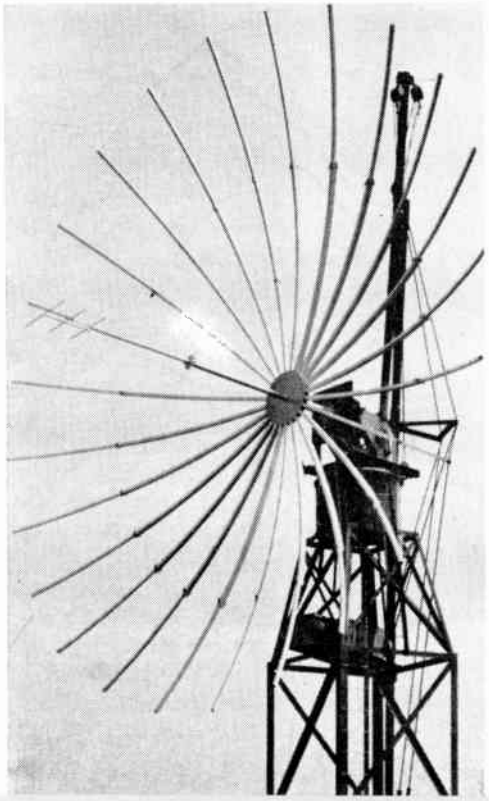
Typical Multiband Antennas

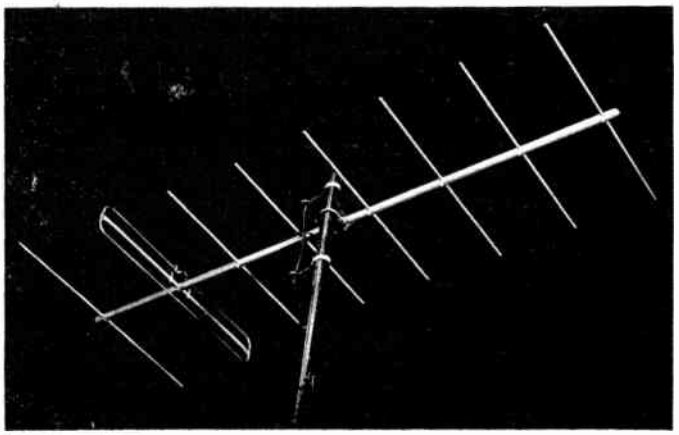
Designed for semi-fringe area reception, the Jerrold PXB-70 antenna is designed for VHF and UHF reception. The VHF section has 6 driven elements and 2 parasitic elements; the UHF section has 11 driven elements and 24 parasitic directors. Hinged joining permits individual orientation of up to 30° of VHF and UHF sections. Both 75- and 300-ohm downlead outputs are featured. Graphs show typical gain over a reference dipole.

The driven elements of Jerrold's Paralog-Plus VHF antennas work in two modes simultaneously: ½ wavelength on low-band channels and 3/2 wavelength on high-band channels. The PIX-225 has 10 driven elements and 9 parasitic elements with 75- or 300-ohm outputs.



New 30' parabolic antenna developed for CATV by RF Systems offers high gain with low side lobes and back radiation. This design makes it possible to pick up all channels from a given area with one feed and high gain on each channel. In addition, this antenna will pick up different channels from different directions with good rejection between channels.





Typical 8-element yagi for Ch. 7-13. This Sitco Model MD-8 offers 13 dB gain, front-to-back ratio of 12.3/1, front-to-side ratio of 7.4/1, is especially designed to withstand severe weather conditions. Sitco makes complete line of cut-to-channel yagis and 2-bay and quad arrays.

antenna (Fig. 2a) produces a signal of 200 μV. Our antenna site is located in a medium noise area; therefore, we need 700 μV more to overcome the 11 dB deficit. If we have a mountain head-end site with an elevation of, say, 2,000′ above average terrain along the path to the transmitter, anything we might do to raise the receiving antennas 50, 100 or even 300′ above the receiving site would be small by comparison to the natural elevation. Most of the gain, clearly, will have to come from additional antenna gain, increasing the size of the receiving antenna array.

A 10-element Channel-7 yagi (Fig. 2b) would produce 11 dB gain; two 10-element yagis (Fig. 2c) would produce 14 dB; four 10-element yagis (Fig. 2d) would produce 17 dB. Eight 10-element yagis should produce 20 dB gain. Unfortunately, as additional yagis are stacked, there is a tendency for the theoretical 3 dB gain to be harder and harder to achieve. As an antenna array becomes larger and larger, it is increasingly sensitive to surrounding objects, such as the metal tower and other nearby antennas. It also becomes less and less tolerant of human error—namely, miscalculations in antenna and phasing line design and installation. And because you must double actual antenna size each time requirements call for an additional 3 dB gain, physical space requirements can become a real problem in short order. Mounting four 10-element Channel-7 yagis may be no problem. But if you need 6 dB additional gain, you will have to quadruple the antenna size (16 antennas). In short order, sheer physical space and mechanical mounting problems can turn the required antenna size into a real monster.

Returning to our Channel-7 problem, 4 yagis netted us 17 dB gain, 2 dB shy of the 19 dB we need for a 700 μV (−3 dB) input to our preamplifier. Recall that test measurements were made at 30′ above ground at an elevated site. If we were on flat terrain, we could double the antenna height to 60′ and expect 3 dB additional gain (±1 dB). On the elevated site, we *might* get 3 dB by doubling, but chances are we would not. Even doubling the height again, to 120′ probably would not bring the signal up 3 dB.

The solution? Common sense suggests we try height-gain measurements first, to ascertain whether a height increase *can* produce an additional 2 to 3 dB. If not, the only choice left is to double the projected number of 10-element arrays to eight bays.

Co-Channel Interference

If the only major problem at your head-end site is signal strength, count your blessings. With the great number of stations in operation today, most CATV head ends have *at least* one co-channel problem. Co-channel interference is hardest to cure because it is aggravated by varying weather conditions which frequently raise the level of the interfering signal(s) to a point where the desired primary signal actually may be weaker than the interfering signal. This condition may last for a few minutes, a few hours, or a few days. If only one secondary signal is involved, it is possible to *skew* (electrically orient) the receiving antennas so that much of the unwanted signal is phased out. With two or more secondary signals, the skewing may eliminate or re-

TABLE I

Recommended Minimum Head-End Video Signal Input.
Columns represent head-end location signal-to-noise conditions.

Channel	Excellent	Medium	Poor	Channel	Excellent	Medium	Poor
2	700 uv	1,200 uv	2,000 uv	8	1,600 uv	2,000 uv	3,200 uv
3	700 uv	1,200 uv	2,000 uv	9	1,600 uv	2,000 uv	3,200 uv
4	700 uv	1,200 uv	2,000 uv	10	1,400 uv	1,800 uv	2,800 uv
5	600 uv	1,000 uv	1,600 uv	11	1,400 uv	1,800 uv	2,800 uv
6	600 uv	1,000 uv	1,600 uv	12	1,400 uv	1,800 uv	2,800 uv
7	1,600 uv	2,000 uv	3,200 uv	13	1,400 uv	1,800 uv	2,800 uv

Actual required minimum AGC amplifier input will vary with equipment specifications. Figures shown are typical for equipment with a 40 dB AGC window; the figure shown is 30 dB down from the top of the window.

TABLE II

Recommended Minimum Peak Video Carrier Input to Preamps.

Channel	Excellent	Medium	Poor	Channel	Excellent	Medium	Poor
2	250 uv	900 uv	3,000 uv	9	300 uv	700 uv	2,000 uv
3	250 uv	900 uv	3,000 uv	10	250 uv	600 uv	1,800 uv
4	250 uv	900 uv	3,000 uv	11	250 uv	600 uv	1,800 uv
5	250 uv	900 uv	3,000 uv	12	250 uv	600 uv	1,800 uv
6	250 uv	900 uv	3,000 uv	13	250 uv	600 uv	1,800 uv
7	300 uv	700 uv	2,000 uv	UHF	200 uv	1,000 uv	2,000 uv
8	300 uv	700 uv	2,000 uv				

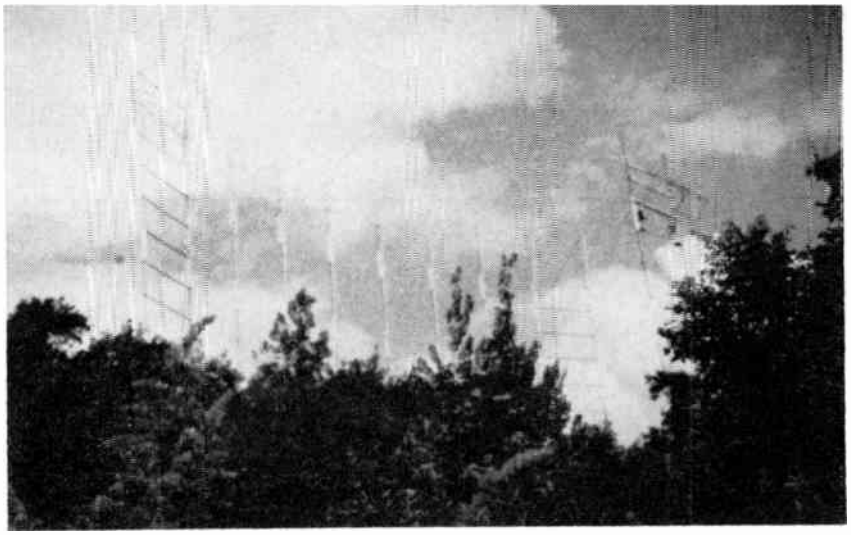
Each column represents head-end location signal-to-noise conditions. Signal levels shown are to be delivered to single-channel vhf preamplifiers having typical 20 dB gain with low-band noise figure of 5 dB, high-band noise figure of 6 dB, uhf noise figure of 10-11 dB.

duce co-channel interference from one station, but actually increase it from another. In several known midwestern and southern locations, co-channel interference from three different stations is often present as much as 90% of the time. And frequently one or more secondary signals will climb to levels as high as the primary signal, along with the addition of a fourth and fifth co-channel signal. The resulting beats between such a multiplicity of signals all but obliterates the primary video and audio.

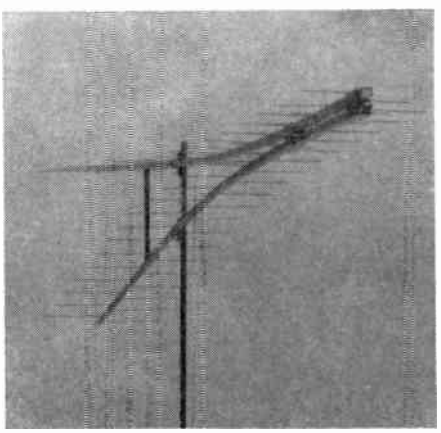
Co-Channel Tolerances

The results of a Bell Telephone Lab video crosstalk experiment conducted under reasonably pure observational conditions indicates general viewer reaction to co-channel interference. In essence, most people begin to detect co-channel beat bars when the primary to secondary signal ratio is between 32 and 35 dB. Between 28 and 32 dB the average viewer finds the interference objectionable, and between 25 and 28 dB the average viewer is out-right annoyed by what he sees.

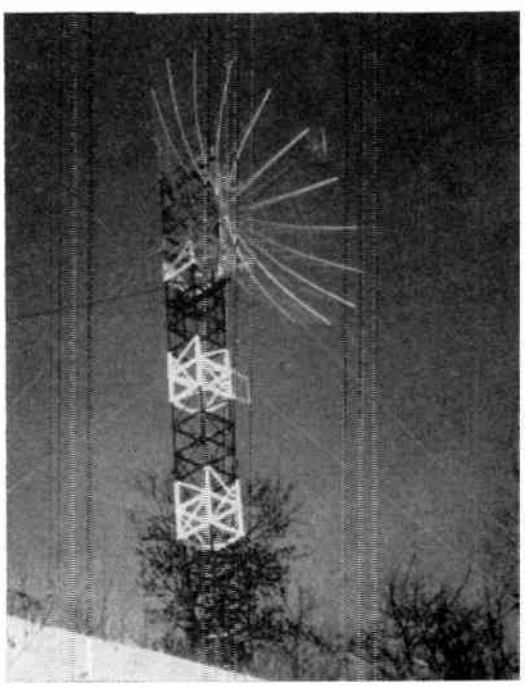
From a CATV operator's standpoint, the value of his cable product must certainly wane considerably when the ratio of primary-to-secondary signal(s) drops below 30 dB. It follows then that our objective in reducing or eliminating co-channel interference should be to maintain a minimum 30 dB ratio between the primary and the sum of secondary signal (s). Recall our Channel-7 example: If we feed the 700 μV antenna output into a typical 20 dB preamplifier, our 700 μV (−3 dB) signal increases to 7,000 μV (+17 dB). This amplified signal, driven down 250′ of .412 aluminum transmission line to the head-end equipment, will lose 3 dB in feedline attenuation. Now the signal, ready for insertion into traps and filters ahead of the Channel-7 AGC string, is 14 dB or 5,000 μV. This is our primary signal. If, in the absence of our primary signal, we can measure 160 μV or less from all secondary stations on the channel (a ratio of 30 dB), chances are we will have few complaints. If, after preamplification, the ratio of primary to secondary signal is less than 30 dB, we can expect a serious degradation of primary sig-



Original tropo-scatter system installed at North Bay, Ontario, in 1964 under supervision of Stan Hosken. Firm does not recommend tropo-scatter system as best for color reception, although reports are generally very good.



New "Exponential Curved Antenna" developed by Hosken is reported to have high gain, excellent rear rejection, and wide-band characteristics necessary for color. Reception quality is said to be superior to that achieved with yagi design.



30′ parabola developed by Hosken. Firm is now installing 100′ unit for Pittsfield (Mass.) Cable TV, mainly to receive New York signals originating 125 miles away. Hosken recommends use in pairs to eliminate co-channel and adjacent-channel interference.

CATV System Carries Co-Channel Stations

Cablevision, Monroe, La., carries Channels 3 and 12 from Shreveport and Channels 3 and 12 from Jackson, Miss. The head-end tower is located midway between the two transmitters, creating a 180° co-channel problem. Normally this fact would present a big enough problem, but to add to the impossibility of the situation, the Jackson signals are three times as strong as the Shreveport signals because of hills just west of Ruston, La.

After 10 months of unsuccessful attempts to provide viewers with the desired service, Scientific-Atlanta's quadrate channeler antennas —Models QCS-2 and QCS-7—were installed on Cablevision's 500′ tower to eliminate previously objectionable co-channel interference.

nal picture quality and numerous viewer complaints.

Eliminating Co-Channel Interference

Determining the extent of co-channel interference is a relatively simple matter. Eliminating the interference is not so simple. Until very recently, elimination of co-channel interference was entirely dependent upon skewing or electrical phasing of yagi antenna patterns. Skewing, like stacking, becomes more and more complex and increasingly sensitive as the size of the array increases. Skewing a 2-stack array presents some minor problems; skewing a 4-stack or 8-stack array multiplies the problems many times. As the size of a skewed array grows, final adjustments (both electrical and physical orientation) must be made on the tower with all antennas in place. As with any large antenna array, its performance is affected by metal objects, including the tower, feedlines, and other antennas. Anyone who has spent a day or two several hundred feet in the air, making alternate adjustments of first one antenna, then another, surely wonders if there isn't a better method than skewing. There may or may not be in your particular situation.

With the development of the Quadrate Channeler antenna series by Scientific Atlanta, precise control over the antenna's minor receiving lobes (those which most often pickup secondary co-channel stations) is more nearly achieved. By eliminating troublesome side lobes in the antenna pattern, secondary station pickup can be virtually eliminated, unless it arrives on the same beam heading as the primary signal.

Some forms of co-channel interference can be eliminated or reduced to an acceptable level with standard yagi phasing lines. Such an array is shown in Fig. 2d, where four 10-element Channel-7 yagis are stacked horizontally to maximize the frontal pattern and minimize the side pickup patterns. Using this array in one instance, we found that a single 10-element antenna produced a 2,000 μV primary signal (*after* 20 db amplification), but it also delivered a 200 μV secondary signal (a ratio of 20 dB). The four horizontally stacked yagis produced a 4,000 μV primary signal (after 20 dB amplification) while the secondary station dropped to 100 μV (a ratio of 32 dB). In this situation the offending secondary station was on a beam heading of 330° while the primary station is 256°. Thus, the offending station is 74° off the front pattern of the yagi array. Generally, a secondary signal arriving at an angle of 20° either side of the antenna can be adequately rejected by physical stacking and orientation of the array—*if* the offending signal is 20 dB or more lower than the primary signal.

Parabolic Antennas

A gigantic curved screen, delicately and precisely constructed to form a reflecting surface suitable to capture and focus vhf-uhf signals, is erected in a quiet location where noise is at a minimum. Energy intercepted by the curved reflecting screen is focused at one point—directly in front of the reflection surface. Focus point varies with each channel, and if more than one station per channel is available, the focal point for *each* station will also vary. Co-channel interference is greatly reduced because only one focal point is right for station A on Channel 7. The pickup antenna, spotted at that focal point, will see *only* station A.

In addition to their ability to reduce or eliminate co-channel interference, the large parabolic reflecting surface catches a lot of signal. Several CATV systems have installed parabolics up to 200 miles from the transmitting station with excellent results.

Summary

Today, the mainstay of the CATV antenna farm is still the yagi. Log periodics and parabolic antennas have begun to make inroads into CATV head-end design. Variations of the yagi, including screen-reflector yagis, have been around for some time and are still used in special applications.

The antenna chosen for a particular head-end site has a job to do—deliver a quality TV signal without degradation and interference. Here, and here alone, the system design engineer has the opportunity to eliminate video and audio degradation. If he does not do the job here, he'll not do it anywhere else in that particular system. ●

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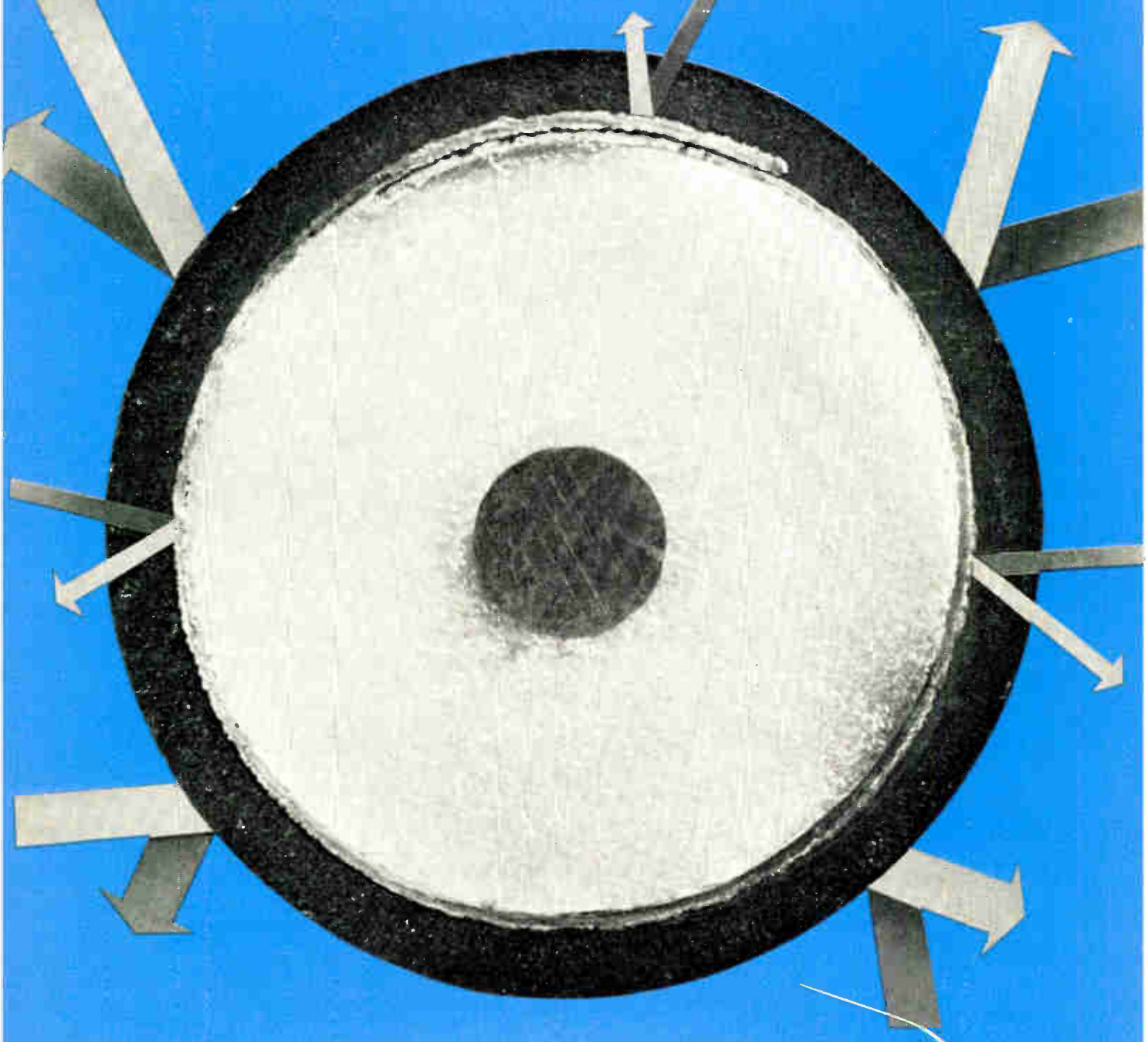

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R.F. load impedance	50 ohms	50 ohms
Carrier frequency stability	±5 parts in 10^7	±500 Hz (relative to intercarrier spacing)
Type of modulation	Negative, Amplitude	Frequency
Modulation capability	Peak white 10% Peak sync. 100%	75 kHz deviation (system requirement 25 kHz)
Signal input impedance	75 ohms unbalanced	600 ohms balanced
Signal input level	1 to 3 volts peak to peak	+10 dBm for 25 kHz deviation
Pre-emphasis	—	75 microseconds
Frequency response	−3.58 MHz : −42 dB −1.25 MHz : −20 dB −0.75 MHz : +0.5 dB to −3 dB −0.2 MHz : +0.5 dB to −1.5 dB Carrier : ±0.5 dB +0.2 MHz : 0 dB reference +0.5 MHz : ±0.5 dB +1.25 MHz : ±0.5 dB +2.0 MHz : ±0.5 dB +3.58 MHz : 0 dB to −2 dB +4.18 MHz : −2 dB to −4 dB	60 to 3,000 Hz: ±0.5 dB 30 to 15,000 Hz: ±1.0 dB
Harmonic distortion	—	30 Hz to 60 Hz : 1.5% 60 Hz to 10 kHz: 1.0% at 50 kHz deviation
Transient response	'K' factor 2% with a 2T sine squared pulse	—
Linearity	(a) 10 steps: 0.92 (b) 7 steps : 0.95	
Differential gain	3.58 MHz: 0.95	
Differential phase	3° max. at 3.58 MHz	
Blanking level stability	±1.5% for any picture level	
Phase modulation	−40 dB below 25 kHz deviation	
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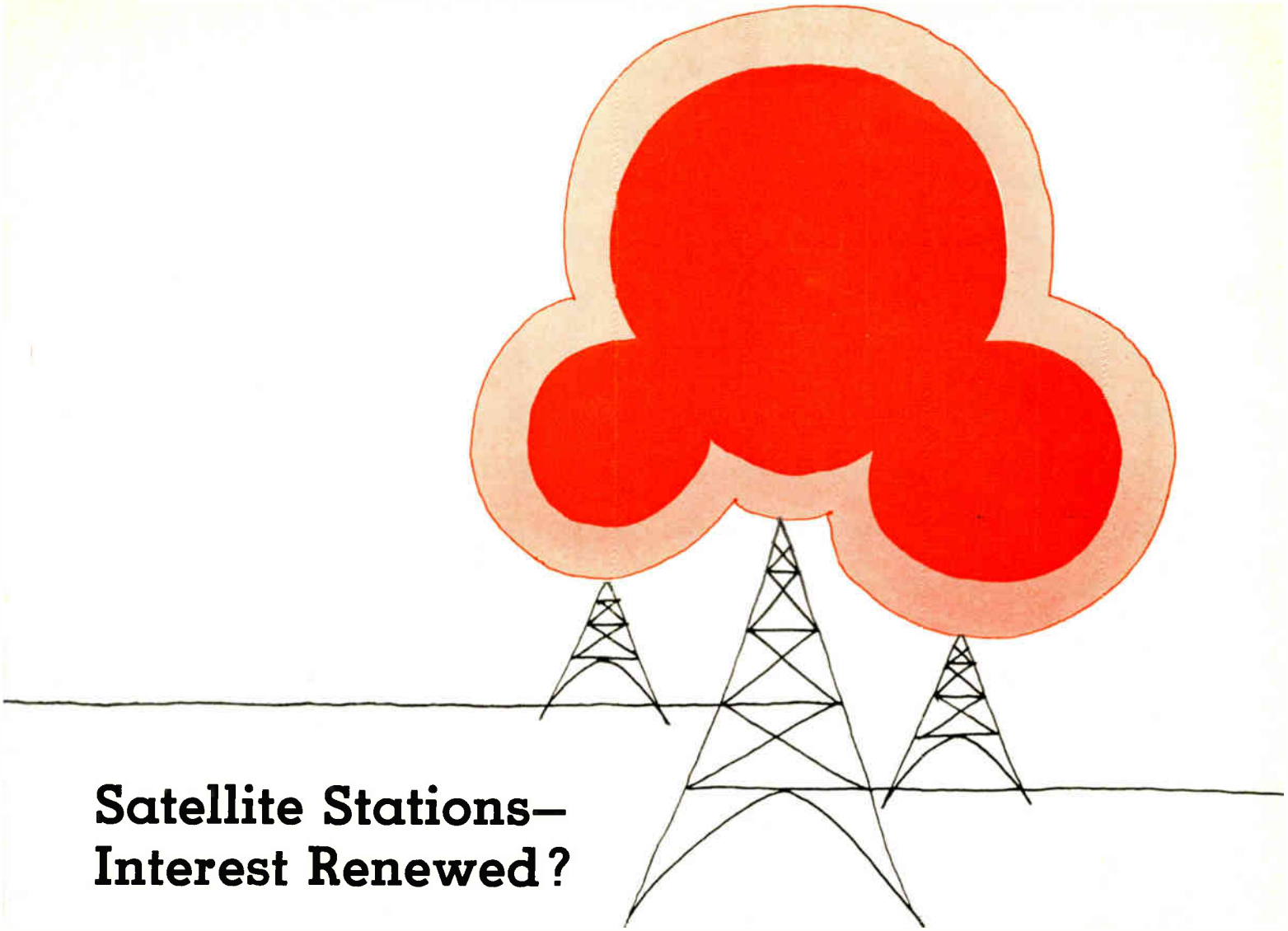


Satellite Stations—Interest Renewed?

by Charlie Buffington

The sharp rise in new TV station starts seems to have sparked interest in establishing satellite facilities. What are the general FCC rules governing satellites? How about market considerations and operating costs? For the answers, read on.

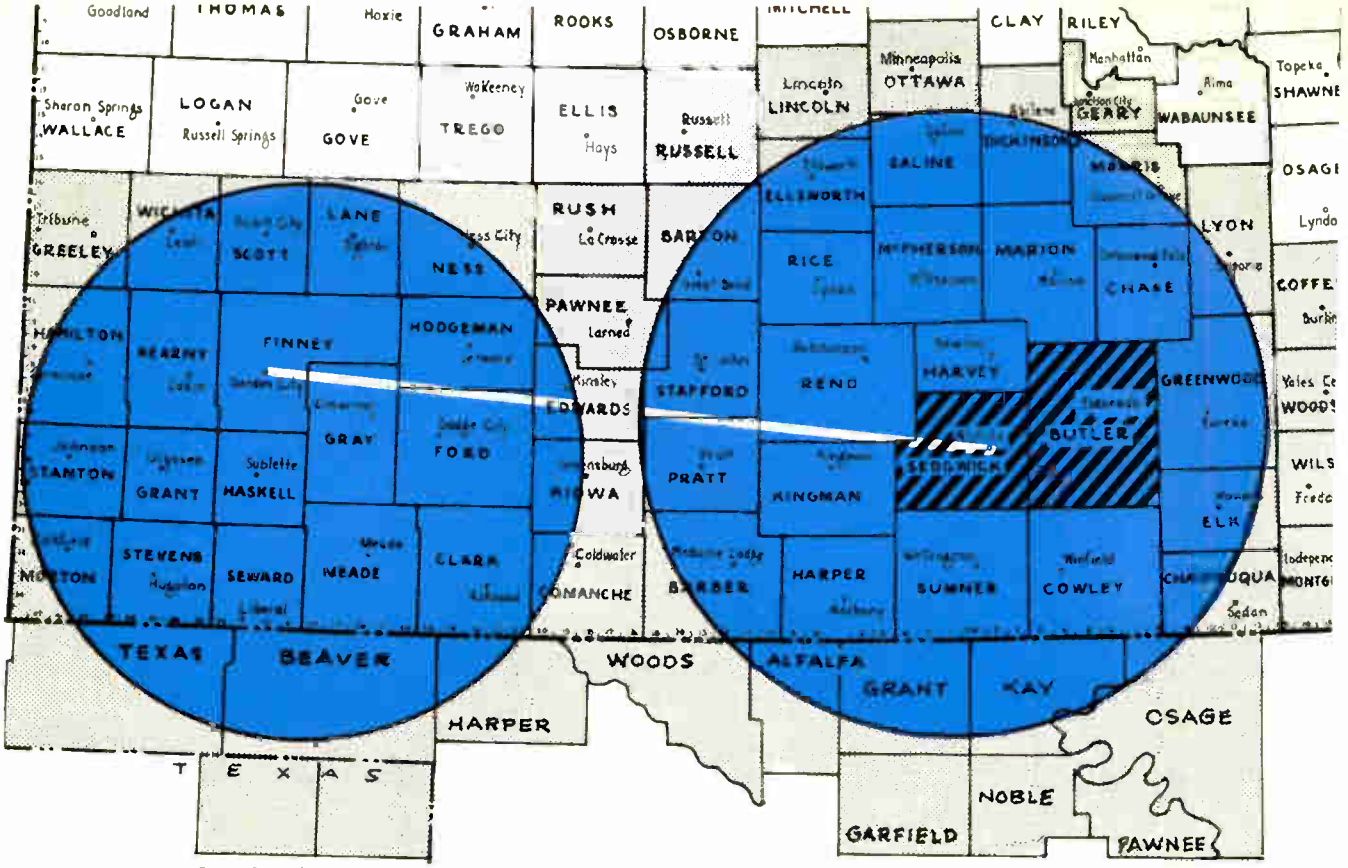
As of mid-1966 there were 36 satellite stations operating in the continental U.S.—28 vhf and 8 uhf—plus 6 vhf stations in Hawaii. Since then, however, there has been a marked increase in satellite applications. The term "satellite," as applied to a TV station, means different things to different people; in some cases, it may be a "glorified" translator—which it may well be—while in other cases it is a special broadcast facility providing basic network programming from a parent station and originating local programs from its own studios. Satellites are allowed—even fostered by relaxation of certain FCC rules—so that TV service may be provided in areas where it may not otherwise exist.

More specifically, a satellite is a TV station licensed to serve a specific area or community by rebroadcasting all or part of the program schedule originated by a parent station. A *pure* satellite does not originate *any* programming; however, a station which originates some programming of its own—even as much as 10% or more—is still generally regarded as a satellite so long as it depends to a large degree on a parent station for the bulk of its programming. In broad terms, "satellite" may describe almost any type of operation between a simple translator and a full-time independent (though not necessarily non-network) TV station.

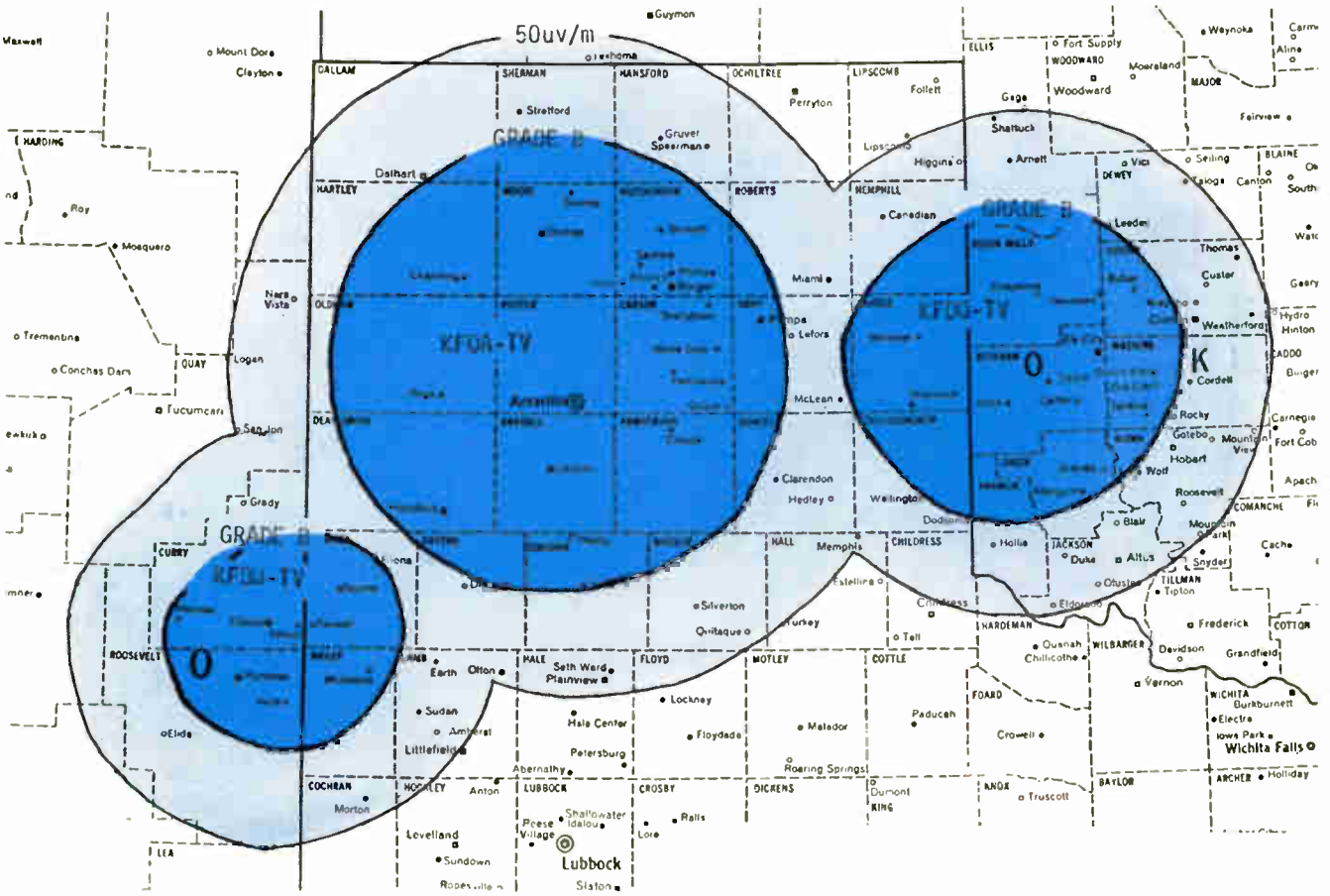
The most significant technical difference between a satellite and a translator is the legal operating power; a satellite may be licensed to radiate as much power deemed necessary to serve a proposed area, considering terrain, propagation, and other area characteristics. On the other hand, a translator usually operates with a maximum power of 5 watts, except those assigned to channels allotted to a particular community, in which case uhf translators may operate with 1 kW and vhf with 100 watts. Whether or not a satellite originates local programming has no bearing on its assigned channel or operating power.

FCC Regulations

Actually, there are few FCC "satellite rules," as such. This



Relative Grade B coverage of 316-kw KAKE-TV Wichita and 87-kw Channel 13 satellite KUP-K Garden City, Kan. The satellite uses a 10-kw transmitter which feeds a 12-bay superturnstile antenna mounted atop an 800' tower. A 6-hop microwave system is used to relay the parent signal.



KFDA-TV Grade C satellite signals overlap the 316-kw parent signal. KFDW-TV (ch. 12) Clovis, N.M., operates with 30-kw erp antenna 210' aat) 100 miles from Amarillo; KFDO-TV (Ch. 8) radiates an effective power of 26-kw (antenna 580' aat) 118 miles from the parent. Each satellite has a 5-kw transmitter and 6-bay batwing antenna.

is largely because there is little difference in basic allocation rules, i.e., rules which determine operating frequency and power, for TV stations and satellites. In fact, most technical rules apply to a TV facility whether it is called a satellite or not. Significant differences arise solely from the standpoint of the service to be provided, and this is based on the existing need in the community under consideration.

If an applicant (not necessarily the licensee of an operating TV station) wants to build a satellite operation, he must prove the community need for such service. Satellite stations are encouraged by the Commission as a means of promoting TV in communities which might not be expected to have, in the near or forseeable future, a primary service; this has been the sole reason for liberalization of the rules. Where another station is already providing some local service, a *pure* satellite is not encouraged. The goal of the FCC is to get something going in as many localities as possible, providing the best available community service. It is not impossible to prove that an additional pure satellite service is needed in any community, but the Commission likes to see as much local origination as possible. Also, where there is an established satellite — particularly one active in local origination— additional allocations usually are not granted due to competitive community economics. The basic reasoning behind satellite operations is to foster the growth of community TV, not to indiscriminately license stations in difficult competitive markets. If the FCC is faced with a decision between two applicants for a facility, where one intends to originate local programming and the other intends to operate as a pure satellite, the first will surely win the grant, all other factors being equal.

Channel Allocation

Usually, satellites operate on the channel listed in the FCC's Table of Assignments for that community. If the Table shows that a channel is assigned to a city or town in the desired area, the allocation may be used anywhere within a 15-mile radius. If there is not an allocation for a desired area in the Table of Assignment, an applicant must file a petition for rulemaking, accompanied by engineering data showing compliance with separation rules, etc., to have a channel reassigned.

In May 1966, KFDA-TV Amarillo, Tex., began a satellite operation on Channel 8 in Sayre, Okla., an allocation previously assigned to Elk City. Since Sayre is within 15 miles of Elk City, the channel could be used in Sayre. The situation was not quite so simple for KAKE-TV Wichita, Kan. They filed an application for a satellite to operate in Garden City, Kan., on the Channel 9 allocation listed for that community. Upon learning of KAKE-TV's action, the Kansas Educational System Committee filed a statement with the Commission asking that Channel 9 be reserved for ETV. Rather than oppose the Committee, KAKE-TV petitioned for, and was granted, reassignment of Channel 13 to Garden City. Of course, channel reassignment procedures increase delay and initial expense considderably.

If an applicant indicates an intention to eventually provide local service, the FCC will consider granting a translator license on an assigned channel. In applying for a translator station, an ap-

Market Considerations for a Satellite

Let's assume that a station licensee in a community of 100,000 or more sees the possibility of providing either a primary or even a secondary service to another community located anywhere slightly beyond his B contour—as distant, perhaps, as 200 miles. What basic factors must he consider? If he will provide a primary service, how many homes can he expect to add to his present circulation? By what percentage will these added homes increase total circulation? In the parent community he may have an average daily circulation of 25,000. If a potential of 7,000 homes exists in the proposed satellite area, he could conceivably increase total circulation by about 21%, certainly a sizable and worthwhile increase. If his service is in addition to either an existing local facility or strong off-air signals, the matter may not be so clear-cut.

If the satellite will provide a primary service, will viewers be able to receive the signal? If the satellite will operate on uhf, and if viewers have only VHF will they erect UHF antennas? Or, if viewers have CATV service (and consequently no outside antenna), will they install an antenna? Will the CATV system carry the satellite signal? Unless there is a definite "yes" to at least one of these queries, concrete plans should be made to ascertain what will be required to get the signal into viewers' homes, the amount this effort will add to the initial investment, and to what extent it may affect the eventual outcome of the whole operation.

Is there a channel assigned to the community, or to another within a 15-mile radius? If not, it will be necessary to file for reassignment, which adds to the overall cost.

How will the parent signal be relayed to the satellite? In most cases, an off-air pickup is not satisfactory. Some stations microwave the signal the entire distance with multi-hop repeaters (as many as 5 or 6); some erect a receiving station within the parent's Grade B contour and microwave the signal from there, eliminating 1, 2, or perhaps 3 repeaters. Telephone company facilities can also be used, but the cost of a leased line should be compared to the initial investment for other means of transporting the signal. Terrain will, of course, bear heavily on the relative simplicity or complexity of relaying the parent signal.

If local programming is to be provided by the satellite, both initial costs and routine operating costs will be greater, although simple studio facilities for news, weather, and sports (plus remote pickup, perhaps) can be held down to a reasonable figure. To operate a pure satellite with 2 or 3 employees, monthly costs would be in the neighborhood of $3,000; with a shorter broadcast day, it is possible to get by with one full-time and one part-time employee, resulting in a lower payroll. If local programming is undertaken, monthly overhead can double or possibly even triple. This means, obviously, that the additional revenue will have to come from more regional and national advertisers or the parent station and/or local satellite advertisers, or from an overall increases in rates, or some combination of these possibilities.

plicant can get his foot in the door at a much lower cost, then expand the operation to one which will provide a greater service at a later date. There is usually no set time limit for expansion; however, if an assigned-channel translator licensee procrastinates for what seems to be an unnecessarily long time, he could lose the allocation. At license renewal time, another applicant may cross-file for the same allocation, showing an intention to provide better service. In the interest of the community, the Commission will, in such cases, usually decide in favor of the opposing applicant if the present licensee refuses to provide a comparable service.

It all boils down to the fact that the FCC wants to see every community have the best possible TV service; if it appears that a licensee is simply trying to hold an allocation, the Commission will give it to someone who will provide the service—upon evidence of suitability, of course.

VHF or UHF?

In most areas, obviously, new satellites operate on uhf channels since most vhf allocations have been spoken for. From a technical standpoint this fact presents few problems, thanks to improved equipment and super power. The real rub is that potential viewers in many areas can't *receive* a uhf signal; even those with all-channel sets may not have a uhf antenna. In an all-vhf area, why would they? Unfortunately, this fact has been overlooked in some cases, and — sans an extensive promotional campaign — a majority of TV set owners aren't going to go out and buy a new antenna simply because there's a new station in town. The only reason most set owners would have to install a new antenna—especially in areas with some local service — would be if the new station provided the only signal, or the only really good signal, they could get.

Therefore, for any satellite proposing to operate on a uhf channel — especially in any area where there is already any kind of TV service, off-air or CATV —the trick is getting potential viewers to install uhf antennas. If there is no clear-cut answer to this problem, and the satellite applicant is not equipped or prepared to invest in an extensive promotional campaign, it would be very wise for him to get some precise facts about the community before going in too deep. Even a megawatt uhf signal is useless when the majority of homes in the community aren't equipped to receive the signal.

If a proposed satellite will be a primary service, it will have a good chance of being accepted in the community; many TV set owners would want to receive *local* programming. If, however, a CATV system is already providing the local programming that might be carried on the satellite, the problem may still exist. In this case, the only alternative is to try and provide a service which CATV can't or won't. In some cases, it might be possible for a satellite and a CATV system to embark on a joint local programming effort and provide cable subscribers with the satellite signal. In cases where network program duplication would be rather extensive, this approach may not be too advantageous (unless the satellite and CATV system were mutually owned).

Under these circumstances, even the most stalwart operation can be forced out of existence. The KIMA-TV uhf satellite in Moses Lake, Wash., was forced into darkness after a very trying period of competition with cable-supplied programming from all 3 networks. Viewers in Moses Lake were reluctant to invest in uhf antennas and converters since they were able to get a satisfying program diet off the cable. At the time few people had all-channel sets; however, the problem of getting set owners to spend the comparatively few dollars necessary for a uhf antenna would have been difficult at best.

In such cases, the only obvious salavation would be to offer some type of service for which there is an overwhelming demand and which is not supplied over the cable system. In most areas, this would take some doing—requiring a type of service extremely vital to the community and yet too expensive to be produced by a cable system operator. One answer might be a vast, comprehensive news organization operating in the entire area covered by the satellite's signal (and very probably a much larger area than that covered by CATV). This, of course, requires that a minimum revenue potential must exist in either the satellite area or in the value of added parent signal circulation. If a new satellite is going to get people to spend money in added receiving equipment, it is perfectly logical to expect that the station will have to offer programming service which is not already available. This cold fact should convince even the most idealistic broadcaster that operating a satellite successfully involves a lot more than just plugging in a remote transmitter.

Signal Overlap

Where the need exists, FCC Rules are sufficiently liberal to permit overlap of parent and satellite signals; however, the extent of overlap allowed is always considered on a case-by-case basis. For a pure satellite (no local programming) there is virtually no limitation, except, of course, where a rather extensive area—with respect to areas separately served by the satellite and its parent — would receive both signals. If rather extensive local programming is anticipated, the matter of overlap definitely warrants consideration, again, on a case-by-case basis, just as it would be considered between two mutually-owned stations. If an existing pure satellite begins extensive local programming (10% or more)—even eventual autonomous local programming — the overlap could become a serious matter and fall under jurisdiction of the duopoly rules. In such cases, however, the FCC will permit the use of directional antennas — within prescribed lobe-to-null radiation ratios — to reduce the overlap to tolerable limits.

It is conceivable that a station with a satellite active in local programming could encounter difficulty in increasing the parent signal coverage at some future time, due to mutual ownership overlap. It is possible that a directional antenna would be allowed in this case, too, if lobe-to-null radiation ratios are observed. The problem would be almost identical to that of two nearby mutually-owned stations who were attempting to increase coverage of either one or the other to the point where there would be illegal overlap. Even under these circumstances the Commission has permitted the use of DAs. (WALB-TV Albany, Ga., is one example.)

Mileage separation between parent and satellite operations is not specified; however, it's obvious that a satellite would not be permitted to locate too close

to its parent, unless terrain or other local conditions proved the necessity. Nor are there restrictions as to how far a satellite may be located from the parent. KAKE-TV's satellite KUP-K is 175 miles away, while KIMA-TV (Yakima, Wash.) operates its satellite, KEPR-TV Pasco, Wash., only 90 miles away.

Balancing Service and Income

The purpose of a satellite operation is to provide a service; however, in some way it must produce enough additional revenue to amortize the investment and sustain operation. Hopefully, there are several ways in which a satellite can—directly and indirectly—help support itself. The added parent signal circulation should interest more regional and national advertisers, and at the same time, increase the value of all time classifications to such accounts. Then, too, most satellite markets—if they are big enough to justify a satellite—should produce some revenue from the local community. For example, the Clovis satellite added 36,000 homes to KFDA-TV's circulation, a 22.4% increase. Fifteen accounts were sold in the satellite community, with no local origination. This was not accomplished entirely without competition, since there is another off-air signal plus 2 CATV systems in the market. KIMA-TV satellites in Pasco, Wash. and KLEW-TV Lewiston, Idaho added 64,000 homes to the parent signal circulation, an increase of 142%. On a local sales basis, each station operates independently; each originates news and local spot announcements and is capable of any required local origination. In both markets, Spokane CATV signals are available, but this has never created a problem, much less now with prohibitive nonduplication.

Local program origination will depend, of course, on the market itself and /or the ease with which parent facilities could be expanded to serve local interests. If the distance between parent and satellite is not formidable, local news and video-taped remotes could be produced without the necessity for local studios; in some areas, though, even 75 miles can be formidable. A satellite applicant must always bear in mind, however, that he had better not rest on his laurels, comforted by the belief that local origination is not feasible. If he does, another interest with more daring may find it appropriate to prepare a cross-file at license renewal time.

Costs

Satellite construction costs will, of course, vary; anyone who has built a TV station is quite familiar with those variables: site acquisition, location, power, etc. There is one variable which must not be overlooked at the outset, however, one which doesn't usually enter into the picture in station construction. Depending on distance and terrain, the task of transporting the parent signal to the satellite can be expensive. In most cases, a multi-hop microwave link or a leased line is required since the satellite transmitter is not located within satisfactory parent signal levels. KFDA-TV has an initial investment of $400,000 in the Clovis satellite and $350,000 in the Sayre operation; neither include the microwave systems used in both cases for signal transport. If program origination is to be included in initial plans, this item can outrank all other costs. It is, of course, possible to equip a small studio with necessary gear at a modest cost.

Initial investment isn't the only consideration; operating costs vary, depending on the number of personnel and the extent of local program origination. Without local programming, operating costs are obviously lower. Each KFDA-TV satellite has one part-time and 3 full-time employees with a $3,000 monthly overhead. The KAKE-TV satellite, which originates up to 10% of its programming, employs an average of 15 people.

Even though there is little official terminology in legitimate broadcast authority, the purpose and need for satellites is indisputable. Were it not for satellites, many areas would presently be without local TV service; in fact, there are many communities where local TV would be economically impossible if satellites were not permitted. Then, too, there are some cases where a *parent* station's existence may be solidified by *supporting* satellites located in smaller surrounding communities, forming a sort of regional network with one major programming facility. By allowing satellite operations, the Commission is doing everything possible to foster local off-the-air TV service for virtually every community in the country. ●

Facts About Satellites

What is a Satellite? A TV station licensed to rebroadcast the programming of a parent station. Differs from a translator in that satellite power limits are much higher; satellites may also originate some programming.

Does FCC encourage satellites? Yes, when it appears that a satellite is the only means by which a community will have TV service, or when it provides an additional service in communities where the additional service would be beneficial and would not create a difficult competitive situation.

Who may operate a satellite? Any TV station which can show that it will provide a presently unavailable service to a community. Satellite owner doesn't have to be a station owner, necessarily; satellite could, conceivably, make some sort of arrangement with another station to rebroadcast its programming.

On what channels do satellites operate? Usually on the channel allotted to the community; an assigned channel may be used within a 15-mile radius. If none is allocated, a petition must be filed for a channel reassignment.

Is overlap permitted? Yes. Rules which regulate mutually-owned facilities do not apply to a pure satellite. However, if extensive program origination is anticipated or begun after satellite has been in operation, the situation can change, making duopoly rules applicable. Always decided on a case-by-case basis.

Programming? A pure satellite does not originate any programming. The Commission hopes that a satellite will, as soon as economically possible, originate at least some local programming such as news, weather, sports, etc.

How to turn an ordinary color television set into a highly useful monitor for $195.00.

Money-saving engineering ideas are what put International Nuclear in business. Pre-testing the ideas by in-station use is what guarantees you of the practicality of the ideas. Take the TVM2 Video Modulator pictured above, for example. This self-powered, printed circuit unit (completely transistorized) accepts composite monochrome or color signals and feeds the signals into the IF circuit of any TV receiver, at a frequency of 45.75 megacycles. The TVM2 is simple to install.

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Circle 25 on Reader Service Card

BROADCAST EQUIPMENT

"Super-Cardioid" Mic

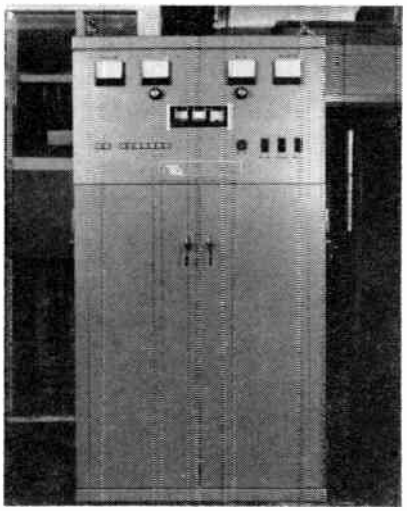
A dynamic, "super-cardioid" mic has been introduced by Electro-Voice, Inc., Buchanan, Mich. The RE-15 is said to have a frequency response independent of angular location and therefore generates no off-axis coloration; greatest rejection, up to 26 db, is at 150° off-axis. Frequency response is 60 to 15,000 Hz; output is −55 db; a bass tilt switch

is incorporated to help overcome "boomy" acoustical conditions. Nonmetallic "Acoustalloy" diaphragm eliminates noise generated by AC lines cable friction, and mechanical shock. Satin nickel finish eliminates reflections for on-camera use under bright lights. Price is $153, including high quality broadcast type cable and model 310 stand clamp.

Circle 101 on Reader Service Card

Translator Amplifier

Townsend Associates Inc., Feeding Hills, Mass. is offering a 1-kw air-cooled UHF klystron translator amplifier. Model TA-10000TLA is designed for unattended operation and requires less than 3w drive. Aural output is 100w; frequency response is flat within 2 db over 6 mHz channel. Harmonic radiation with filters is said to be better than 60 db below visual carrier; spur-



ious radiation and intermodulation with filters is better than 50 db below visual carrier. Price is $19,950.

Circle 100 on Reader Service Card

Projection CRT

A "watering can" shaped projection cathode ray tube said to produce a light output of 36,000 ft. Lamberts has been introduced by Raytheon Components Div., Lexington, Mass. CK1419P31 incorporates liquid phosphor cooling with electron gun set at an

angle resembling the spout of a watering can. After projection through a 5" window on a 3 x 4' screen, brightness is 50 ft. Lamberts. Rated operating life is 500 hours; price range is $2,000-3,000.

Circle 99 on Reader Service Card

Trencher

An 18-hp 4-wheel drive trencher with 3 digging chain speeds, plus reverse, is available from Charles Machine Works, Perry, Okla. As standard equipment the J20 Ditch Witch has a hydraulically operated backfill blade, variable hydraulic drive while digging, and 23 x 8.50 x 12 bar-lug tires. Digging capacity is up to 5-ft. depth

and 12-inch width. Special adaptations include an offset pivot assembly to permit digging flush against buildings or guard rails. The chain reverse allows the machine to back off from obstacles without removing the digging boom from the trench. Attachments include the Roto Witch horizontal boring tool.

Circle 98 on Reader Service Card

SCA Generator

Moseley Associates, Santa Barbara, Cal. has developed a solid-state SCA subcarrier generator with automatic all-electronic subcarrier muting and front-panel

override. SCG-4T is prewired for radio remote control and has a front panel meter designed to read peak modulation; meter calibrated directly in kHz deviation.

Circle 97 on Reader Service Card

CATV Taps

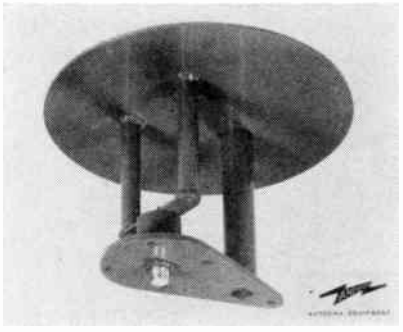
Viking Industries, Hoboken, N.J. has introduced two pressure taps consisting of a 2-piece standard

nut-and-bolt messenger clamp with mushroom head and 2-piece pressure tap. Combination set is designed to reduce cable wear and moisture by having the housedrop connected to a separate messenger clamp. Taps are isolated by over 19 db. Models 402 and 403 will accept all common cable sizes.

Circle 96 on Reader Service Card

VHF Mobile Antenna

Andrew Corp., Chicago, has developed a VHF antenna designed for low profile mobile applications. The 11⅞" diameter Type 25714 mounts 6 13/16" above vehicle roof by five 3/8" bolts and requires a 1½" connector

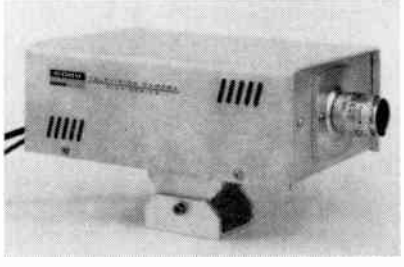


hole. Operating in the 158 to 168 mHz frequency range, the unity gain folded monopole provides a horizontal pattern within 1/2 db of omnidirectional. VSWR is 1.5; impedance is 50 ohms. Price is $40.

Circle 95 on Reader Service Card

CCTV Camera

A self-contained TV camera has been announced by Cohu Electronics, San Diego, Cal. The 4100 Series has all-silicon solid-state circuitry and 75-ohm output. Automatic sensitivity adjustment is said to provide unattended operation over an illumination range greater than 5000:1 with



highlight intensities as low as 10 ft. Lamberts. The 6 lb. camera mounts with standard tripod screws and will accept a standard 16mm C mount lens. Including vidicon and lens, price is $750.

Circle 91 on Reader Service Card

MATV Amplifier

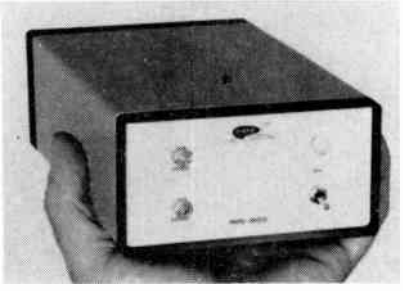
Jerrold Electronics Corp., Philadelphia, Pa. has announced a solid-state MATV amplifier reported to provide a minimum gain of 40 db with flat response across VHF and FM bands. Gibraltar

Model 3660 is capable of handling over 100 outlets and can be used for 12-channel operation. Output is 50 dbmv per channel for 7-channel operation; gain control is 10 db; impedance is 75 ohms; noise figure is 9 db.

Circle 94 on Reader Service Card

CCTV Equipment

Dynair Electronics, Inc., San Diego, Cal. has introduced a series of solid-state CCTV equipment. Called the Mini-Series, it consists of audio-video modulators, distribution amplifiers, and switchers. Also included is equipment to link camera, VTR, and audio source to monitors or stand-



ard receivers. All units are self-contained, measure 2½" high, 4¾" wide, 8" deep, and can be placed on a shelf or mounted vertically or upside down; a 3-unit rack-mount panel is available. Lowband modulator is priced at $170.

Circle 90 on Reader Service Card

CATV Amplifiers

Ameco, Inc., Phoenix, Ariz. has developed a series of all-band CATV mainline amplifiers. Called Pacesetter, the solid-state equipment employs universal housing and unitized circuit assembly said to permit 45-sec. installation or change-out. Circuit assemblies plug-in to housing which accepts all amplifiers in

What do all three Omaha TV Stations have in common?

(Raytheon's Dual-Link II)

Omaha's gone Raytheon in a big way! Each of the network affiliate stations — KETV, KMTV, WOW-TV — now uses Raytheon's Dual-Link II to provide continuous transmitter monitoring, automatic switchover, and duplicated receiver protection. The 1 Watt hot standby STL ends worries about the added demands of color transmission.

The unique design of Raytheon's highly reliable Dual-Link II permits maintenance of one complete STL System during regular programming hours . . . program interruptions are eliminated. Exclusive pull-out drawers provide easy in-service access to all functional modules . . . no extender cards or complicated test cables necessary. Dual-Link II can be supplied with up to four 15 kc program audio channels and is expandable to a completely automated STL system at nominal cost. Naturally, it exceeds all NTSC color standards.

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Company_____

Address_____

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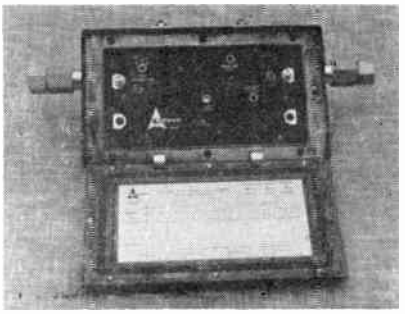
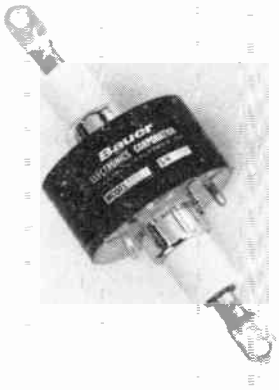


the series, including PSM mainline, PSMB mainline-bridger, PSA mainline with AGC, PSB bridger and PSE extender. PSM features 28 db maximum gain; operating gain is 22 db. Maximum noise figure is 17 db; gain control is 3 db. Housing can be mounted vertically or horizontally with double strand clamp and will accept .750, .500, and .412 cable. Operates within 20-36v AC.

Circle 89 on Reader Service Card

Phase Sampler

A broadband AM antenna phase sampler has been introduced by Bauer Electronics Corp., San

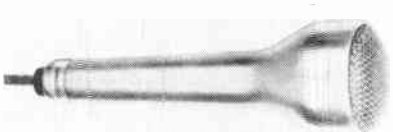


Carlos, Cal. Model 180 is 7" long and can be mounted within almost all DA coupling units. Price is $165.

Circle 88 on Reader Service Card

Dynamic Mic

Electronics Applications Div., Sonotone Corp., Elmsford; N.Y. has added a series of dynamic mics to its present lines. Seven models are available in 200-, 600-, 10,000-, and 50,000-ohm impedances. Diaphragms are made



of polyester film and cartridge cups are encased in rubber sleeves. The Model D-10 (shown) is equipped with a table/lavalier stand, shielded cable, and phone plug.

Circle 93 on Reader Service Card

ETV Studio

An educational TV studio package has been announced by Packard Bell Space & Systems Div., Newbury Park, Cal. Designed to fit in a room as small as 24x25 x8', studio includes 6 model 920 live cameras, 16mm film chain, 35mm slide chain, motorized writing scroll, video cart, on-air and preview monitors, automated lectern, auxiliary control console, lights and scaffolding, cables and connectors, lavalier mic, digital

clock, background drape, tape punch, tape reader in rack cabinet, sync generator, distribution amplifier and video sync mixer. By punching camera sequence on paper tape in advance, the teacher can operate all equipment with a single hand-held control button and move around at will. An auxiliary console is available; options include a VTR, viewfinder camera, and EIA sync. Price is $22,000.

Circle 92 on Reader Service Card

Tape Accessories

Three audio tape accessory items are available from Eastman Kodak, Rochester, N.Y. Items include: ¼" Presstape pre-cut splices which eliminate trimming; a leader and timing tape with provision for write-on identificaton and the numerals 1 and

Announcing...

for color and black and white, the new family of RCA image orthicons with a *big difference here* that *shows up big here*

Now RCA brings you the "BIALKALI PHOTOCATHODE" in the new RCA-8673 and -8674 Image Orthicons. This major engineering innovation has greatly improved compatibility with its non-stick target, maintaining resolution and sensitivity over an extended tube lifetime and improving performance of *existing* color or black-and-white cameras. A simple change in a resistor chain provides proper voltages for a trio of these new Bialkali Photocathode Tubes. Wide-range, the 8673 and 8674 fit spectral requirements of all three channels... eliminating the need for another tube type for the blue channel.

Another big difference: the re-designed image section provides reduced distortion and freedom from "ghosts." These new tubes are available singly or as matched sets—a trio of 8673/S or 8674/S types for color service... types 8673 and 8674 for black and white. Main construction difference is in the target-to-mesh spacing. The closer-spaced 8673 enhances S/N ratio for quality performance under sufficient illumination. The 8674 has greater sensitivity under limited illumination. For complete information about the new RCA Bialkali Photocathode Image Orthicons, ask your RCA Broadcast Tube Distributor.

RCA Electronic Components and Devices, Harrison, N.J.

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For color pick-up,	
If you're now using...	You can replace with:
4513/S 7513/S	8673/S
For black & white pick-up,	
If you're now using...	You can replace with:
4513 7513 7513/L 8093A 8093A/L	8673
UNDER LIMITED LIGHTING LEVELS	
For color pick-up,	
If you're now using...	You can replace with:
4415S 4416S	8674S
For black & white pick-up,	
If you're now using...	You can replace with:
7293A 7293A/L	8674

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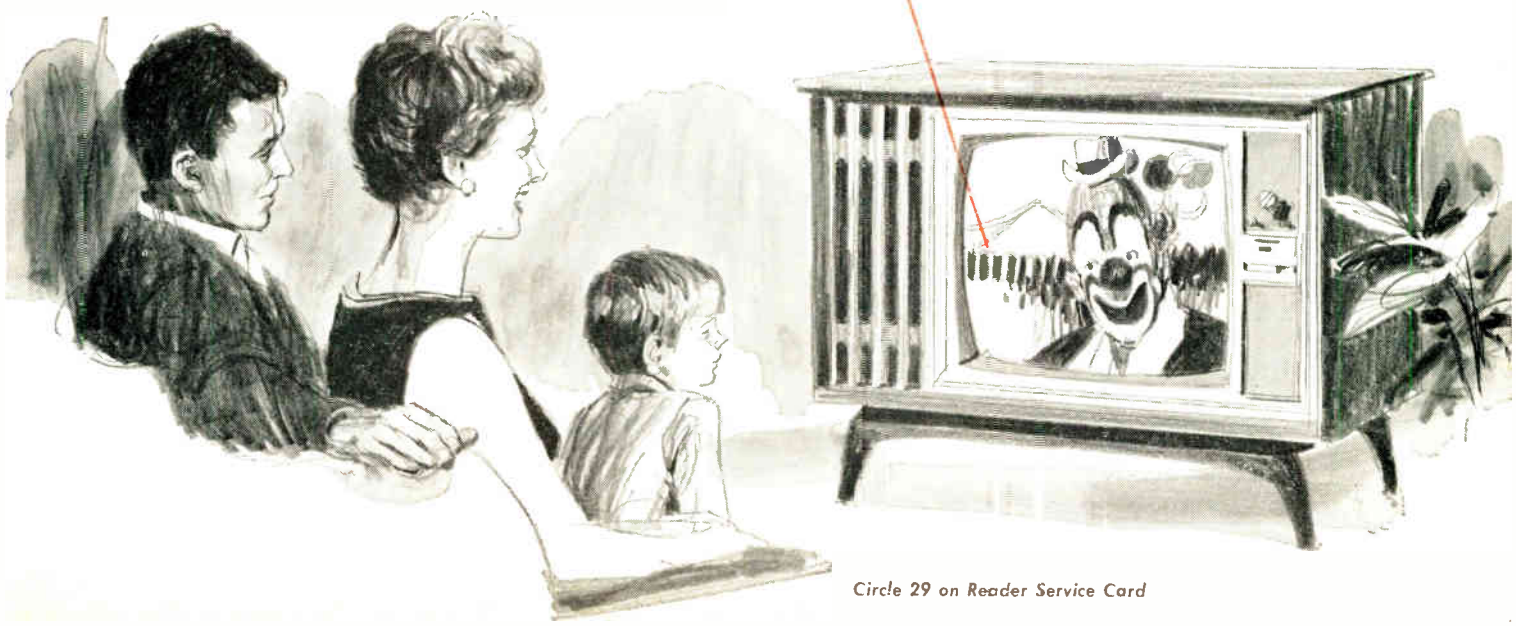


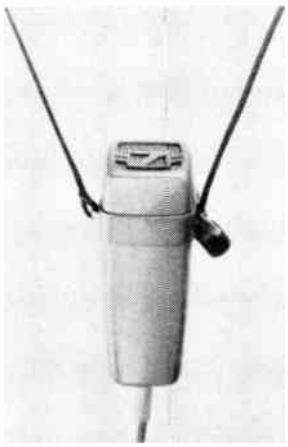
Circle 29 on Reader Service Card

2 printed every 7½"; and a 5 x 1¾" timing guide notched at one end for use with any type sound tape.

Circle 87 on Reader Service Card

Lavalier Mic

Sennheiser Electronic, N.Y.C. has announced a professional lavalier mic specially-shaped response curve and noise-isolating double housing. MD 214 is designed to pre-emphasize high frequencies and to eliminate muffled sound usually encountered with lavalier



mics due to chest resonance in 700 Hz region. Transducing assembly is secured to an inner housing compliantly suspended from outer housing. Equipped with permanently connected 30-ft. cable, price is $110.

Circle 86 on Reader Service Card

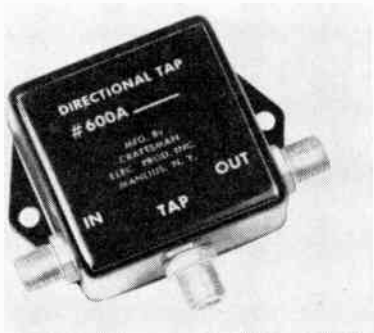
RF Microwattmeter

An RF microwattmeter designed to measure CW power from 0.01 microwatt to 10 milliwatts full-scale has been developed by Boonton Electronics Corp., Parsippany, N.J. Model 41A operates in frequency range of 0.1 mHz to 6 gHz and has maximum sensitivity of 0.001 microwatt per hour; no zero balancing is required on any but most sensitive range. VSWR is less than 1.2 up to 2.5 gHz and less than 1.5 to 6 gHz; accuracy is said to be ±0.5 db. Meter scale is calibrated in microwatts and dbm. Power detector is equipped with type N connector for 50-ohm system Price is $695.

Circle 85 on Reader Service Card

CATV Directional Coupler

Craftsman Electronic Products, Manlius, N.Y. has announced an indoor directional coupler for CATV and MATV. 600A is available with 10, 14, 18, 22, 26, and 30 db tape attenuation and features high return loss on input,

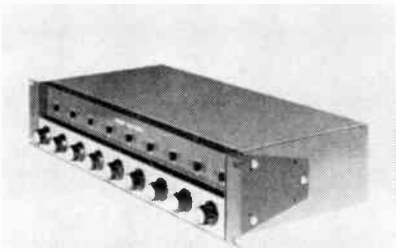


output, and tap terminals. Surface-mount tap features MF-61A fittings for through-coax and tap-off line and may be combined with 2- and 4-way splitters. Price is $7.95 including connectors.

Circle 84 on Reader Service Card

Mic Mixer

A solid-state mic mixer has been introduced by Langevin, Santa Ana, Cal. Model AM2A employs 4000 Series plug-in cards and has 9 low-level inputs with low-impedance preamp modules and one booster amplifier. High-impedance preamps, high-level bridging cards, strapping cards, and blank cards are available. Each channel is equipped with XLR connector, mixer control,



and speech-music switch. Compatible with the AMIA mixer-amplifier, insertion of the AM2A into the "wild input" provides 15 individually controlled low-level inputs. Price is $480.

Circle 82 on Reader Service Card

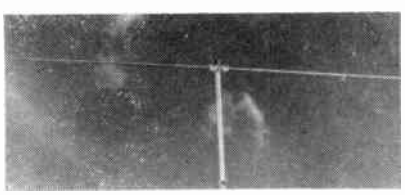
Image Orthicons

RCA Electronic Components, Div., Harrison, N.J. has announced the development of two image orthicons for color and monochrome use. Redesigned image section is said to provide reduced distortion and freedom from ghosts, permitting a more closely matched 3-tube set. Photocathode is a bialkali combination with an efficiency high enough to eliminate the need for an S11 tube in a color trio. Image section and photocathode are combined with a non-stick glass target, field mesh, precision construction, and electron gun and dynode assembly. Types 8673 and 8674 differ in mesh and target spacing, 8673 has a target-to-mesh capacitance of about 200 pf; the 8674 has a similar capacitance of about 100 pf. Both carry a 1200-hour warranty.

Circle 81 on Reader Service Card

VHF Antenna

A VHF antenna designed for full halfwave, omnidirectional, vertically-polarized transmit/receive purposes is available from Cush Craft, Manchester, N.H. "Trik Stik" is adjustable from a chart for 30 to 50 mHz and



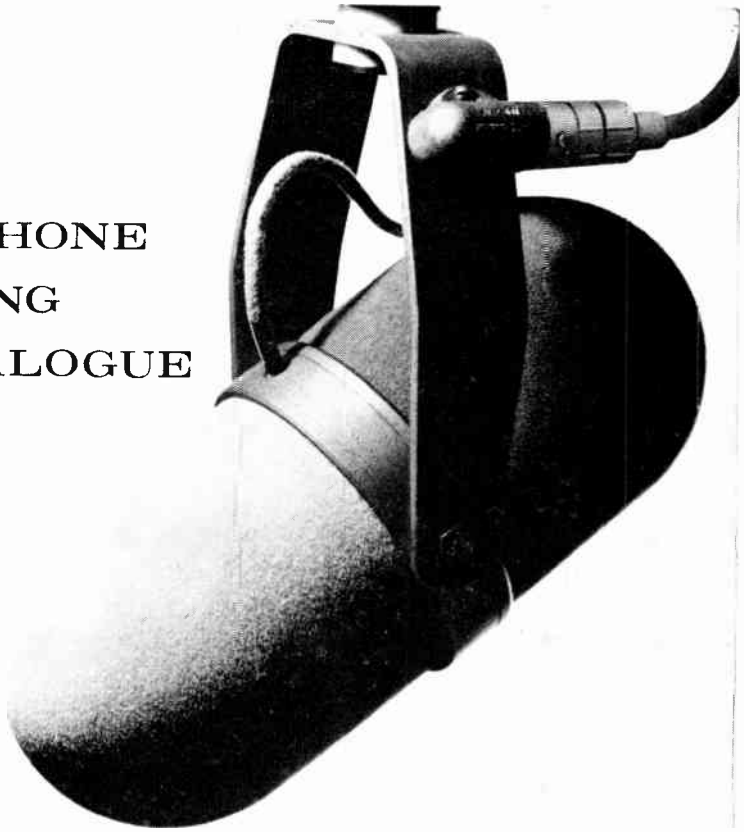
gives multiple half waves in phase for up to 5 db gain with a cloverleaf pattern in the 130 to 178 mHz range. Antenna will handle up to 100w RF and is priced at $6.45.

Circle 83 on Reader Service Card

Portable Quartz Lights

Two battery-operated quartz-iodine portable studio lights have been announced by Berkey Technical Corp., Burbank, Cal. Both models use a 30v 250w ColorTran quartz lamp operating at 3400° K; handle base has a ¼-20 threaded mounting bushing. Model LQ-

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
¾" 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 SM5D
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.

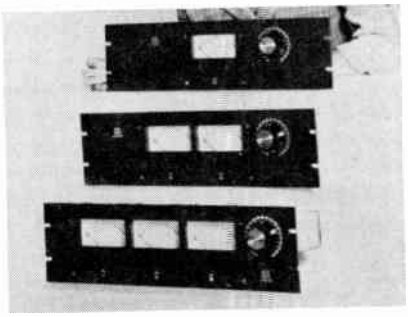
Circle 34 on Reader Service Card

3 provides full focusing from spot to flood and weighs 2 lbs. 10 oz., produces 220 ft. candles at 10′ in spot focus and 56 ft. candles in flood focus. Model LQK-3 is a medium flood with fixed focus; weight is 1 lb. 12 oz. and it produces 160 ft. candles at 10′. 30v nickel-cadmium battery (Model PBC-30/2) with detachable charger will permit 30-min. operation from fully-charged battery.

Circle 80 on Reader Service Card

VU Panels

VU-meter panels available in 1, 2, or 3-meter configurations have been announced by Altec Lansing, Anaheim, Cal. Each model has a precision potentiometer associated with each 4″ meter. The VU extender, a bridged-T attenuator, positions to 1 mw, +4 dbm



to +40 dbm in 2 db steps, plus a reference setting of 0 dbm (1 mw across 600 ohms) and off. Circuit is designed to bridge 600-ohm line.

Circle 79 on Reader Service Card

Degausser

An automatic degausser designed to erase either ¼″ tapes or Cue-Mat magnetic mats is being marketed by Ampex Corp., Redwood City, Cal. Model AE-100 will handle reel sizes from 5″ to 12″ and will erase a 12″ reel of tape or up to 100 mats in 50 sec., then automatically cut off. Heavy duty magnets and automatic motor

EIMAC

250 kW tetrode now ready for tomorrow's super-power transmitters

The EIMAC 4CV250,000C is the world's highest power tetrode. It is designed for service in super-power broadcast transmitters, and was developed on the foundation of technology which produced its "little brother," the hundred-kilowatt 4CV100,000C, now used by the USIA. The giant new vapor-cooled tube combines high power gain with long life. Vapor cooling is accepted as an efficient and economical method of cooling in advanced broadcast systems. As EIMAC's latest addition to its line of power tetrodes, the 4CV250,000C is ideally suited for service as an audio modulator, a pulse modulator, or a regulator, and as an rf amplifier in linear accelerators. Ready now for the super-power transmitters of the future, this 250 kW tetrode is another example of how EIMAC's experience in power tube technology paves the way for the developments of tomorrow. For a power tube to fit your needs—big or small—write Product Manager, Power Grid Tubes, or contact your nearest EIMAC distributor.

TYPICAL OPERATION
(as a Plate-Modulated Power Amplifier at Frequencies below 30 MHz)

DC Plate Voltage	14 kV
DC Screen Voltage	800 V
Peak AF Screen Voltage (for 100% Modulation)	800 V
DC Grid Voltage	−800 V
DC Plate Current	29 Amps
DC Screen Current	3.6 Amps
DC Grid Current	1.8 Amps
Peak RF Grid Voltage	1200 V
Grid Driving Power	2.5 kW
Plate Output Power	292 kW

EIMAC
Division of Varian
San Carlos, California 94070

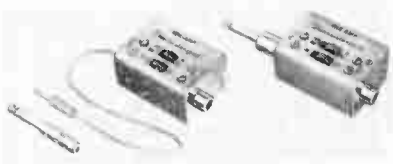
Circle 36 on Reader Service Card

drive provide a 75 db erasure level. Unit weighs 27 lbs. Price is $185.

Circle 78 on Reader Service Card

Mix-Amp Preamps

Two high-gain audio preamps designed for internal DC operation have been announced by Switchcraft, Inc., Chicago. Miniature solid-state Mix-Amps are said to provide uniform gain from 20 to 20,000 Hz. Models 503 and 504 have an impedance switch allowing selection of a

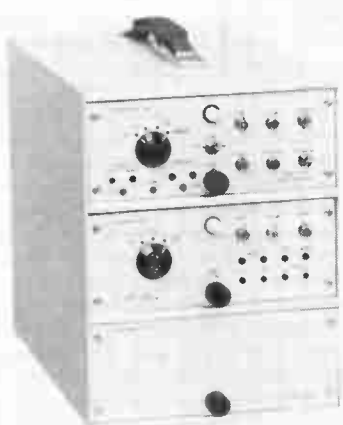


2k-ohm low-impedance output with 25 db gain and a 35k-ohm high-impedance output with 6 db gain. Standard AA penlite cell provides up to 1000 hours operation.

Circle 77 on Reader Service Card

Color Pulse Generator

A color pulse generator designed to produce a 20T-pulse test signal for luminance-chrominance gain ratio and envelope delay measurements has been developed by Videometrics, Brightwaters, N.Y. Model 314A also produces a sine-squared T-pulse and window for linear distortion measurements and will operate in either full field or vertical mode. Test signal is said to combine both high and low frequency signals into a composite waveform in such a way that gain or delay variations of system under test will produce waveform distortions observable on existing scopes. The solid-state self-pow-



MODEL FM-I FIELD STRENGTH METER

Input	75 ohm F type connector
Accuracy	± 1.5 db All TV channels
Voltage Range	10 microvolts to 1 volt
Db Range	—30 to + 60 dbmv
Frequency Coverage	Ch 2 to Ch 13 One Range
Batteries	(2) 9 volt 2mn6 (meter)
	(2) "C" cells (pilot lamps)
Voltage Scale	one
Db Scales	four
Measurement Method	True peak value of sync pulse
Weight including carrying case	5⅛ lbs.
Size without case	4¼" x 5" x 5¾"
Size with carrying case	4¾" x 6½" x 7"
Carrying case	Genuine Leather

$295.00

Complete with carrying case and batteries.

Video Instrument Corp.

The Model FM-1 is completely transistorized and has many advantages over meters now being used for CATV. The circuit is extremely stable through use of silicon transistors of an industrial grade. Shielding is thorough and complete, certain areas are double and triple shielded. Microammeter is one of the finest types available. Illuminated meter and dial are powered by a separate "C" cell batteries. Video detector output is provided for oscilloscope monitoring of video. Bandwidth is limited only by the .5mc I.F. carrier. (Earphones not supplied.) Image rejection is quite good, and error due to side channel overload is minimal due to the use of a double tuned bandpass filter that tracks with the oscillator across the dial. The carrying case is constructed of genuine leather, the same thickness as the ¾" shoulder strap and is lined with velvet covered board for added strength and rigidity. A snap holds the cover completely open in either horizontal or vertical position.

AVAILABLE FROM:

TVC

TV CABLE SUPPLY CO.

BOX 38 • CARLISLE, PA. • PHONE 717 - 243-4918

Circle 38 on Reader Service Card

WHY DID (T) BUILD THE FIRST SOLID STATE T.V. TRANSMITTER?

RELIABILITY_____
EFFICIENCY_____
PERFORMANCE_____

From its very beginning as a manufacturer of broadcasting equipment, Townsend Associates has placed emphasis on words like these. The Townsend Associates' Engineering Department has in it many people who have been in TV broadcasting since the very early days of UHF television. These people, because of their background, have come to know the requirements of the broadcasting industry intimately. They know from personal experience the importance of both equipment reliability and efficiency.

It is experienced, knowledgeable men like these that helped formulate the design philosophy behind Townsend Associates' equipment. Many progressive ideas such as space saving T.A. utilized beam power supplies, low level sideband filtering, coaxial switching for emergency multiplexing of both aural and visual carriers through one linear amplifier, and numerous other T.A. transmitter features evolved from their philosophy.

Recently Townsend Associates' engineers asked themselves: What more can we do toward achieving our goal of high reliability with maximum efficiency? The answer to this question was the TD-15B transistorized driver. The TD-15B is the television industry's first solid state driver. This driver is designed to drive the Eimac klystrons employed as final amplifiers in the Townsend Associates' transmitters at the 3KW, 15KW, 30KW, and 55KW power levels.

The driver's R.F. oscillator and multiplier strings are completely solid state featuring plug-in transistors. The aural and visual modulators are also 100 per cent solid state.

The heart of the visual modulator is the famous Ampex processing amplifier long recognized by the industry as one of the finest video stabilizing amplifiers ever built.

The video modulator section, which also contains color corrective circuits, is designed to be an integral part of the Ampex processing amplifier.

The aural section of the TD-15B driver employs a direct FM modulation system for maximum simplicity and performance.

Both the aural and visual exciters have motorized R.F. attenuators and ferrite isolators to provide precise control of driver power output without changing the driver performance characteristics.

The TD-15B transistorized driver designed and developed by Townsend Associates represents the application, by T.A., of the state of the art in providing the broadcaster with a truly reliable and efficient television transmitter system.

TOWNSEND ASSOCIATES INC.

P.O. BOX 215 • FEEDING HILLS • MASSACHUSETTS • 01030

AREA CODE 413-733-2284

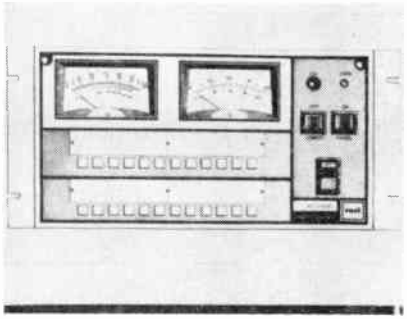
Circle 39 on Reader Service Card

ered unit may be rack-mounted or mounted in a portable carrying case (shown) with companion Model 308 sync generator.

Circle 76 on Reader Service Card

Transmitter Remote Control

Rust Corp. Everett, Mass. has developed a transmitter remote control system designed for TV (VHF and UHF), FM, and both directional and non-directional AM transmitters. Model RC-2400 offers 48 control functions and 24 metering functions, and may be operated with microwave, voice telephone line or 2-pair metallic circuits by module selec-



tion. A 2-meter system containing 5 scales is used for most readings; equipment selects meter on which reading will appear. External meters for direct reading of any parameter may be added.

Circle 75 on Reader Service Card

Color Phase-Shift Equalizer

Telemet Co., Amityville, N.Y., has developed a color subcarrier phase shifter distribution amplifier designed to equalize phase shifts which occur in long cable runs or in studio distribution systems. The Model 3248A1 offers 360° phase shift in 30°

steps; a fine phase control provides incremental adjustment. The solid-state unit with built-in power supply may be rack-mounted. Four isolated outputs at 2v p-p are provided for distribution of phase corrected signals.

Circle 74 on Reader Service Card

(Continued from page 27)

picture, resulting in a new *lower* limit, even though actual interference is *greater!* This situation has been recognized, and Section 73.182 Paragraph (0) of the Rules provides examples of RSS calculations in different cases where the addition of a new signal results in paradoxical answers. There is no point in repeating these notes in this article; examples given in the Rules are very straightforward and should be easily understood.

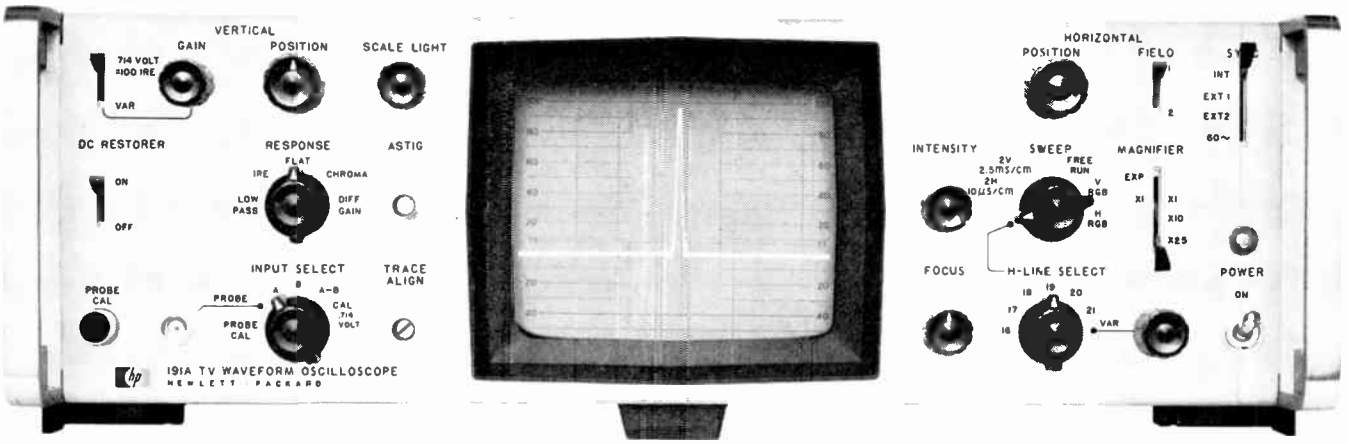
Another frustrating part of nighttime coverage work is the need to compute data for a lot of stations with the purpose of eliminating many of them! It is not sufficient to state in the application that a given limit does not enter into one's figuring—it is necessary to prove it!

Class IV Stations

Class IV night coverage is computed by following the instructions in Rule 182 (a)(4), which provides that an approximation that may be used for Class IV stations. The Rule assumes that all stations operating with the same type of antenna —one that produces 88 mV/m at one mile with 250 watts (quarter-wave). Circles are drawn about the proposed site at distances shown in the Rule. Each zone thus produced has an assigned field intensity value. These are all RSS'd and the total produced is considered to be the night limit figure. Stations beyond 500 miles are not considered and stations having radiation greater or less than 88 mV/m are adjusted by the square root of the ratio of the radiated power to 250 watts.

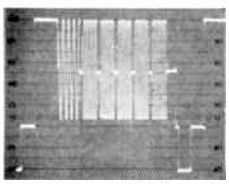
Although the Class IV tabulations are sometimes laborious, they do not require as much researching of FCC files, generally, as night computations for Class III's. Special considerations for Class I and II stations are covered in Section 73.185 of Rules. Nighttime coverage computations are not as easily carried out as daytime coverage contours mainly because of the need to have engineering data concerning other stations, data which so often consists of many independent and interdependent) variables. In many cases, the most difficult and time-consuming task is to locate this data. ●

All-Solid-State Scope Gives 1% Measurement Accuracy!

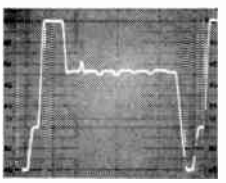


Sine-squared T/2 pulse in Flat Response position magnified X25.

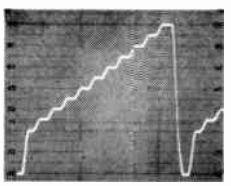
IMPROVE BROADCAST QUALITY — MAKE ACCURATE, RELIABLE VITS AND COLOR SETUP MEASUREMENTS



Multiburst signal accurately displayed using Flat Response Position of vertical amplifier, gives frequency-gain characteristics.



Multiburst signal shown using Low Pass Response position allows exact determination of average value of video signal.



Stairstep levels shown in Low Pass Response position. Deviation from designated values indicates compression.

Continuous monitoring of your broadcast operation with 1% measurement accuracy; easier, faster, more precise setup of cameras and recorders; and high speed trouble-shooting are yours with the all-solid-state hp Model 191A TV Waveform Oscilloscope! Now you can update your system for color. This scope is designed to meet today's requirements and tomorrow's demands! It now is the standard of interstate transmissions—and will be your standard to measure incoming video signals.

CHECK THESE FEATURES:

High tolerance filter design plus the parallax-free internal graticule CRT combine to give you 1% measurement accuracy. The 191A has a vertical amplifier with an extremely wide bandwidth to allow exact response shaping with five filters including Flat, Low Pass, IRE, Chrominance, and Differential Gain—without introducing any phase distortion into your signal. CRT is large 7 x 10 cm with a 20 kv post accelerator drive to provide bright, easy-to-see traces, including low duty cycle T/2 sine-squared signals—even in brightly-lighted control rooms.

You get the reliability of all-solid-state construction. All components, except the CRT, are solid-state, to allow low power consumption (only 70 watts) and convection cooling. *No ventilating fan is needed!* Solid-state components also means the 191A is rugged and can be used either in control rooms or for remote broadcasts. Model 191A maintains 1% measurement accuracy from +15° to +35°C (59°F to 95°F)—and still gives 3% accuracy at the ambient temperature extremes of −20°C and +65°C (−4°F to +149°F) for remote broadcasting accuracy.

Positive, digital Field-Select is insensitive to noise, and syncs to the right field every time without adjustment because of computer-type circuitry. You *know* which field you're examining! Line-Select system is discrete for lines 16 through 21 for quick, easy viewing of VITS. Variable-Select lets you manually select *any* line. Five sweep modes allow optimum examination of the entire composite TV signal, individual lines, video setup and color setup. Free Run and WRGB sweep modes facilitate signal level measurements and color setup.

You can switch rapidly from normal operating mode to check calibrated gain or to check VITS without resetting scope. With the 10' accessory probe connected to the front of the scope you get high-speed accurate trouble-shooting without interfering with the feed-through broadcast signals!

To see how the hp 191A TV Waveform Oscilloscope can improve your broadcast quality and to get full specifications, call your nearest hp field engineer. Or, write to Hewlett-Packard, Palo Alto, California 94304; Telephone (415) 326-7000; Europe: 54 Route des Acacias, Geneva. Price: hp Model 191A Oscilloscope, $1295.00; hp Model 10009A Probe, $50.00. This oscilloscope is also available as hp Model 193A for telco interstate television signal relayers. Price: hp Model 193A, $1350.00.

106A

HEWLETT hp PACKARD

An extra measure of performance

Circle 45 on Reader Service Card

NAMES IN THE NEWS

Reeves Soundcraft Div. named **Arthur C. Fritog** distributor products mgr., **George Petetin**, professional products mgr.

John G. Russell appointed v.p., general sales mgr., Entron.

Lawrence J. Scully, Scully Recordcording Instrument Corp., received Audio Engineering Society Emile Berliner Award.

Lawrence J. Scully

Arthur E. Gagnon

Arthur E. Gagnon appointed manufacturing mgr., Raytheon Equipment Div.

Larry Mallach

John R. Shearer

Larry Mallach named general mgr., Visual/Allen Div. **John R. Shearer** named mgr., Television Color Film System. Field engineer appointments: **N. A. Bratcher, Roy Price,** Dallas; **Howard G. McClure,** West Coast.

Frederick H. Tribolet named antenna sales mgr., Jerrold Gov't & Industrial Div.

Michael J. Rodriguez

Duncan M. Freel

Viking Industries appointments: **Duncan M. Freel,** director; **Joseph F. Monette,** director of personnel; **Michael J. Rodriguez,** director of engineering; **Edward A. Jarzebowski,** mgr., quality assurance.

Elected to Ampex board of directors: **John P. Buchan,** group v.p., **Arutur H. Hausman,** group v.p.

Edward Jarzebowski

R. Duane Hall

John L. Stoddard named mgr., Ampex Service Co.

R. Duane Hall named v.p., marketing, Ameco.

Thomas J. Lyons appointed north central district sales mgr., and **Robert E. Wohlberg,** midwestern district sales mgr., Superior Cable. **Ronald N. Kahill** named sales representative, southeastern district. New district sales offices: **Grandview, Mo.** (1605 Little St.), southeastern office relocated at **175 Wieuca Rd., N.E., Atlanta, Ga.**

Kenneth D. Lawson appointed CATV sales mgr., TeleMation.

Merle S. Jones, pres. CBS TV Stations Div., announced appointment of **Joseph L. Stern** as v.p., Engineering Services.

Ronald C. Mandell appointed chief engineer, Anaconda Astrodata CATV Systems.

Harold C. Potter appointed gen. mgr., Voice Communication Div., Roanwell Corp.

Harold C. Potter

Benjamin Stevens

Benjamin Stevens appointed mgr., Systems and Procedures, Thomas & Betts Co.

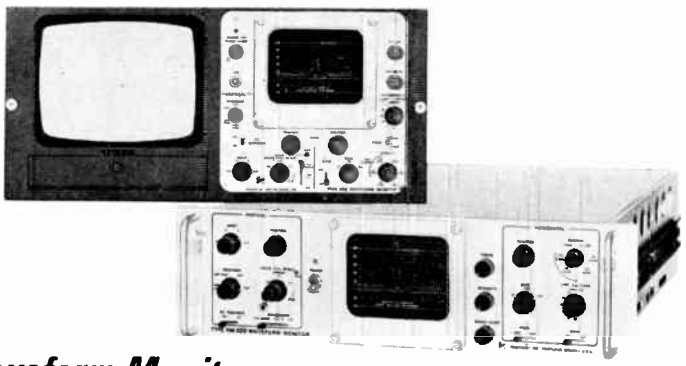
Walter E. Baxter promoted to general sales mgr., Kaiser-Cox Corp.

Anthony S. Katona appointed Product Sales mgr., CATV/broadcast transmitter Div.

Walter E. Baxter

Wallace Adler

measuring picture quality in terms of K-factor



. . . with a Tektronix Type 529 or RM529 Waveform Monitor

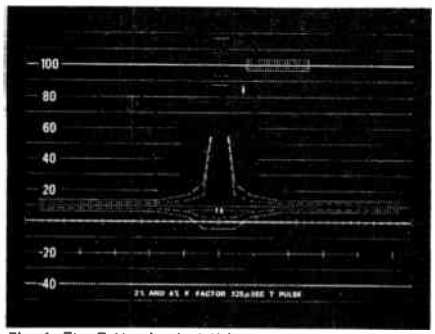


Fig. 1. The Tektronix sine² K-factor graticule. Two sweep speeds are provided on these waveform monitors so that this graticule can be used for 0.125 μs T-pulse testing on such applications as studio and network transmission lines, and for 0.250 μs 2T-pulse testing on such applications as video tape recorders and transmitters.

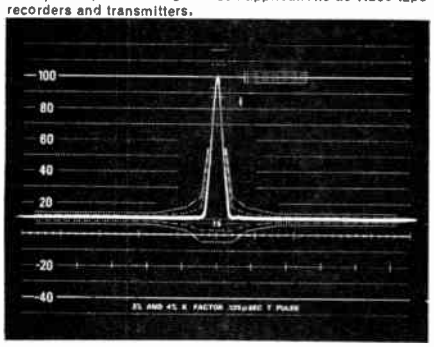


Fig. 3. Display of an undistorted 0.125 μs sine² pulse at 0.125 H/cm magnified 25X. A T-pulse with its base on the +10 IEEE unit line will reach the −100 IEEE unit line if the video system has 6.7 MHz equivalent bandwidth. At 4 MHz, pulse height will be reduced by 18%.

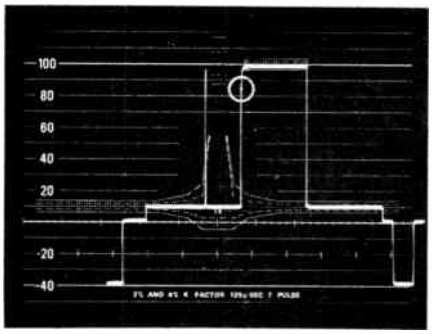


Fig. 5. Display of a bar signal at 0.125 H/cm with the base on the +10 IEEE unit line and the rising edge aligned with the arrow (encircled). The top of the bar signal should be at the −100 IEEE unit line. The inner and outer lines of the box at this point show the 2% and 4% K-factor limits.

Measurements of TV picture quality in terms of K-factor can be made simply and precisely using the sine² graticule of a Tektronix Waveform Monitor. These measurements can be made when a sine² pulse and bar is transmitted during the vertical blanking interval of normal broadcast operation.

Figure 1 shows the sine² graticule — marked in percent of K-factor for signal-distortion measurements when using a sine² pulse and bar and also marked in standard IEEE units for normal signal-level measurements. Figure 2 shows an undistorted sine² pulse and bar.

T-pulse measurements. The phase response of a video system can be determined by observing the leading and trailing edges of the sine² pulse. Figure 3 shows an undistorted pulse. Phase distortion causes asymmetrical aberrations, such as shown in Figure 4. Any display of symmetrical ringing on both the leading and trailing edges of the pulse indicates bandpass degradation without phase distortion.

Bar Measurements. The critical mid-band frequency and phase response of a video system can be determined by observing the amount of tilt in the flat-topped portion of the bar. If the video system has ideal response, the bar will be transmitted as shown in Figure 5. Impaired response in the system will cause tilt or sag, such as that shown in Figure 6, with streaking or smear in the picture.

Type 529 Waveform Monitor $1050
(8¼" high, 8½" wide, 19" deep, weighs 24 lb.)
Rack Mount Type RM529 . . . . . $1100
(5¼" high, 19" wide, 20" deep, weighs 27 lb.)
Power consumption of each model is ~80 watts — no fan used.

U.S. Sales Prices f.o.b. Beaverton, Oregon

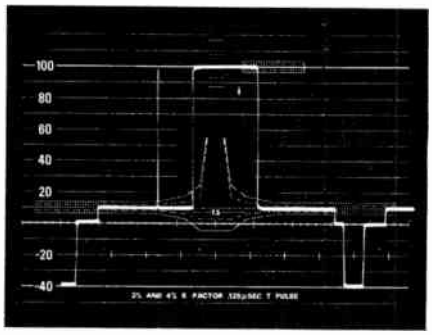


Fig. 2. Display of a sine² T-pulse and bar. Waveform shows the following: the horizontal sync pulse on the −40 IEEE unit line, the backporch on the 0-level line, the 10% offset or base for the pulse and bar, and the sine² or T-pulse on the +10 IEEE unit line, and the bar on the +100 IEEE unit line.

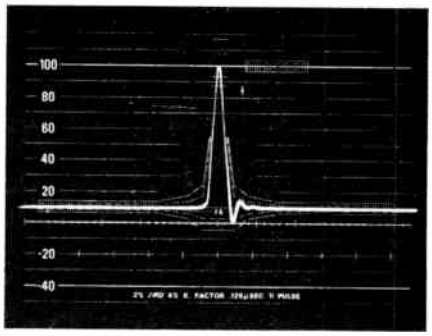


Fig. 4. Display of a sine² T-pulse showing some phase distortion. Phase distortion will appear as aberrations on the leading or trailing edges of the T or 2T-pulse. The K-factor system relates the amplitude of ringing vs the displacement of the ring from the transient in terms of picture degradation.

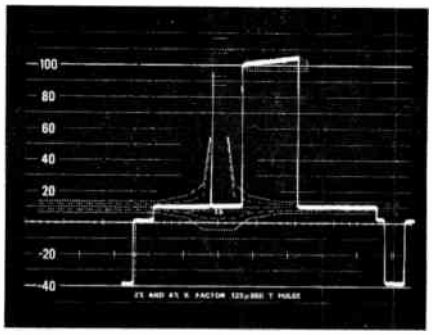


Fig. 6. Display of a bar signal at 0.125 H/cm, showing tilt which exceeds the 2% to 4% K-factor tilt limits.

Preformed Line Products Co. announces key administrative changes: Wallace Adler named v.p., mfg. Succeeding Mr. Adler as v.p., foreign operations is **W. Frederick Corkran. James R. White**, appointed corporate controller.

W. Frederick Corkran

Cliff Ratliff

Cliff Ratliff appointed chief engineer, Magnetic Heads, Inc.

Henry S. Broughall appointed marketing mgr., Teletronix Div., Babcock Electronics Corp.

Henry S. Broughall

Jack Horne

Jack Horne appointed general sales mgr., Berkey Technical Corp.

Benco Television Corp.'s U.S. factory service dept. is in operation at 724 Bugbee St., Jacksonville, Fla. 32207.

Thomas L. Aye appointed marketing mgr., Metrotech's Audio Products Div.

Donald L. Wyckoff named Entron western regional mgr., headquartered in San Francisco Bay area.

Andrew J. Hayes has been named corporate controller of Blonder-Tongue Labs. **Jerome I. Cohn** has been promoted product mgr., Distributor Products Div.

BROADCASTERS SPEAK

Sirs:
In your January 1965 issue, on page 6, there is a table summarizing a survey of average wages in the industry, as compiled by NAB. Is there a more recent compilation available? If so, we would appreciate knowing when or if you will be pub-

EMCOR® I—tough, beautiful protection

EMCOR I cabinets guard your valuable instrumentation. They're hard, tough, long-lasting steel. The beauty of form and the color, or colors, of your choice mask the toughness underneath.

Beauty, yes! When you see EMCOR I cabinets, you'll appreciate that they are sleek, beautiful pieces of craftsmanship.

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electronic equipment

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Circle 49 on Reader Service Card

lishing it, or where we could obtain a copy.

Kenneth E. Lux
Chief Engineer, KFEQ-TV
St. Joseph, Mo.

No new survey has been conducted to date. The table mentioned summarizes the latest data available.

Gentlemen:

On page 23 of your November 1966 edition you show a picture of our rather unique automation system. We would be interested in knowing how you got it.

We are proud of this system, especially the fluorescent lights on the floor, and believe we should have credit for thinking of it first.

Jim Rieger
Engineer and full-time boy wonder, KILN
Lincoln, Nebr.

The credit is all yours! But how are you going to show it off to visiting "firemen"?

Sirs:

I read with interest the article by Joseph Coons in the June issue, regarding mobile units, and would like to add my comments. AT WTVB/WANG we have been using mobile pick-up facilities since 1954. All our equipment is modified police gear of various makes—RCA, Federal, and Motorola. Four mobile units and a base station comprise our system at present. Costs range from a high of $250 for a 60 W transceiver to $15 for a transmitter-only, ac-powered unit.

For many years we operated on 153.05 MHz. This frequency, as all others in the 150 MHz band is a share-the-channel. Since we were hearing industrial stations as far as 200 miles away, we moved to the 161 MHz broadcast-only frequency. I would urge any station going mobile to use the 161-MHz frequencies. Another advantage is that Civil Defense nets are being set up between broadcast stations using this band.

I concur with Mr. Coons that mobile units are an essential part of the broadcaster's equipment, helping him keep in touch with the community. During the Palm Sunday 1965 tornadoes, our mobile units afforded the first communication from the

affected area. We wouldn't be without them.

Virgil M. Royer
Operations Mgr.,
WTVB/WANG
Coldwater, Mich.

Sirs:
I noticed the article on the last page of the November 1966 issue Engineering Casebook and find that I have approximately the same thing but built commercially by Bogen. Our amplifier is a model M60A, and has an attachment called the Model WMT-1 line input/line output matching transformer which fits into the available chassis holes of the M60A.

I have used this amplifier as a console for remotes, also as a PA amplifier, and find that this accessory works fine. It also works very well with other amplifiers. To make the M60A more versatile, I have installed 3-prong mike plugs so that plug-in transformers may be used.

At present I am using BM/E for its articles on new studios and find the articles are very thorough and have many new ideas not included in many books.

Burton Landry
Chief Engineer, WARE
Ware, Mass.

Gentlemen:
Thank you for your further interest in our high power for CATV project. It seems odd that a vhf translator can put out 5 watts and serves thousands of TV sets while cable systems need up to 50 amplifiers to do the same job. Why don't cable systems put out 5 watts with just one piece of equipment for each channel, guiding the signal through low loss cable to the homes that want to pay for the service? How can a cable system run that signal through 50 pieces of electronic equipment and maintain as good a picture and as dependable a service as a translator? It can't be done, but that same 5 watts with new low loss cable can cover a good size town operating a CATV system, with everything out of the office, simply a passive CATV system.

Naturally, you have less trouble, lower light bills, less outages, less deterioration of signal—just a better, simpler cable system. And by the way it costs a lot less initially, too. It's that simple. Everybody else, in mixing channels together, loses 50% signal right off the bat. We have pretty much licked that problem, and the high power equipment costs $200 per channel.

You used to have to run low level to keep down radiation. Now that we have radiation-proof cable, everybody has gone to transistorized amplifiers with lower levels.

Harlan L. Jacobsen
Jacobsen Electronics
Rapid City, S.D.

Sounds good, but we're still leery about the radiation problem. Also, how do you control signal level to customers' receivers? And what about signal level for customers at the end of the cable? If you have these problems licked, a lot of small system operators surely will be very interested.

LITERATURE of INTEREST

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

RF instruments, coax components with 7 and 14 mm connectors described in bulletin from Alford Mfg. Co. 153

Screwdriver kits with plastic handle and selection of interchangeable blades described in literature from Xcelite. 154

Tower Saf-T-Climb described in brochure from Safety Tower Ladder Div., Air Space Devices. 155

VTR application information, teleproduction capabilities, outlined in 6-page brochure on VR-660B from Ampex. 156

Field strength meter for RF measurement in air, twin lead, coax, described in "Commander" brochure from Amphenol. 157

V-O-M panel and portable electrical and electronic test instruments listed in 12-page catalog from Triplett. 158

Push buttons for horizontal- or vertical-row mounting described in engineering bulletin from Switchcraft. 159

Relay selector chart from Cornell-Dubilier lists technical information on miniature, general purpose, program, bi-stable, time delay, telephone types. 198

Tape deck described in literature from International Good Music has reversing 14" reels in mono or stereo. 197

Automatic programming system described in brochure from Automatic Tape Control. Shows actual radio operations. 160

Cartridge tape handling equipment described in Mark II Carousel literature from MaCarTa. 161

Video test set described in literature from Riker Industries. Produces multiburst, $\sin^2$ window, stairstep pulses. 162

Audio console installations described in McCurdy literature from Visual Electronics. 163

Cartridge tape recorder/reproducer, described in literature from KRS, outlines recording, editing, playback features of SB1 series. 164

TV camera deflection components listed in catalog from Cleveland Electronics. 165

CATV bridging amplifiers described in literature from Entron includes operating specifications. 166

Translators for up to 1-kw UHF operation described in literature from EMCEE. 167

Encoders for live and film color camera systems described in literature from G-E. 168

Books on all phases of radio-TV-CATV, many unavailable from other sources, fully described and illustrated in 18-page literature package from TAB Books. 170

Two-way radio systems described in literature from Motorola. 152

Pickup cartridges for stereo application described in literature from Stanton Magnetics. 171

CATV distribution equipment listed in literature describing American Electronics Colorvue Series. 172

CATV News Channel equipment described in literature from TeleMation. 173

CATV distribution equipment listed in brochure from Cascade Electronics. Describes features of modular unit, universal housing types. 174

Video switching and distribution equipment listed in literature from Applied Electro Mechanics. 175

Stereo cartridge literature from Elpa Marketing Industries describes S-15T moving-coil type. 176

Phono cartridge literature from Shure Bros. describes Super-Track V-15 Type II unit. 177

Video amplifiers designed for high resolution CRT display applications described in literature from ITI Electronics. 178

Waveguide components, microwave equipment listed in literature from Lectronic Research Labs. 179

CATV system reference data book from Jerrold includes channel frequency data, coax cable descriptions and attenuation data, data on fittings, etc. 180

Vector voltmeter discussed in Application Note from Hewlett-Packard. Describes precision frequency comparison. 181

TV newsfilm system described in literature from Eastman Kodak provides ready-to-run film in 2 minutes. 182

Precision audio equipment listed in literature from Hi-Q Div., Aerovox. Includes attenuators, equalizers, filters, etc. 183

Video pulse generator described in literature from Videometrics. 314A designed for color equipment alignment. 184

TV lens list from Burke & James includes more than 1,000 types, ½ to 40". 185

Micro cleaning products for electronic and optic equipment described in 8-page catalog from Texwipe Co. 186

Audio tape recorders, reproducers, loggers, described in literature from Metrotech. 187

"ColorTran News" published by Berkey Technical Corp. for motion picture and TV industries. 188

Video test unit described in literature from Rohde & Schwarz offers sweep and analysis functions. 189

Tape decks with solid-state plug-in components described in literature from Scully Recording Instruments. 190

Video terminal equipment described in literature from Central Dynamics Corp. 193

Audio equalizing equipment listed in catalog from Lang Electronics. 194

Tape recorders for mono or stereo applications listed in literature from Crown International. 195

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Engineer with experience in TV, radio or allied fields preferred. Must have 1st license. Excellent opportunity for experience in broadcasting. Reply to Chief engineer, WFSU-TV, Tallahassee, Fla.

Wanted: 1st phone for announcing & production. Small market with middle of road format. Call Station Manager, WSER, Elkton, Md. 301-398-3883.

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HELP WANTED (continued)

WTOC-AM-FM-TV Savannah, Georgia, has opening for first class engineer with experience. Reply by letter to Chief Engineer, WTOC, P.O. Box 858, Savannah, Ga. 31402.

Need engineer with first class license—transmitter and maintenance duties—no announcing. Will train if necessary. Contact R. J. Bitner, Chief Engineer, KRVN AM/FM, Lexington, Nebr. 68850. Phone 308-324-3271.

First class engineer for maintenance, no announcing. Work under chief. Growth company. Good opportunity. Contact Arnold Lerner, WLLH, Lowell, Mass. 617-458-8486.

Experienced television broadcast engineer. Replies confidential. Send resume and phone number to Bob Anderson. KIMA-TV, Box 702, Yakima, Washington.

Chief engineer for long established 5,000 watt directional in good Michigan market. Excellent permanent position. Contact General Manager, WPAG, Ann Arbor, Michigan.

Chief engineer, 1 kw daytime directional. Contact Jack Sullivan, WOKW, Brockton, Mass.

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1st class engineer—announcer, WEBO, Owego, New York Phone 607-687-0371.

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heavier tools and equipment, WBIR-TV has a come-along reaching from the elevator to the top of the antenna, and a winch from the ground to the 60'-high elevator base.

It is vitally important for climber safety to have a means of communication between tower and ground. A 3-way radio system has been installed at WBIR-TV: a station at the base of the tower, one in the elevator, and a third in the station control room with override capabilities to monitor all conversation. As a back-up to the radio system, they use battery-powered phones with plug-in stations at every tower working level; in addition the phones may be clipped across the line at any point. Communication with the man on top of the tower is maintained by voice contact with the man at the elevator. A third man is always stationed at the elevator base.

The elevator is electronically controlled from the car itself; however, the man at the elevator

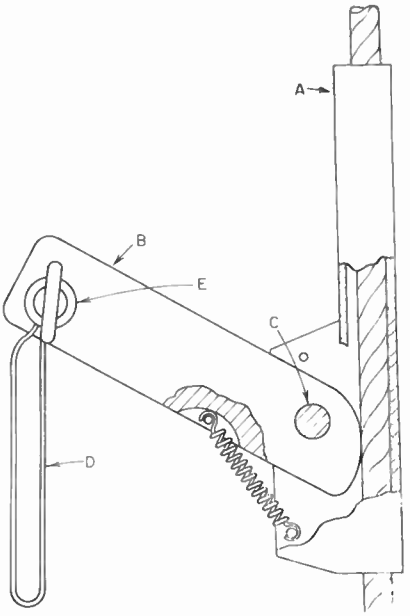


Fig. 1. The stainless steel safety clamp, manufactured by Meyer Machine Inc., Red Wing, Minn., operates on a tower-mounted ⅜" diameter cable, held taut by a compression spring at the tower base. The clamp attaches to the climber's safety belt (d) by an automatic locking steel pin (e). The 1¾ lb. clamp assembly (a) is permanently attached to the cable (portable model also available) and slides freely up or down until a downward pull from the safety belt pivots arm (b) on shaft (c) against the cable. The safety belt cannot turn on the clamp, thereby maintaining the wearer in an upright position should he become unconscious.

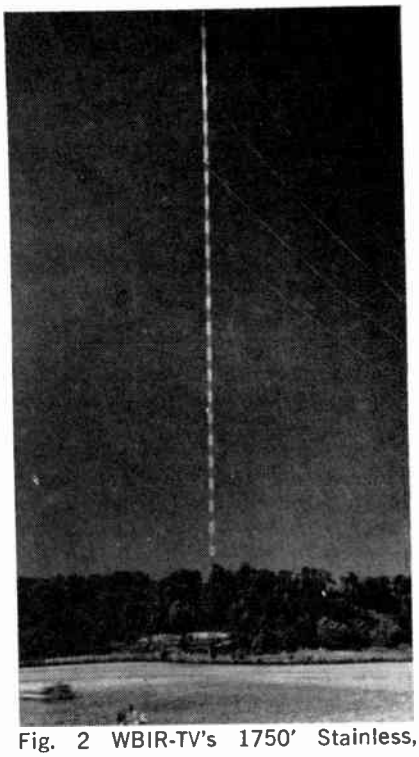


Fig. 2 WBIR-TV's 1750' Stainless, Inc. tower.

base can take control whenever the necessity is indicated by a lack of communication on either the radio or phone system or when asked to do so by the car operator. There is also an elevator travel indicator — a pulley-driven counter calibrated in feet-above-ground — so that the person at the elevator base knows where the car is.

Safety Precautions

Personnel should never be permitted to work on lighting circuits when ac power is on, except, perhaps to change lights. Work on transmission lines or any exposed points carrying rf energy should be postponed until the transmitter is shut down. WBIR-TV will not permit a man to go above the elevator until the rf nas beeh turned off. When breaking into pressurized transmission lines, the workman must be careful not to inhale the nitrogen or other gas fumes escaping from the line. After the line has been opened, WBIR-TV provides "O" rings to seal the line to minimize asphyxiation hazards and also to cut down on gas waste.

Also contributing to the safety of all involved is a rigid maintenance program for all antenna climbing equipment. WBIR-TV services their elevator system at least every 90 days and maintains a constant check on batteries and elevator cable tension. A little carelessness can result in a very serious accident. The importance of exercising every precaution and absolute maintenance regularly cannot be overstressed. ●

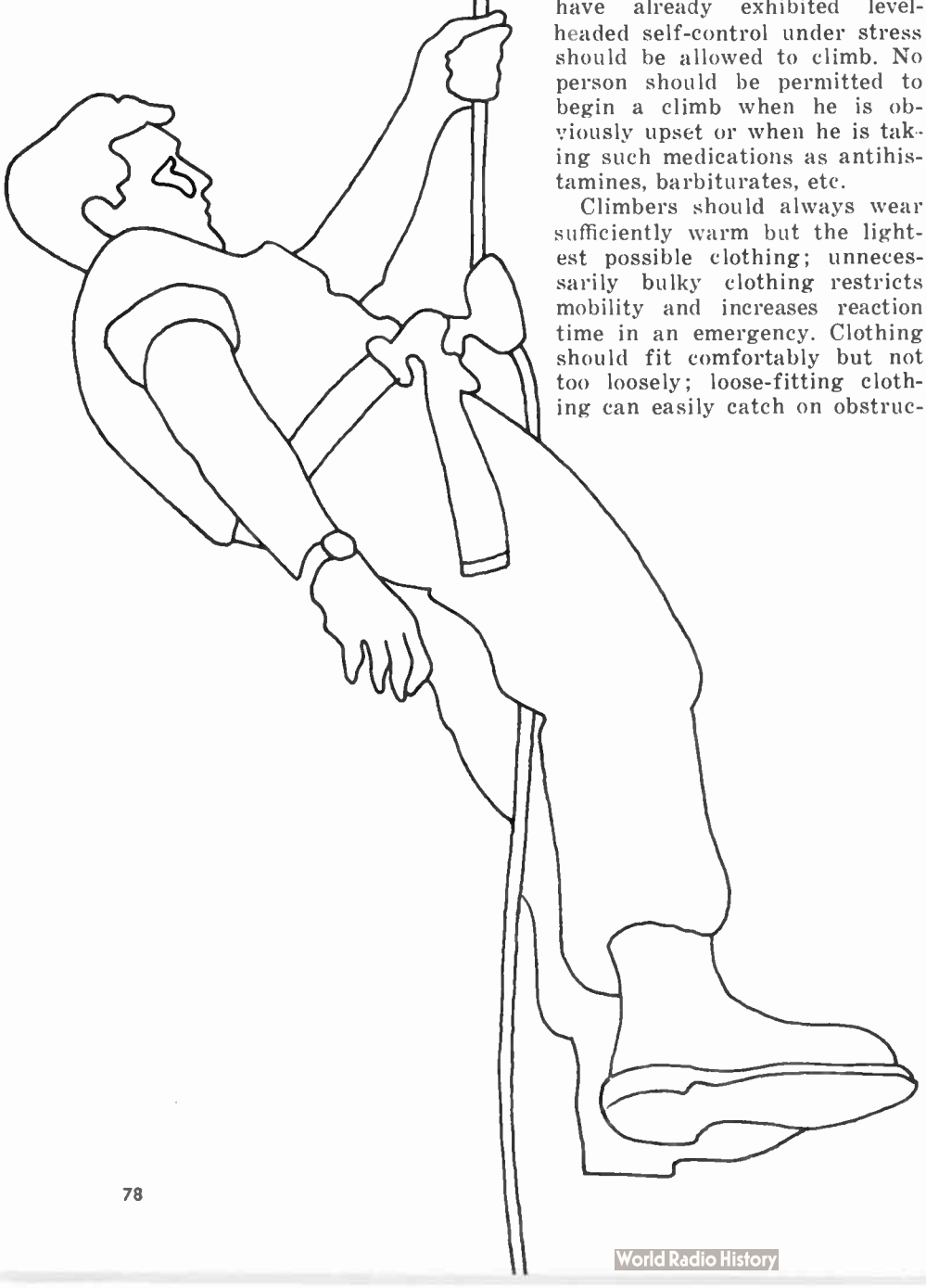
Twelve Points of Tower Sofety

- Never allow anyone to climb when even slightly upset or when taking such medications as antihistamines, barbiturates, etc.
- Always insist that climbers wear the lightest possible clothing; in cold weather provide warm but light-weight jackets, etc.
- Insist that personnel weai "hard" hats and suitable boots with soles that do not become slippery when wet.
- Climbing too fast causes fatigue. Encourage climbers to determine a safe speed. To keep hands warm in cold weather, provide gloves and other handwarming devices.
- Never allow anyone to climb alone or at least without someone near the tower, in the case of smaller towers.
- Never permit climbing without suitable safety belts, make sure they are in good condition.
- Never permit climbing when thunderstorms are threatening, even when storms seem far away, lightning can be extremely dangerous. Obviously, climbs should not be made when the tower is coated with ice or there is danger that ice may form.
- Provide some means of carrying necessary tools—a bag or pouch that will not interfere with normal arm and leg movement.
- Provide a means of communication with workmen (and preferably a backup) and between the tower and ground.
- Never allow lighting circuits to be serviced with ac power on.
- Never allow work to be performed on transmission lines and other rf-energized elements until the transmitter has been shut off.
- Insist on thorough maintenance of all safety devices and equipment. Lives depend on it!

ENGINEERING
CASEBOOK

Increased Safety for Tower Climbers

Pointers for those who climb, and those who hire or supervise climbers.



AS ONE VETERAN antenna engineer once remarked, "When you're climbing up and down these towers as much as we have to, the only amount of height that bothers a guy is the first 10 feet. Above that, if we think about losing our grip, the distance doesn't make much difference." Beginning with this somewhat wry—but nevertheless sagaciously accurate — attitude let us explore some considerations for tower safety.

The Climber

The task demands the best a man has to offer—a calm, collected attitude, the ability and agility to maintain self-control under stress, and the capability to act wisely in an emergency. Only those individuals who show no fear of height and who have already exhibited level-headed self-control under stress should be allowed to climb. No person should be permitted to begin a climb when he is obviously upset or when he is taking such medications as antihistamines, barbiturates, etc.

Climbers should always wear sufficiently warm but the lightest possible clothing; unnecessarily bulky clothing restricts mobility and increases reaction time in an emergency. Clothing should fit comfortably but not too loosely; loose-fitting clothing can easily catch on obstructions. Insulated garments made especially for extremely cold weather are available, garments which provide the necessary warmth without encumbering an individual's freedom of movement. To lessen the danger of head injury a climber should always wear a hard hat, with a suitable cold weather liner. Preferred footwear is a pair of sturdy boots with soles which do not become slippery on wet surfaces.

Stress the importance of not climbing too fast; if a man tries to climb too fast, fatigue can cause him to lose his grip, or even worse black out or be stricken with a heart attack. Pace usually varies with the individual; if a climber is most comfortable climbing 3 minutes and resting 10, he should practice that speed. In cold weather, hands have a tendency to become cold before other parts of the body. WBIR-TV Knoxville, Tenn., provides a small portable hair dryer (which may be plugged in at any number of places along the tower's length) with which the climber may warm his hands.

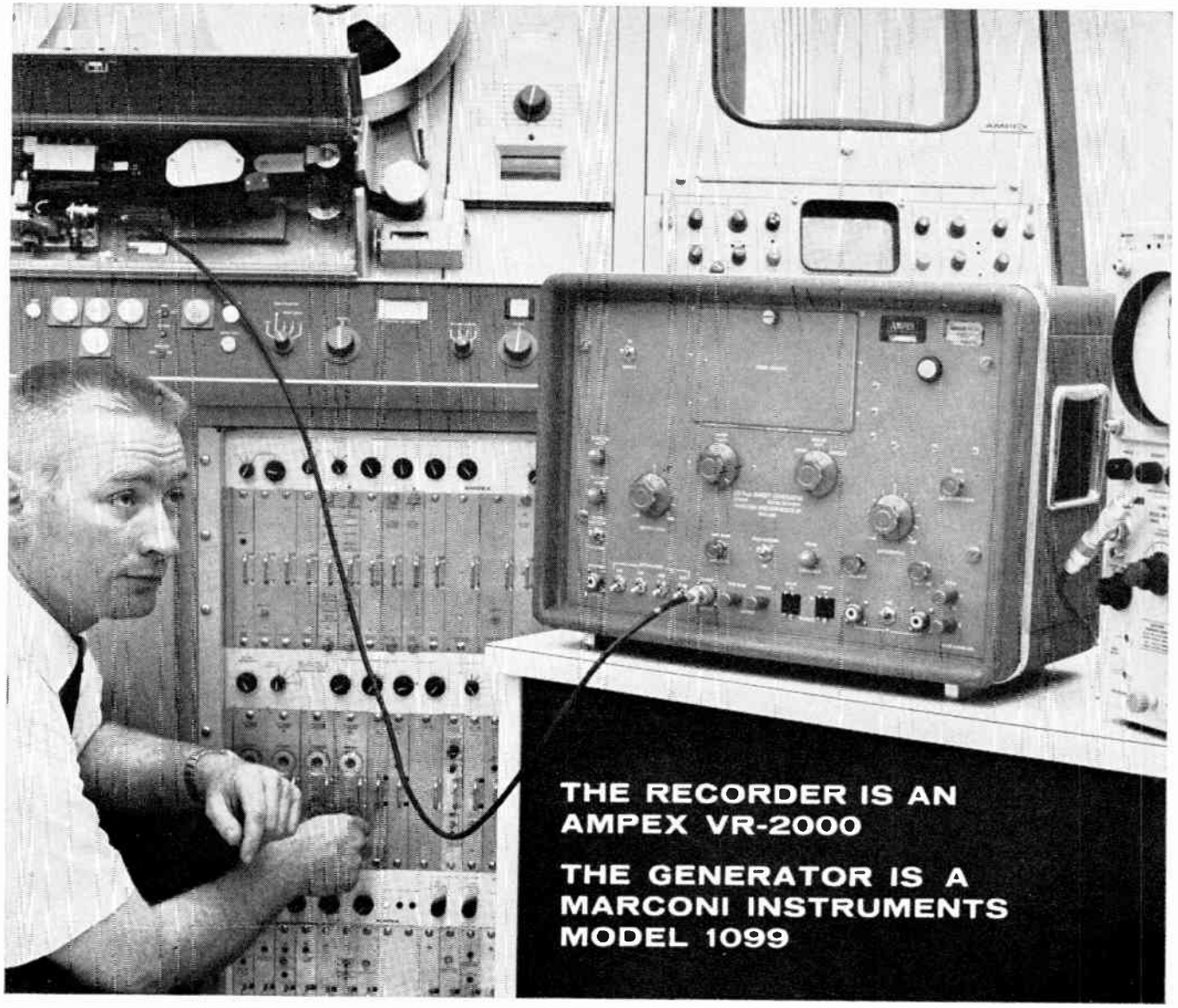
It is not wise to climb alone, or to go up when the tower is icy or during a thunderstorm. A considerable length of time is required to go up and down tall towers; therefore, a man should not begin a climb in threatening weather. WBIR-TV Chief Engineer Rex Horton instructs all his men to come down immediately when there is danger of nearby lightning; and from the top of their 1750′ tower, it's not hard to see approaching storms.

Safety Devices

WBIR-TV will not permit a man to climb without a safety belt; they use and rely upon the Tulito safety clamp for the 90′ climb up from an elevator which ascends to the 1660′ level. Extra clamps are also carried in the elevator so that if it should stall, a man could climb down the tower from any point.

A safe means of carrying necessary tools should be provided. A paperboy's bag has been found suitable by WBIR-TV; it hangs comfortably from the shoulder and does not interfere with arm and leg movement. When it is necessary to lift

Continued on page 76



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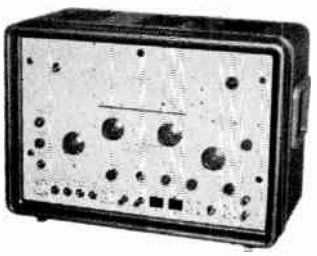

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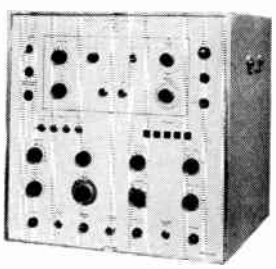

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