A MACTIER PUBLICATION / JANUARY 1966

BM/E

THE MAGAZINE OF BROADCAST MANAGEMENT/ENGINEERING

when Jerrold hands you the key you're in CATV

Jerrold "turnkey" service can pave your way to CATV profits!

This, we admit, is a bold statement. We urge you to verify it. How? Simply examine Jerrold's fifteen-year CATV record. We believe that the facts will convince you that Jerrold can put you in business faster and more profitably than any other CATV contractor.

Learn for yourself why Jerrold equipment does the job better, lasts longer, requires less maintenance. By all means, compare Jerrold equipment and specifications with any others on the market.

Find out why Jerrold has built more systems on a "turnkey" basis than any other manufacturer-contractor in CATV. Discover why we say: "*Satisfied subscribers make operators contented Jerrold customers.*"

Finally, consider the comprehensive Jerrold "turnkey" package. We provide every necessary service from market and feasibility surveys, through construction, financing, community relations—to handing you a completely operational CATV system.

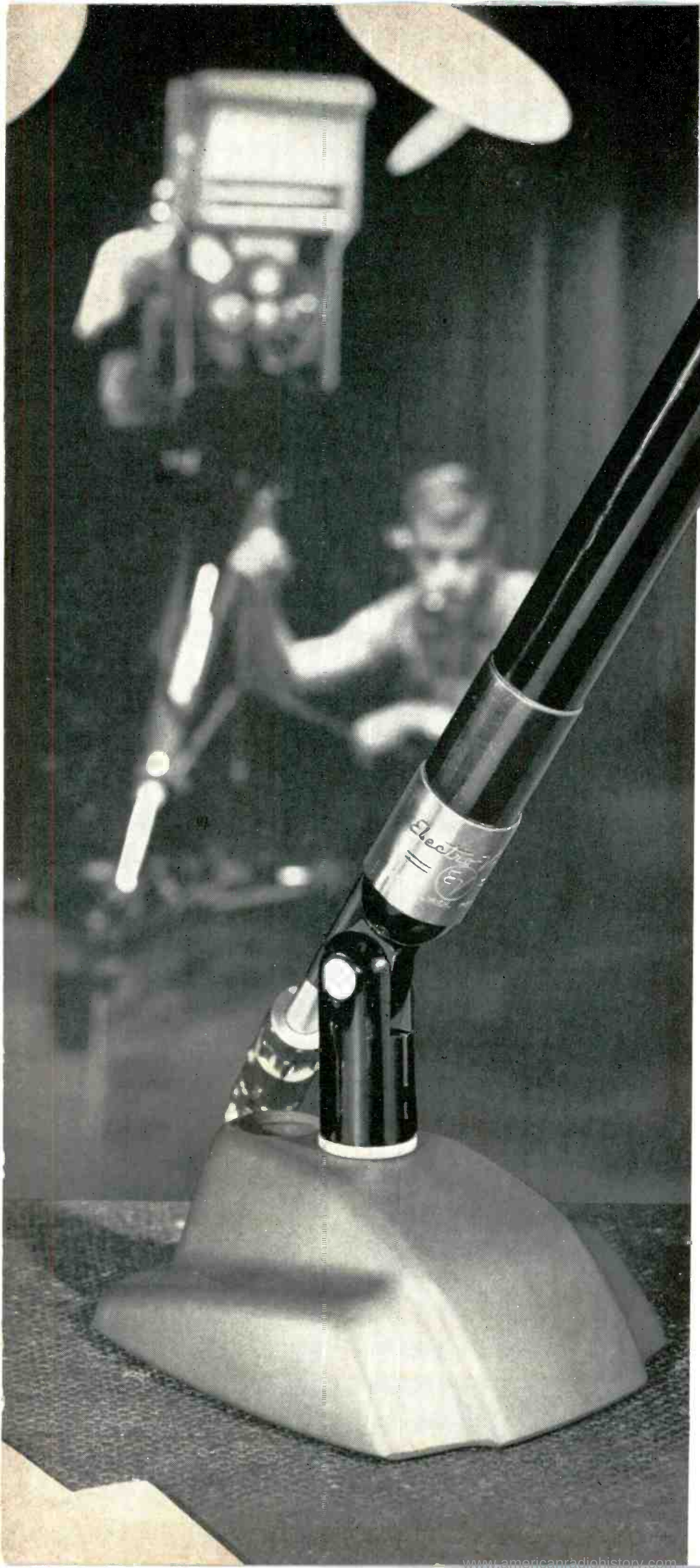
For complete details phone 215-226-3456, or write:

JERROLD

CATV Systems Division
JERROLD ELECTRONICS CORPORATION
15th and Lehigh Ave., Philadelphia, Pa. 19132

FIRST IN CATV • The nation's largest, most experienced manufacturer-supplier of CATV equipment and services.

Circle 2 on Reader Service Card



15 Years Old and Still Ahead of the Times!

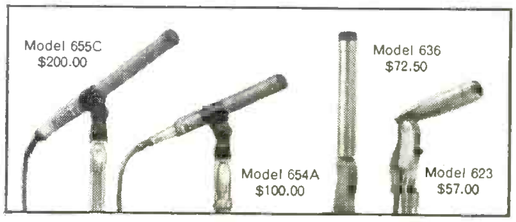
It may not look revolutionary today, but fifteen years ago the E-V 655 shown here was unique. Then it was the only truly omnidirectional dynamic microphone on the market. And it offered ruler-flat response from 40 to 20,000 cps, plus plenty of output for critical broadcast applications.

Even today, those specs are first rate. Many of the early 655's are still proving that in dependable daily service. But during the years, E-V has continued to refine and improve so that today's Model 655C can set even better records for performance and service.

Having proved the point, the 655 inspired a complete series of Electro-Voice omnidirectional microphones that serves every need over a wide price range. The full benefit of our fifteen years of design leadership is lavished on even the most modest model in the line.

For instance, every slim E-V dynamic microphone uses the famed Acoustalloy® diaphragm. This E-V exclusive insures more uniform response while withstanding the effects of high humidity, temperature, corrosion and shock. It makes E-V omnidirectional microphones almost indestructible.

You'll learn the real value of engineering leadership when you put any of these slim E-V dynamics to work in the field. You can do it with the extra assurance of a *lifetime* guarantee against defects in materials or workmanship. See them now at your franchised E-V microphone headquarters, or write for complete catalog today.



Normal trade discounts apply to list prices shown.

ELECTRO-VOICE, INC.
Dept. **162EM**, Buchanan, Michigan 49107

Electro-Voice®
SETTING NEW STANDARDS IN SOUND

Circle 5 on Reader Service Card

JANUARY 1966 / VOLUME 2 / NUMBER 1

BM/E

THE MAGAZINE OF
BROADCAST
MANAGEMENT/
ENGINEERING

Publisher:
MAL PARKS, JR.

Editor:
VERNE M. RAY

Corporate Editorial Director:
JAMES A. LIPPKE

Art Director:
GUS SAUTER

Associate Editor:
CHARLES BUFFINGTON

Production Manager:
HELEN HORAN

Editorial Production:
INEZ ATHEY

Circulation Director:
H. C. GAINER

Circulation Fulfillment:
N. VARTABEDIAN

Reader Service:
R. R. BELL

Promotion Manager:
E. L. GRAY

Classified Advertising Manager:
EILEEN HESSION

Gus Sauter's front cover design symbolizes the main theme of this 2nd Annual Antenna Systems issue. Antenna systems, like the astronauts' 24-carat gold-plated umbilical cord, are your very lifeline, providing the all-important link between you and your listening public. Be you manager, engineer, director or VP, in AM, FM, TV or CATV, you'll find something in the contents of special interest. If you're not at all interested in antennas, we invite your attention to the FCC Rules section, which discusses fraudulent billing practices.

Cover photos were supplied through the courtesy of G-E's public relations office. The zig-zag unit, on test for WPIX, Ch. 11, graces the top of the Empire State Building.

MACTIER PUBLISHING CORP., BRYCE GRAY, JR., President
820 Second Ave., New York, N.Y. 10017, 212 MO 1-0450

BM/E Editorial & Production Offices: 18 Frederick Rd., Thurmont, Md. 21788—phone 301 271-7151

Publishers also of:
EEE—the magazine of Circuit Design Engineering
ELECTRONIC PROCUREMENT
VOLT/AGE—the magazine of Electrical Apparatus Maintenance

BM/E, the magazine of Broadcast Management/Engineering, is published monthly by Mactier Publishing Corp. All notices pertaining to undeliverable mail or subscriptions should be addressed to 820 Second Ave., New York, N.Y. 10017.

BM/E is circulated without charge to those responsible for station operation and for specifying and authorizing the purchase of equipment used in broadcast facilities. These facilities include AM, FM, and TV broadcast stations; CATV systems; ETV stations, networks and studios; audio and video recording studios; consultants, etc. Others please write for subscription prices.

Controlled Circulation postage paid at Orange, Conn.

BROADCAST INDUSTRY NEWS

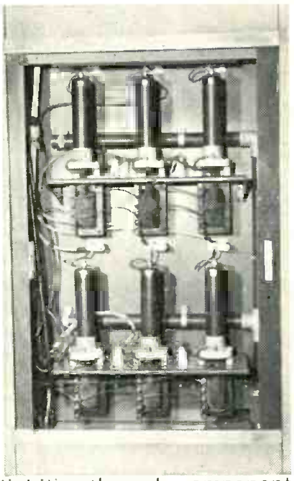
Studio Standby: N.E. Blackout

The saga of *The Great Northeastern Power Failure* has strongly underlined the value of standby power supplies, not only for transmitter sites but also for *studio* facilities! At least three New York City stations didn't lose transmitter power at their nearby New Jersey sites, but of course their mid-town studios did. Therefore, transmitter generator plants were of no real value.

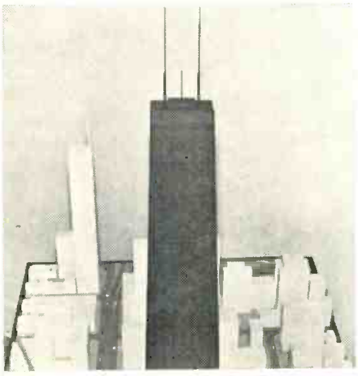
WOR has maintained a standby studio generator for a number of years; the events of last Nov. 9th aptly demonstrated its worth. WOR learned something else — it pays to keep M-G starter batteries in full charge. (Studio personnel had to go searching for a new battery to get the unit started, and had to carry the battery up 24 flights!) Until the power plant could be started, battery-operated remote amplifiers were connected to a spare transmitter line, allowing resumption of operations within 20 minutes of the power failure. WOR's AM remote control point is located at the Empire State Building, necessitating the use of the STL line. Chief engineer Orville Sather said WOR's 1.5-kw generator has since been replaced with a 6-kw unit, and standby power is being considered for the Empire State Building location.

WNEW and WINS also operated with battery-powered remote amplifiers. WINS normally uses battery-operated tape recorders for numerous street interviews, etc., and these units were pressed into service. WNEW personnel operated by flashlight until spare storage batteries could be hauled in from a mobile unit. Bruce Ratts, WINS C. E., and Max Weiner, WNEW C. E., indicated both stations were strongly considering future auxiliary studio power. WNEW also lauded the telephone company's rapid utilization of standby power which enabled them to maintain news line facilities.

All broadcasters in the blacked-out areas, including the networks, have responded quickly to the FCC letter of inquiry on the power failure. Commissioner Lee Loevinger's office reports that all broadcasters, in general, did an outstanding job during the crisis, alleviating what could have been near-chaotic conditions.



WKBW-TV, Ch. 7 Buffalo, N.Y. is operating with replacement solid-state rectifiers in its TT25BH transmitter. Syntron avalanche silicon diode assemblies are used as direct replacements for such mercury vapor tubes as 673's, 8008's, and 866's. Chief Engineer Bob Niles reports that one 3-phase, full-wave bridge supply, using six avalanche assemblies in place of 673 tubes, has been providing 2950v DC at 5.1 amps for over 6,000 hours of maintenance-free service. Power for visual drivers, IM power amplifier and tripler is delivered by Syntron's 8008 and 866 replacement assemblies. Operating time, with no shut-downs due to failures, is over 9,000 hours. Solid-state units have eliminated difficulties such as warm-up time, arc-back, and arc starvation. Filament transformers and associated control circuits are not necessary, increasing reliability through component reduction. Cabinet heat is also reduced, increasing component life.

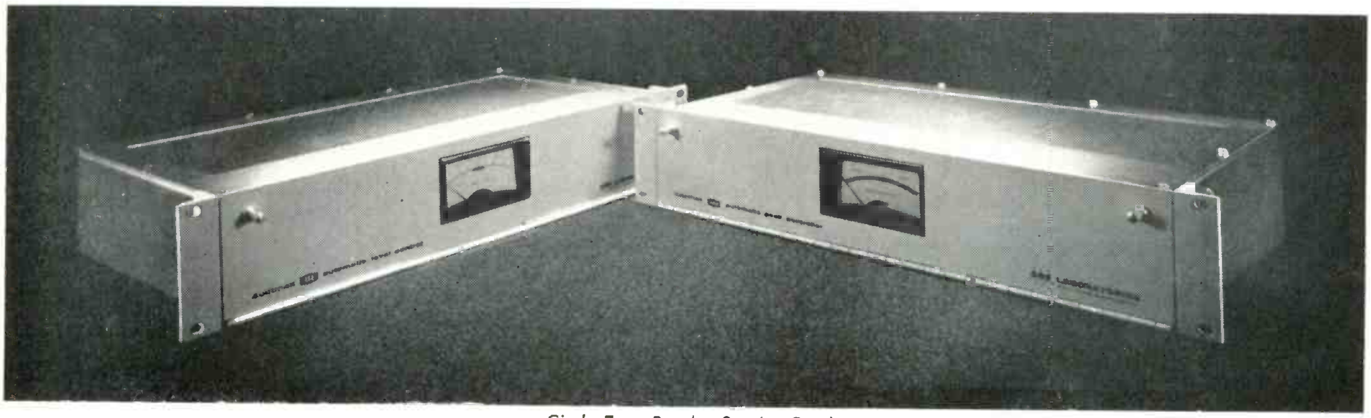


Antennas for six Chicago TV stations, WGN-TV (Ch. 9), WMAQ-TV (Ch. 5), WBBM-TV (Ch. 2), WTTW (Ch. 11), WXXW (Ch. 20), and WSNS (Ch. 44), will be located on top of the John Hancock Center. The facility calls for twin towers 344′ high (2,049′ above sea level, 1,449′ above ground). Operation is expected to begin during the summer of '68. A 100′ FM antenna between the TV towers will serve 15 stations. Cost of the TV facility is estimated to be $5 million.

State EBS Plans Approved

State Emergency Broadcast System plans for 49 states, D.C., and several territories have received FCC approval as "Interim Detailed State EBS Plans," with an effective date of Dec. 3, 1965. (Each state must formulate its own plans within the framework of the national EBS.) In many states, systems are fully operational, but in others some daytimers may be given approval to operate during night-time hours where local service is not available or where the only available night-time signal is from out-of-state.

A total of 541 stations in the interim operational plans are under contract to use Federal funds to construct radiological fallout shelters, add emergency power and programming equipment, and install radio communications circuits between shelters and local emergency operating centers. Approximately half the authorized stations have completed construction and 20-25% are partially complete. The National Office of



Circle 7 on Reader Service Card

Civil Defense decides which stations will "harden" their facilities, with recommendations from each state advisory committee.

Telecable Signs AP Contract

Telecable, Inc., has signed agreements with the Associated Press for News Channel installations in six Washington state systems. The first was scheduled for the Longview System about December 10 with installations at the Burlington, Anacortes, Bellingham, and Olympia systems as soon as the equipment is available.

ETV Growth

The display of ETV equipment at the NAEB Convention reflects the growth of scholastic TV. Cameras, tape recorders, and a new film recorder were displayed by RCA. The shift to color in ETV is expected to multiply many times the effectiveness of TV as a teaching tool. Presently, RCA is designing a 2500-mc system for the Roman Catholic New York Archdiocese which will link approximately 3,000 classrooms in more than 400 elementary and secondary schools in 10 countries. Programs will originate at a TV center at Yonkers and transmitted from 7 locations.

Memorex Tape in Japan

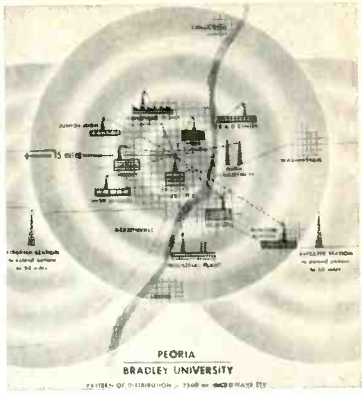
Memorex Corp., leading manufacturer of precision magnetic tape products, and Shiba Electric Co., Ltd., jointly announced signing of an agreement giving Shiba exclusive distributorship of Memorex broadcast video tape in Japan. Edward S. Seaman, Memorex v.p. of marketing, commented that Shiba supplies more than 90% of the broadcast video tape recorders in Japan, and is in an excellent position to market Memorex video tape.

Viking Expands

Viking Industries has opened a new sales branch in Indiana to serve CATV systems in Kentucky, Ohio, Indiana, Illinois, and Michigan. Robert W. Lemon will head the new office. Viking also advises that contracts have been signed between Systems Construction, Dallas, Tex., and Community Telecable of Georgia for construction of a system at La Grange, Ga. Systems Construction estimates that they will be building over 600 miles of systems using Viking cable and equipment during the next 6 months.

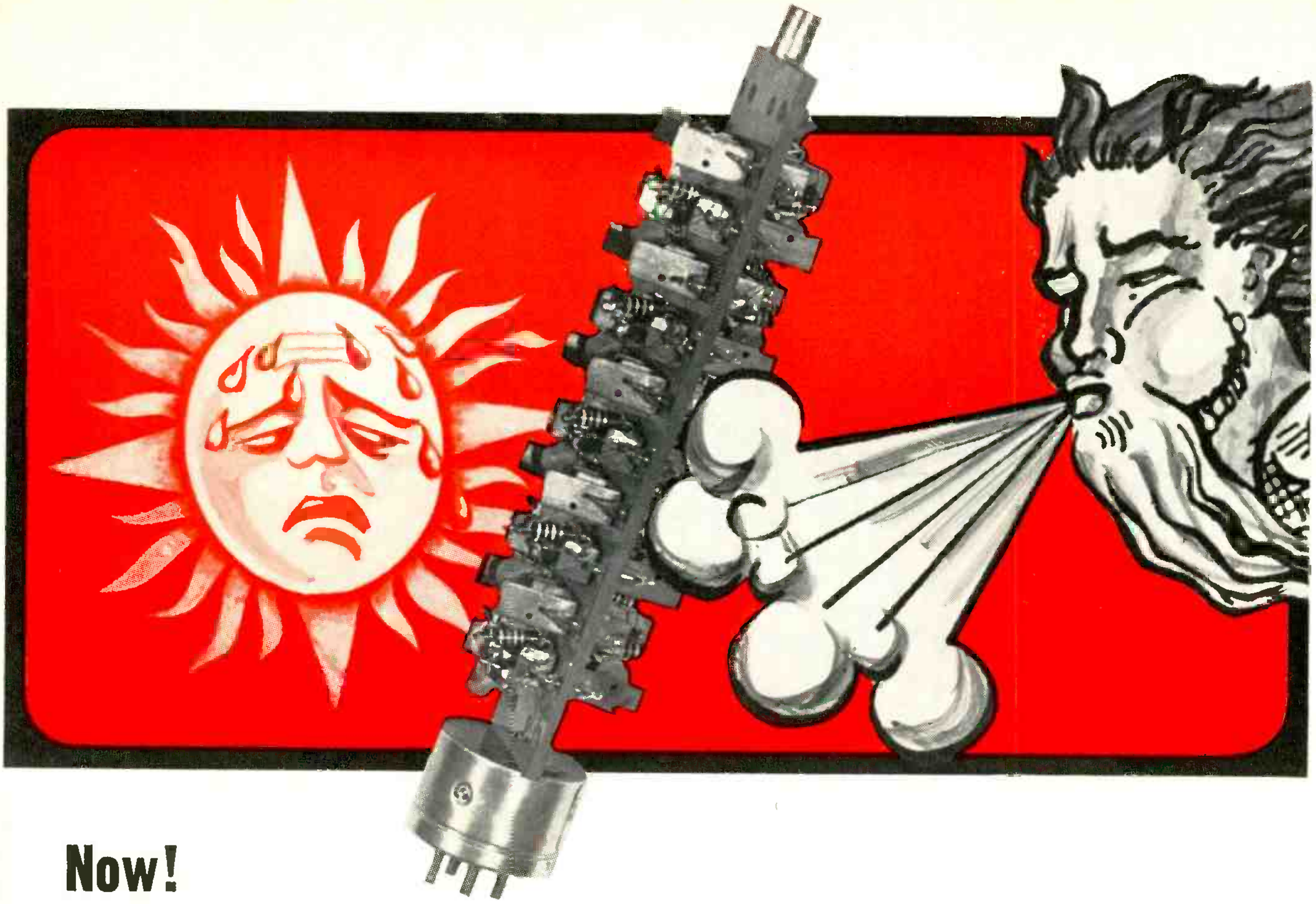
Sales of Viking Goldline Series equipment exceeded $1,850,000 from July 20 to Oct. 31.

Viking has also decided to drop the parent company name of Rego Industries, Inc., in favor of the more popular Viking identity.



Simultaneous video tape transmission on three separate channels was accomplished recently at Bradley University, Peoria, Ill. ETV programs were sent 19 miles from a 2500-mc microwave transmitter to a repeater station 11 miles away and relayed to Eureka College. The EMCEE system is designed to transmit signals in several directions to 22 schools in 4 cities, then converted to a standard VHF channel. Under ideal conditions, schools up to 20 miles from the transmission point can receive a sharp picture. Cost of setting up a 2500-mc system is about $35,000 for the first channel, $15,000 each for additional channels.

Paul E. Wenger (l), speech and broadcasting professor at Milliken U., Decatur, Ill., and Arthur H. Peterson, Chicago rep for Magnecord, examine the oldest operating Model PT6 recorder in existence. For finding the unit during Magnecord's "Wanted" Contest, Wenger won a new Model 1028 and the university was given a new PT6.



Now!

End "Off-Air" Panic and Eliminate Temperature Worries Forever, with... WILKINSON SILICON RECTIFIERS

No more finicky temperature sensitive mercury vapor rectifiers . . . Go on cold mornings! Forget heating and air conditioning! . . . Wilkinson Silicon Replacement Rectifiers produce no filament heat and function below −60° C.

No longer high priced! Wilkinson Silicon Rectifiers cost less than others and can be repaired in seconds with low-cost replacement diodes. No encapsulation used! No more guesswork or costly test time! You know at a glance the exact status of your complete power supply because a "GO, NO GO" indicator warns when the reverse leakage of any diode is in excess of 50 microamps. Wilkinson Rectifiers virtually last forever!

Now it's easy and economical to solid state the power supplies in high power equipment. With Wilkinson Rectifiers no rewiring is necessary. Just plug them into your present mercury vapor tube socket. Filament transformers as well as other components are left in place.

Modernize your equipment today! Consult the Tube Replacement Chart shown here and order now!

FEATURES: Light indicator on each diode warns of any difficulty or high voltage ON. • Easily replaceable low-cost diodes. • Reduces heat — power cost — hash. • Operates from −65° C to +70° C Free Convection. • Eliminates warm-up time.

TUBE REPLACEMENT CHART

WE TYPE	REPLACES TUBE TYPE			P.R.V.	AMPS	UNIT PRICE
SR-3-1	866A	816		3KV	1	10.95
SR-10-6	872	8008		10KV	6	50.00
SR-10-12	872	8008	575	10KV	12	60.00
SR-14-6	872	8008	575	14KV	6	72.00
SR-14-12	872	8008	575	14KV	12	84.00
SR-20-6	6894	6895	673	20KV	6	100.00
SR-20-12	6894	6895	673	20KV	12	120.00
SR-24-15	869B			24KV	15	225.00
SR-32-25	857B			32KV	25	475.00

FOR COMPLETE DETAILS WRITE:

WILKINSON ELECTRONICS, INC. 1937 MACDADE BLVD. • WOODLYN, PA. 19094
TELEPHONE (AREA CODE 215) 874-5236 874-5237

Circle 9 on Reader Service Card

CATV

Sealmetic Coaxial is the flexible CATV cable that stabilizes attenuation by eliminating moisture penetration. Anaconda's exclusive process of hermetically sealing the sheath creates a positive moisture barrier—and at the same time increases flexibility.

Easy handling during installation, and positive moisture protection in service, assure a stable attenuation

ATTENUATION

stabilized by new Sealmetic® Sheathed Coaxial –the flexible moistureproof cable

level year after year. TV pictures will still be sharp and clear long after other cables have failed.

New Sealmetic Coaxial is designed for CATV, tested for CATV, manufactured for CATV to Anaconda's high standards. For more information, call your Anaconda Wire and Cable Company, Department EFL, 605 Third Avenue, New York, N. Y. 10016. 65223

ASK THE MAN FROM

ANACONDA®

THE OUTSIDE PLANT SPECIALIST
TO THE INDEPENDENT TELEPHONE INDUSTRY

Circle 10 on Reader Service Card

NAMES IN THE NEWS

Sherrill Dunn has been named Ameco sales promotion manager. Mr. Dunn will provide advertising, publicity, and public relations support for the Ameco sales organization. **Richard Peterson,** appointed president of newly formed Ameco Acceptance Corp., will have responsibility for providing capital requirements to customers, and he and his statff will act as liason between Ameco and the financial community.


Sherrill Dunn


Sydney Topol

Sidney Topol has been named manager of Raytheon's CADPO Div. He succeeds **William T. Welsh** who was promoted to V-P, Gov't Marketing. **J. Paul Audet,** formerly midwestern sales manager for Gencom, has been appointed to direct the operations of Ward Electronic Industries' new Chicago sales office.

Kemp Pace, appointed sales manager of CAS Manufacturing Co., will be responsible for national sales as well as the firm's distributor network.

L. Kenneth Powley has joined Superior Cable Corp. and will establish a sales office in Atlanta, Ga., to serve the southeastern states.


L. K. Powley


Hollis Rogers

Hollis Rogers, named Viking sales rep for Louisiana, Arkansas, and Mississippi, will operate from the new Viking office in Greenville, Miss.

J. C. Sparkman has been appointed Viking Industries' Technical Sales Rep in the newly established Northwestern regional sales office in Portland, Ore.

Donald Spencer has been named Chairman and Chief Executive Officer, Spencer-Kennedy Labs. **Charles H. Wright** has been appointed President and Treasurer.

Dan L. Johnson has been added to the staff of Jack Pruzan Co. as Sales Representative in Western and Rocky Mountain states.


Richard Yearick, Ameco VP of Product Sales, delivers the keys of the new Salesmobile II to Lloyd Tate (r), CATV engineer coordinator. The $14,000 mobile lab features over 300 sq. ft. of working area, including a completely equipped test and alignment section. Some 18 units are now in service.

Robert Alan Brooks has been appointed chief engineer of Anaconda Wire and Cable Co.'s Communications Systems Div. He and his staff will be responsible for the design and installation of CATV and associated systems.

Fred P. Ciambrone, named operations manager, Dynair Electronics, Inc., will direct all manufacturing operations of military, commercial, and broadcasting products.

Hal L. Johnson has been appointed national sales manager, Industrial Products Div., Sony Corp. of America, with headquarters in Inglewood, Cal.

Don Jones has been appointed district sales manager for McMartin Industries. From his Dallas, Tex., headquarters, Mr. Jones will work with sales reps in 14 southern and south central states. **Robert Milsk Co., Detroit,** is now representing McMartin in Michigan, Indiana, and Kentucky.


Gilbert Engineering Co., Inc., manufacturer of coaxial cable fittings and connectors for CATV, recently held an open house to introduce its Phoenix-area customers to its new manufacturing plant at 3700 N. 36th Ave. Mr. Earl Gilbert is shown welcoming Mr. Gay C. Kleykamp, Kaiser-Cox Corp. The move to the 20,000 sq. ft. building was necessitated by the firm's expansion from 6 employees in 1957 to 125 in 1965. Sales for last year reached about $2½ million.

Those R&D eggheads have fouled us up again.

They called our bluff, met our design objective, raised us two operational modes and hit the jackpot–The PCA-1

(Program Controlled Amplifier)

A modest $990.00*

*(U.S Funds, F O B Toronto. Duty and Brokerage Fees Included)

All we asked the lab to develop was a simple forward acting solid state limiter, with 30:1 ratio, fast attack, low distortion, "Set and Forget" operation. Then they surprised us with multifunctional circuitry—a bonus of two additional operating modes *essentially for the same price*.

The automatic leveller has a 40 db range—and that's about twice as good as the competition — plus an audio external controller. Given some modicum of sophistication, you can even juggle a constant or three, and the PCA-1 functions imperturbably as a limiter *and* an automatic leveller. Simultaneously.

And if this little introduction isn't intriguing enough, *you should see the specs*. Those PhD's of ours really came up with a lallapalooza. For details write to:

Northern Electric
COMPANY LIMITED
DEPT. 9950, BELLEVILLE, ONTARIO, CANADA

. . . tantalizing, isn't it?

1065-2

Circle 12 on Reader Service Card

Rules on Fraudulent Billing Practices

On March 9, 1962, the Commission issued a Public Notice (FCC 62-272) warning licensees against the fraudulent practice of double billing, specifically stating that it regards the practice as contrary to public interest. On October 20, 1965, by Report and Order (FCC 65-951) in Docket No. 15396, the Commission amended Part 73 to regulate fraudulent billing practices by AM, FM, and TV stations. The Report was designed to (1) clarify and broaden applicability of the Commission's policies against "double billing" and (2) establish formal rules based on existing policies.

The essence of fraudulent practice is the existence of a scheme to defraud a manufacturer, his distributor, jobber or advertising agent, or any other party, by deceiving him as to the (1) quantity, (2) content, or (3) amount actually charged for cooperatively sponsored advertising. The same principle applies when a broadcaster engages in a scheme to permit an advertising agency to mislead its clients as to the amount charged by the station for advertising. The classic double billing practice results in the manufacturer paying a larger share of a local dealer's cooperative advertising costs; however, in some instances, the manufacturer uses this scheme to violate the Clayton and Robinson-Patman Acts. The Commission's current release on fraudulent billing is aimed at deception and misrepresentation by *any* party in this area. If the station has knowledge of such deception it should not accept the advertising.

These laws make it unlawful for a manufacturer to give discriminatory discounts, rebates, or advertising allowances to dealers. (any information of this nature, which involves a scheme to violate a federal statute, will not only reflect seriously upon the qualifications of the licensee before the FCC, but the matter may also be referred to the FTC.

Recent FCC Actions

Pursuant to its announced policy, the Commission took several actions:

(1) On December 4, 1963, the Commission sent a letter to WFHA-FM deferring action on a renewal application pending response by the licensee to questions concerning double billing.

(2) On December 13, 1963, an Order was released designating for hearing the renewal application of Station WILD on various issues, one of which was concerned with double billing.

(3) On February 12, 1964, a letter addressed to Station WATS granted its renewal application, but contained a warning concerning double billing practices.

On March 31, 1964, the Commission issued a Notice of Proposed Rule Making (Docket No. 15396) directed towards the establishment of appropriate rules to prohibit double billing practices. Nine parties filed comments;

Argument 1. Because double billing is obviously fraudulent and reflects upon a licensee's character. It should, therefore, be a relevant factor to consider when a renewal application is filed. However, it is a business matter which does not affect the station's basic mission to serve the public; therefore, the Commission should not regulate this area by rules.

Response: The Communications Act, which requires operation of a station in the public interest, necessarily implies that the licensee be required to abide by the law in the operation of the station, *F.C.C. v. American Broadcasting Co.*, 347 U.S. 284, 290 (1954); *Granik v, F.C.C.*, 234 F. 2d 682 (1956). Not only is the licensee engaging in a patently fraudulent act (for which damages may be obtained by the injured parties at common law), but the pursuit of such illegal conduct by a licensee may injure other competitive stations not engaging in such actions.

Argument 2. Because other legal remedies are available, adoption of rules prohibiting double billing would constitute double jeopardy.

Response: The Commission is not required to stand aside merely because there may be remedies available locally or on the federal level. *F.C.C. v. American Broadcasting Co., supra.*

Examples of Double Billing

1. A licensee issues a bill or invoice to a local dealer for 50 commercial spots at a rate of $5.00 each, for a total of $250. In connection with the same 50 commercial spots, the station also supplies the local dealer, or an advertising agency, jobber, distributor, or manufacturer of products sold by the local dealer, another affidavit, memorandum, bill or invoice which indicates that the amount charged the local dealer for the 50 spots was greater than $5.00 per spot.

INTERPRETATION: This is the classic case of fraudulent billing, since it tends to deceive the manufacturer, jobber, distributor, or advertising agency to which the inflated bill eventually is sent, as to the amount actually charged and received by the station for the advertising.

2. A licensee issues a bill or invoice to a local dealer for 50 commercial spots at $5.00 each and the bill, invoice, or accompanying affidavit indicates that the 50 spots were broadcast on behalf of certain cooperatively advertised products, *whereas some of the spots did*

not advertise the specified products, but were used by the local dealer solely to advertise his store or other products for which cooperative sponsorship could not be obtained.

INTERPRETATION: This is fraudulent billing, even though the station actually received $5.00 each for the 50 spots, because, by falsely representing that the spots advertised certain products, the licensee has enabled the local dealer to obtain reimbursement from the manufacturer, distributor, jobber, or advertising agency for advertising on behalf of its product which was not actually broadcast.

3. A licensee sends, or permits its employees to send, blank bills or invoices bearing the name of the licensee or his call letters to a local dealer or other party.

INTERPRETATION: A presumption exists that licensee is tacitly participating in a fraudulent billing scheme whereby a local dealer, advertising agency or other party is enabled to deceive a third party as to the rate actually charged by licensee for advertising, and thereby to collect reimbursement for such advertising in an amount greater than that specified by the agreement between the third party and the local dealer. *It is the licensee's responsibility* to maintain control over the issuance of bills and invoices in the licensee's name, *to make sure that fraud is not practiced.*

4. A licensee submits bills or invoices to an advertising agency, station representative, or other party indicating that licensee's rate per spot is $50.00, whereas the licensee actually receives only $5.00 or $10.00 per spot in actual payment from the agency, representative or other party. Licensee claims that the remaining 80 to 90 percent of its original invoice has been deducted by the agency as "commission" and, therefore, no "double billing" is involved.

INTERPRETATION: This is fraudulent billing. The agency discount does not customarily exceed 15 percent and the supplying of bills and invoices which indicate that the licensee is charging several times as much for advertising as he actually receives constitutes participation in a fraudulent billing scheme.

5. A licensee submits a bill or invoice to a local dealer or other party for 50 commercial spots at $5.00 each, for a total of $250. However, the bottom of the bill or invoice carries an addendum, so placed that it may be cut off the bill or invoice without leaving any indication that the invoice originally carried such an addendum. The addendum specifies a "discount" to the advertiser based on volume, frequency, or other consideration, so that the amount actually billed at the bottom of the page is less than $5.00 for each spot.

INTERPRETATION: The preparation of bills or invoices in a manner which seems designed primarily to enable the dealer to deceive a cooperative advertiser as to the amount actually charged for cooperative advertising raises a presumption that the licensee is participating in a "double billing" scheme.

6. A licensee submits a bill or invoice to a local dealer for 50 spots involving cooperative advertising of a certain product or products at a rate of $5.00 each, and actually collects this amount from the dealer. However, as a "bonus," the licensee "gives" the dealer 50 additional spots in which the product or products named on the original invoice are not advertised, so that the dealer actually obtains the benefit of 100 spots in return for payment to the station of the $250 billed for the 50 cooperative spots.

INTERPRETATION: If the 50 "bonus" spots were broadcast as the result of any agreement or understanding, expressed or implied, that the dealer would receive such additional advertising in return for contracting for the first 50 spots at $5.00 each, the so-called "bonus" spots were in fact a part of the same deal, and the licensee, by his actions, is participating in a scheme to deceive and defraud a manufacturer, jobber, distributor, or advertising agency.

7. A local appliance dealer agrees to purchase 1,000 spots per year from a station and thereby earns a discount which reduces his rate per spot from $10.00 to $5.00. During the course of the year, the dealer purchases 100 spots from the station which advertise both the dealer and "Appliance A" and for which the dealer pays $5.00 per spot. Since the station's rate per spot for 100 spots is $10.00, the dealer asks the station to supply him with an invoice for the 100 spots on behalf of "Appliance A" at $10.00 per spot, claiming that if the manufacturer of the appliance had purchased the 100 spots, or if the dealer himself had purchased only these 100 spots within the course of a year, the $10.00 rate would apply, and that, therefore, the manufacturer should be required to reimburse the dealer at the $10.00 rate.

INTERPRETATION: This practice constitutes fraudulent billing unless the dealer can provide satisfactory evidence that the manufacturer of "Appliance A" is aware that the dealer actually paid only $5.00 per spot because of the volume discount.

8. A licensee issues a bill or invoice to a dealer for commercial spots never broadcast.

INTERPRETATION: This practice, prima facie, involves fraud, either against the dealer or against a third party which the dealer expects to provide partial reimbursement for the non-existent advertising.

The Commission's View

In summary, as the Commission stated, ". . . *the basic element in double billing* is the furnishing of *false information to any party* contributing to the payment of broadcast advertising as to *the amount actually charged* by the licensee for such advertising or as to the *nature, quantity or content* of such advertising." (Italics supplied.) The Commission, by its new double billing rules, seeks to terminate misrepresentation and deception of any party, as to the rates, quantity, and content of broadcast advertising. Such "fraud" may take many forms, but the licensee should keep the Commission's *basic* purpose uppermost in his mind. The licensee is required to use "reasonable diligence" to be sure that his employees and agents do not engage in double billing practices. This requirement is simply a re-affirmation of the licensee's long-recognized obligation to exercise adequate supervision over its broadcast operation. ●

The Great New Phoenician Series

NEW Solid-State, All-Band, Trunkline Amplifiers

Featuring unsurpassed serviceability and flexibility ■ Unique design for easy "fool-proof conversion ■ Die-cast aluminum casing, all-weather and moisture-proof ■ Universal-type fittings to accommodate all popular sizes and types of cable.

THE OUTSIDE STORY

The new "Phoenician" series combines rugged construction, unusual serviceability, and dependable performance under all operating conditions. The 3 sealed access ports permit internal probe measurement in any weather without exposing the entire internal parts. Fittings of new design and moisture-proof seal are backed by Kaiser-Cox warranty. (Patent applied for) The new Kaiser-developed aluminum alloy used in fittings is impervious to corrosion.

The Kaiser-Cox Phoenician series is ready NOW. The SOLID products you can DEPEND on . . .!

THE INSIDE STORY of the Phoenician Amplifier series. Modular construction of the "plug-in" type allows complete interchangeability from trunkline amplifier to 2 and 4-output bridging amplifier — or combinations of trunkline and bridging amplifier (with or without AGC and automatic tilt). Built-in knob type controls eliminate the need for screwdrivers, plug-in pads or accessories.

SOLID PERFORMANCE! The new Kaiser-Cox "Phoenician" series works as well as it *looks* . . . CATV's finest all-band, "human-engineered" amplifier. The Phoenician series is your assurance that your CATV system (from head-end to tap-off) will deliver maximum signal quality with minimum degradation at all times. Low noise figure—minimum cross-modulation products — CASCADEABILITY PLUS — these are the results of Kaiser-Cox background in the exacting aerospace world of close tolerances, rigid specifications, quality control. An excess of 25,000 man-hours of engineering research and development, unrelenting purchasing standards and production know-how mean these Kaiser-Cox CATV products perform to published specifications.

Your inquiries are invited . . . write, phone or visit . . .

KAISER-COX CATV

KAISER-COX PRODUCES CATV EQUIPMENT
IT IS NOT IN THE FRANCHISE BUSINESS

KAISER-COX CORPORATION / *P. O. Box 9728, Phoenix, Ariz. 85020, Phone (602) 944-4411*

DEPEND ON KAISER-COX FOR CATV LEADERSHIP TODAY AND TOMORROW

Circle 14 on Reader Service Card

Design & Operation Of DA Systems

By John H. Battison

Part I—With the increasing use of AM directional systems, a working knowledge of their operation is a necessity for every broadcaster.

About This Series: *This initial part of a 6-Part series deals with simple directional pattern calculations, providing the basic design theory for achieving a simple pattern. Next month, complete description of a 2-tower antenna design and final proof of performance of the array will be given. We will assume that reasons for using a directional antenna are understood by the reader and that he plans to design his antenna to fit a particular situation. Succeeding parts will delve into more complex systems until, at the end of the series, the average engineer/reader should be able to make a pretty good stab at designing his own system.*

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

To many radio engineers, the directional antenna is still a mystery-shrouded enigma. As a result, the demand for qualified directional antenna operators continues to grow. This series of articles will acquaint operator-engineers and management personnel with the design and operation of DAs to the extent that they can develop a working familiarity with DA systems.

Basic Directional Considerations

A single vertical antenna will radiate an equal amount of power in all directions, providing a basically circular pattern. If a second vertical antenna is inserted into the field of the first, the pattern shape will no longer be circular; it may be elongated, "dented," or approximate a figure 8, depending on height, spacing, and current in the second antenna. Patterns shapes may be distorted if an antenna system is built too close to a water tower or a similar structure capable of re-radiating RF energy. The contrived introduction of the second antenna into the field of the first allows us to control its effects and achieve the pattern desired.

Three factors determine the radiation pattern of any array: spacing between the towers; phase relationship of tower currents; and the ratios between the amounts of current in each tower. By manipulating these parameters, almost any desired pattern can be achieved. In physical construction, each tower is treated as though it were an individual antenna as far as its ground system is concerned. All antennas must have the same number of radials. If tower spacing is such that the radials would overlap, each radial must be terminated where it meets another and the ends bonded together (Fig. 2). Bonding is necessary to obviate any high resistance joints that can cause power losses in the ground return path. Bonding also reduces the possibility of cross modulation and harmonic radiation due to corroded connections in the high power field surrounding an antenna.

The ground systems of all the antennas in an array should be identical. If they are not, and one antenna has fewer radials than another, there is a possibility that radiation in that direction may be impaired due to increased ground losses on that side. This is a the-

Know the Rules

Contrary to popular belief, any engineer can present a design for a directional antenna to the FCC. In fact, any engineer can file any kind of FCC application. All he has to do in the case of a directional antenna is satisfy the Commission that he is properly qualified to perform the work. If he does not, chances are the application will be returned with a request for more information. In some cases it may simply be denied!

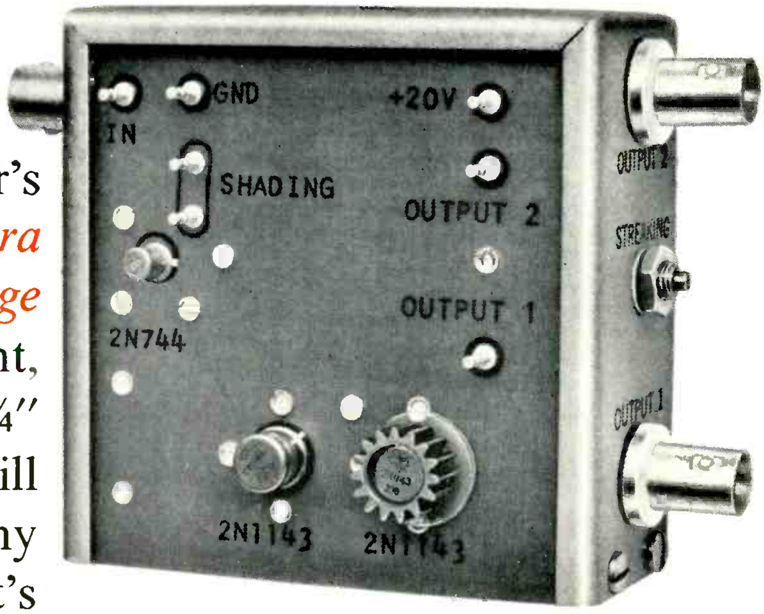
One word of warning is in order: Although it is quite true that **anyone** can file an FCC application, it is legal, as far as state professional engineering laws are concerned, **only** if it is for one's employer, or oneself. An engineer, no matter how qualified, cannot set himself up as an engineer for public consultation unless he has achieved registration as a professional engineer in his state.

The following FCC Rules describe the data to be provided by the applicant:

73.33 Antenna Systems, and **73.45 Radiating System:** Describes the basic showing required.

73.150 Data Required with Applications for Directional Antenna Systems: Call for a complete technical description with an actual sample calculation using the formula specified. Full constructional and antenna layout details are required in pictorial (sketch) form. All actual pattern data such as major and minor lobes as well as nulls must be plotted.

73.151 Field Intensity Measurements Required to Establish Performance of Directional Antennas: Governs the making of a proof of performance once the system is built. Its main objective is to demonstrate to the Commission's satisfaction that the antenna conforms in performance with the technical specification. This Rule tells **how** to make the measurements, **where** to make them, and **what** to do with them. It specifies how the resulting data should be presented, and defines the method for determining ground conductivity. It also asks for details concerning the monitoring points selected.



International Nuclear's *transistorized TCA3 camera amplifier fits any image orthicon camera.* That's right, this miniaturized (3¼" x 3¼" x 1¼") camera amplifier will replace vacuum tubes in any image orthicon camera. It's completely transistorized and is very simply mounted within the camera. Microphonics are eliminated. Operating voltage is obtained from 285 volt source already in camera and is post-regulated. *The TCA3 fits any image orthicon camera.* A transistor protective device is included in case the high-voltage blocking capacitor at the image orthicon anode should short-circuit. Signal connectors are BNC type as well as solder-terminals. TCA3 circuit uses but three transistors, all proven EIA types. Output stage delivers signals for view-finder as well as camera chain. Peaking and streaking controls are included and are easily adjusted by use of standard RETMA resolution chart. *We promise, the TCA3 camera amplifier will fit any image orthicon camera.* They are on-the-air proven in TK10/TK30, TK11/TK31, 4PC4A1 and TA124E cameras. Instructions, necessary hardware and pre-cut cables are included.

PRICE, F.O.B. NASHVILLE . . . . . $295.00 EACH

For more complete information write or phone:

INTERNATIONAL NUCLEAR CORPORATION

608 NORRIS AVENUE • NASHVILLE, TENN. • PHONE 615-254-3366

INTERNATIONAL NUCLEAR CORP.

Circle 15 on Reader Service Card

oretical problem; however, if an array design proposing a very seriously lopsided ground system is presented to the FCC, a special showing may be required to prove that the pattern and efficiency will not be impaired.

Two-Tower Arrays

Fig 2 is a plane representation of a typical two-tower array. It is convenient to assume that the currents in each tower are the same, the height of each tower is the same, and the current phasing in each tower is the same. The only thing that can affect the value of the radiation field is the position of the observer in relation to the combinaiton. The towers are indicated as #1 and #2, the observer's positions as P1 and P2; these positions were chosen so that they are at least 10 wavelengths away from the towers, and in fact can be treated as though they were infinitely far away. For all practical purposes, the distance of P1 to both towers is the same. But no matter how far P2 is from the array, its distance from tower #2 will always be a maximum of a half wavelength (180°) greater than from tower #1. P1 and P2 may be moved 180° (P1 to the top of the illustration and P2 to the right of the array) and the result will be exactly the same.

Remembering that radiation from each tower is identical, let us look at the signals received at P1 and P2. At P1 the two radiation path lengths are identical; therefore, each signal will arrive with the same phase and magnitude (neglecting transmission path distortions). Since the signals will be in phase (and thus will add), signal strength will be twice the amplitude as from a single antenna (see Fig. 4).

At P2 the distance from tower #2 is the same as from P1, but the distance from tower #1 to P2 is 180° (a half wavelength) longer. Therefore, the signal from tower #2 will reach P2 before the signal from tower #1. In fact, it will reach P2 exactly 180° out of phase with the signal from tower #1. As a result, the two signals will exactly cancel each other so that there will be zero signal at P2.

The broken circle in Fig. 4 would be the radiation pattern from a single antenna at the same power, drawn to scale so that it can be seen that the radiation in

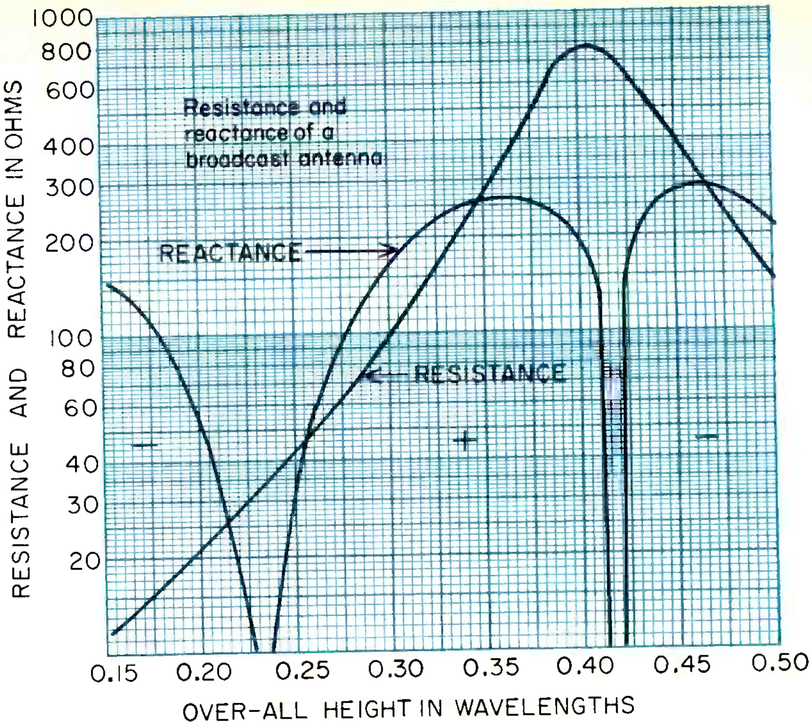


Fig. 1. Location of 1st and 2nd resonance points, and the resistance/reactance relationship in a broadcast antenna.

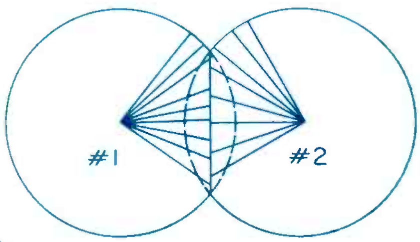


Fig. 2. The ground radials of multi-tower arrays must be terminated and bonded at their junction.

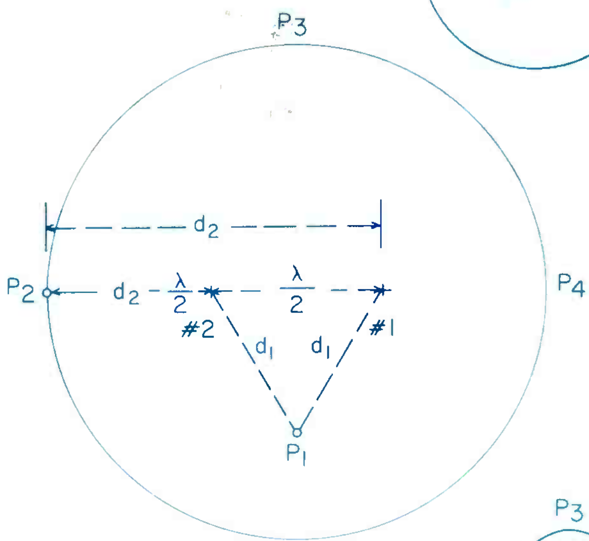


Fig. 3. Geometric layout of basic 2-tower array. P1 is equidistant from each tower; P2 is the same distance from tower #2 as P1, but ½ wavelength further from tower #1.

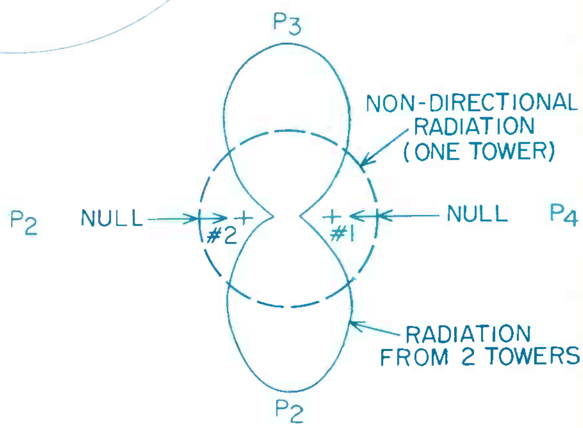


Fig. 4. Radiation of array in Fig. 3.

Antenna Engineering Fundamentals

Radiation Measurement: The radiation standard used in all antenna computations is the millivolt per meter (mv/m) at one mile from the antenna. With non-directional antennas, radiation is referred to, for example, as 175 mv/m: the one mile is understood. Directional antenna radiation is given the same way, but an angle from True North is included to describe the azimuth bearing—for example, azimuth 110°, radiation 175 mv/m. The one mile distance still applies but only on this azimuth.

Bearings (azimuths) are measured from True North. During the actual design work, a line through the towers (line of towers) is used as the zero degree reference. After the pattern has been computed it is oriented to True North to obtain the required coverage.

Radiation Resistance: Radiation resistance can be computed by applying Ohm's Law. The actual radiated power equals the antenna current squared times the resistance. Therefore, a half-wave dipole with one amp of RF energy flowing through its center (note the specific location) will produce a field intensity of 37.42 mv/m at one mile. The radiation resistance measured at the antenna center would be 73.13 ohms. The power required to produce one amp of current (one amp squared times the resistance of 73.13) equals 73.13 watts.

Note that 73.13 ohms is the correct radiation resistance only at the point of measurement (center). The value at other points may be computed by applying the sine of the distance from the end of the antenna to the point of measurement. For example, suppose we measured 45° from the end of the antenna; the sine of 45° is 0.7071, or 0.7071 amps. Radiation resistance is computed by dividing the power (73.13 watts) by the current squared (0.5), 146 ohms.

Antenna resistance is generally computed at the point of maximum current; however, it is usually necessary to know the input resistance at the drive point of the antenna. It is usual to measure resistance at the input of the tower with all coupling equipment disconnected. In directional arrays, resistance must also be measured at the common feed point to all towers.

Antenna Resonance/Reactance: Transmission line theory applied to the dipole gives us a usable tool; in fact, the characteristic impedance of a half-wave dipole can be analyzed in the same manner as a transmission line, generally described by $Z = Z / j \tan \phi$. Applying this formula to the two elements of a half-wave dipole, we find that $Z = 120\ (l_n\ 4S\text{-}1/d)$. At low frequencies, input impedance is largely capacitive and radiation resistance is low. Above the first resonance, resistance continues to increase and reactance becomes inductive. At the second resonance, reactance again falls to zero, theoretically, and resistance reaches a maximum (Fig. 1). The height of a typical broadcast antenna is approximately one-half wavelength at the second resonance.

Practical Broadcast Antennas: Quarter wavelength towers, using the "earth image" as one section of a half-wave dipole, are widely used in broadcasting. The two parts of the antenna (tower and earth) are separated by an insulator; one side of the transmission line is connected to the drive point of the tower, the other side is grounded. Thus, half the power goes into the antenna and the other half goes into the ground radiation field. Since the antenna input is divided in half, so is the impedance of the half-wave antenna. As a result of the capacity between the tower and ground, certain losses due to poor earth conductivity are inevitable. The loss is minimized by a system of buried wires radiating out from the base of the tower. Generally, there are 90 such radials ¼ or ½ wavelength long. Burial depth, size, and earth conductivity are less important than length of and distance between radials.

One amp in a half-wave antenna of 73.13 ohms resistance will produce 37.42 mv/m at one mile. Due to the apparent existence of the second portion of the half-way antenna in the ground, a quarter-wave section will produce 37.42 mv/m at one mile with one amp flowing at its base. However, the radiation resistance of the quarter-wave tower is half that of a half-wave dipole, so the power required to drive the antenna with one amp is only 36.6 watts (radiation resistance is 36.6 ohms).

Field intensity is proportional to the square root of the power, with 1 kw as the usual reference. Thus, we refer our statements to 1 kw as: 37.42 mv/m $\sqrt{1{,}000/36.6} = 196$ mv/m (one amp produces 37.42 mv/m at one mile). This says that with an ideal antenna (no losses and 100% efficiency), 1 kw fed into a quarter-wave antenna will produce 196 mv/m at one mile. If we want to judge how more power will increase field intensity at the same distance, we multiply 196 by the square root of the new power. For example, an increase from 1 to 10 kw will give us 610 mv/m (multiply 196 by 3.16, the square root of 10).

the direction of P1 (and P3) is twice that expected from one antenna. On the other hand, the radiation at P2 (and P4) is zero, as shown by the tangents of the two major lobes. At other positions around the 360° circle surrounding the array, the pattern size and shape will vary according to the distances and the particular position.

It must be remembered that this an idealized theoretical treatment of the situation so that the pattern comes out evenly. In practice, the radiation will not go to exactly zero under most conditions, nor can we literally expect twice the radiation at the maximum signal positions. Generally, these conditions may be assumed initially, then modifying factors are applied to obtain the actual operating parameters. It is well to remember that in practice the pattern is not formed until the induction field (strong signal field in the immediate area of the array) has been left behind, and the measurement point is far enough away for the field intensity to be modified by the phase of the arriving signals.

Next month, we will delve into the practical application of two-tower theory. ●

TV Antenna Engineering For Effective Coverage

By Harry A. Etkin

Thanks to modern design techniques, TV antennas can provide efficient coverage from a suburban site. With the right combination of height, power, and antenna type, almost any contour is possible.

A BROADCASTER is obliged to cover his *principal* market area with a signal of prescribed strength. Theoretically, this is simple: Find a high spot near the center of the area, erect an antenna, then crank up the power until the signal goes out far enough in all directions. Sometimes this theory will work, especially for low power and daytime radio stations, but in many cases, it's little more than a pipe dream for TV broadcasters. In the first place, the highest (or any high) spot near the center of an area may be undesirable for many reasons. Thus, the transmitter may have to be located on a lonely mountain top or a site bordering on the boondocks, miles from the center of the area. Hence, some tricky coverage problems may present themselves.

In addition to the antenna type, four basic factors, all variable, enter into the design of a radiation pattern: antenna *site*, antenna *gain*, antenna *height*, and transmitter *power*. These factors,

---

Mr. **Etkin** is a staff engineer, WQAL Philadelphia.

Photo A

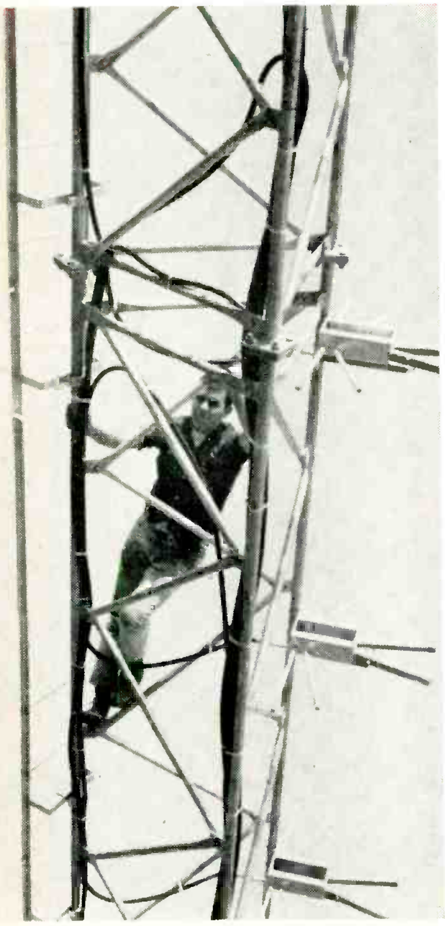
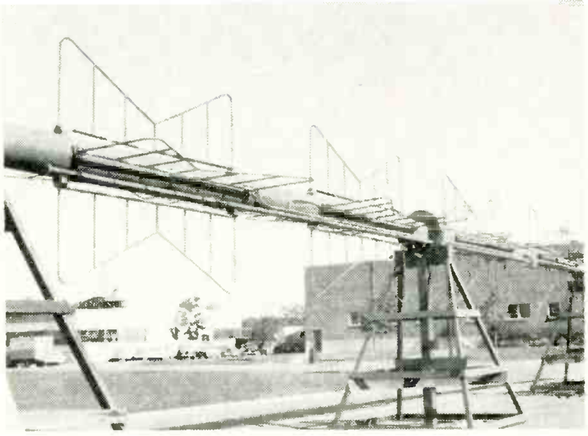


Photo C



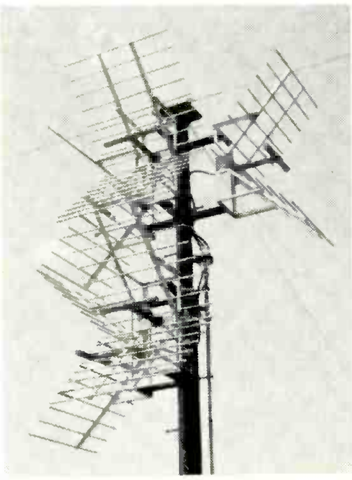


Photo B

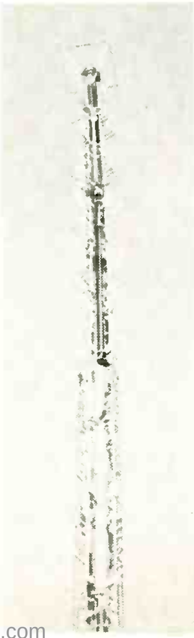


Photo D ►

Photo E

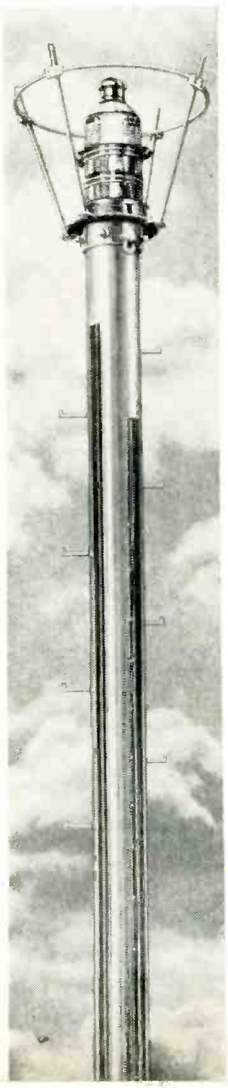
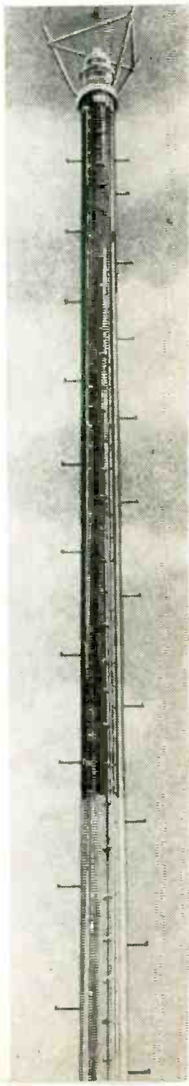


Photo F



in turn, depend on the operating channel, competitive coverage, condition of the terrain to be covered (flat, mountainous, adjacent to water, etc.), and of course adjacent and co-channel interference.

Site Selection

Ideally, the antenna site must provide an unobstructed line-of-sight path over the area to be served. This is best obtained, obviously, from a tall building, a mountain, or other points with terrain or structural height advantages. A centrally located antenna will radiate equal amounts of energy in all directions (omnidirectional) and, when fed with enough power, will provide the necessary Grade A coverage (Fig. 1A).

If, on the other hand, the only available (and most logical) site happens to be near the *edge* of the principle area (Fig. 1B), greatly increased transmitter power (or more antenna gain or greater height) will be required to provide proper coverage. If the omnidirectional radiation were increased, as it would have to be in Fig. 1B, additional coverage outside the principle area must justify the increased capital costs in the form of additional TV homes and greater potential revenue. An alternative solution, and in many cases the most logical, is to use a lower power transmitter and a *directional* antenna (Fig. 1C).

For these reasons, an applicant must consider transmitter location, height, and proximity to (or in) the principle community. Generally, it is wise to conduct experimental transmissions (which your consultant can perform) from prospective sites so that, from field strength measurements, an accurate prediction of coverage may be made.

Antenna vs Transmitter

For reasons of economy, both initial and operating, it is better to use a lower power transmitter and a higher (above average terrain) antenna than it is the other way around. However, there are antenna height limitations, and when this point is reached, the only alternative is a higher power transmitter and higher gain antenna—up to the maximum ERP allowed by the Rules (see Table I). Normally, ERP will exceed actual power due to antenna gain. The cost (initial and operating) of a 316-kw transmitter and single bay antenna, compared to that of a 25- or 50-kw transmitter and a high gain antenna designed to produce 316-kw ERP, strongly demonstrates the economy of high gain antennas.

From Figs. 3 and 4, we can see that a signal exceeding FCC minimum principle community requirements can be obtained beyond 10 miles with a 500′ antenna and a relatively low ERP. Further, a typical 4-bay antenna and a 25-kw transmitter or a 5-bay antenna and a 20-kw transmitter will furnish an ERP of 316 kw. With directional arrays, the gain per bay may be as high as 7.2; thus, an ERP of 316 kw may be obtained with a 3-bay directional antenna and a 20- or 25-kw transmitter.

Directional Antenna

The trend toward higher gain antennas, higher towers, and greater distances between transmitters and the communities they

Photo G

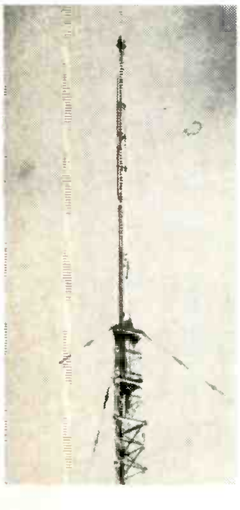
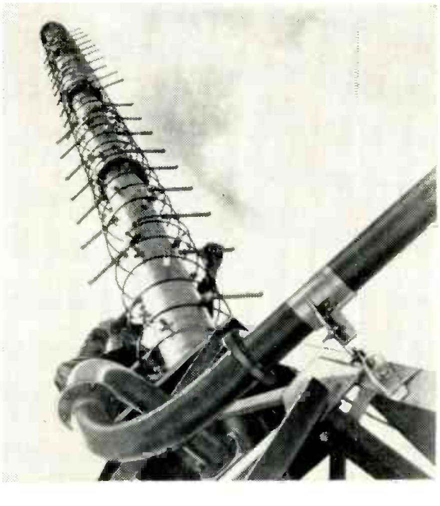


Photo H



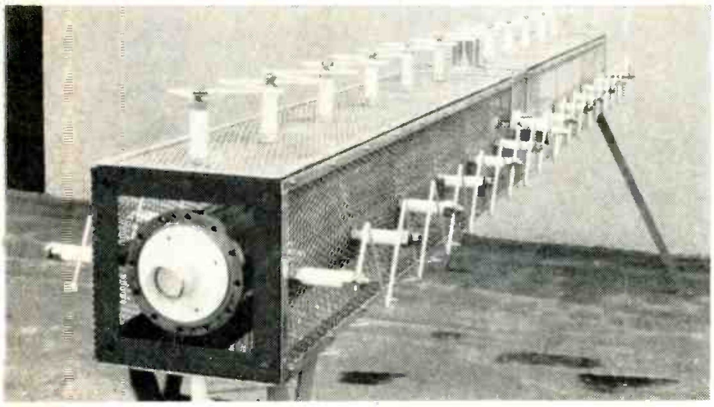


Photo I

Photo A—**"V" Element** or corner reflector is directionalized by certain tower sections and/or reflectors. Vertical bay spacing is critical.
Photo B—**Screen dipole** is directionalized by the same methods as those used for the "V" element. Antenna shown is designed for Channel 12.
Photo C—**Batwing** uses a slot diplexer and phasing unit to produce directional patterns.
Photo D—Various power divisions between the two planes of **Superturnstile** radiators will produce different types of directional patterns. Directional degree is determined by dividing tees—a 10/1 feed results in a 10 db notch; a 100/1 split produces a 20 db notch. Feeding power to only one side produces a full depth notch.
Photo E—**Slotted cylinder** or traveling wave antenna provides a high degree of flexibility in pattern choice by changing the diameter over wavelength ratio and by varying the number of slots.
Photo F—**UHF pylon** is directionalized by methods similar to those used for the slotted cylinder.
Photo G—**Slotted ring** is directionalized by two beam shaping members, each connected to alternate rings. A substantial part of the current, which would normally flow in the rings, is carried in the beam shaping members, thereby causing them to function as fed radiators. Beam members shape and length, as well as angle between them, determines pattern.
Photo H—**Helical** directional patterns are achieved by attaching stubs to the radiators at certain positions on each section. The stubs act like end-fed dipoles which distort the horizontal pattern by reinforcing the radiation field in a direction at right angles to the stubs. Directionalization may be changed by adding or removing stubs; stub length is not critical, usually 0.1 to 0.15 wavelength.
Photo I—Four **zig-zag** panels, forming a square cross-section, provide a wide range of orientations for a variety of patterns. Cross-sectional dimensions, distance between elements and reflecting screen, element phasing and amplitude, and power distribution to each panel determine directionalization.

serve has led to some fundamental coverage problems, many which can be solved with a directional antenna.

In many cases, the population concentration is such that a circular pattern can not efficiently cover the desired area. If, viewed from the antenna site, most of the potential audience is concentrated in one or two major localities, it may be impossible to cover all the desired area with a circular pattern. Under these circumstances, signal radiation over unpopulated areas (oceans, lakes, mountains, etc.) is wasteful, not to mention the very real possibility of reflection problems from mountains or other obstacles.

Directional Operation

With a directional array, it is possible to concentrate the signal in a specific area (or areas) without using excessive power or extremely high gain antennas. An antenna may, within reasonable limits, be modified (usually at higher cost) to provide more effective coverage of the desired area(s).

Fig. 5 illustrates the mathematical relationship between a directional and omnidirectional antenna; the directional pattern serves one-half the area of the circular pattern, but four times the circular pattern power is concentrated in the directional pattern. Hence, the field strength is doubled and the directional radius is extended by $\sqrt{2}$R. (As a general approximation, the service radius varies as a fourth root of the power.)

Almost any shape horizontal pattern—cardioid, figure eight,

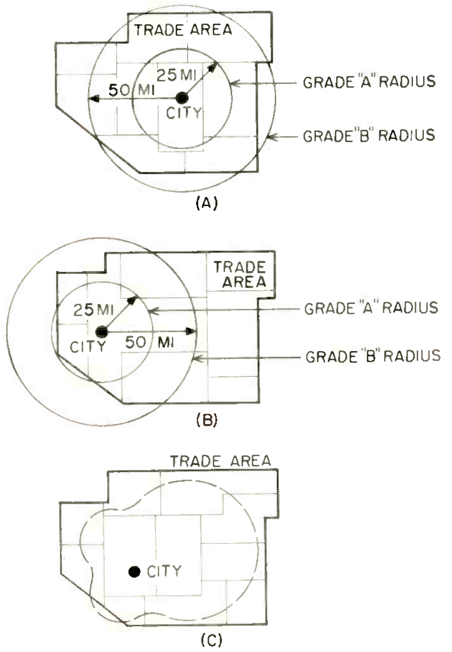


Fig. 1. A directional antenna (C) will cover (with similar ERP) the market area as well as a centrally located omnidirectional antenna (A).

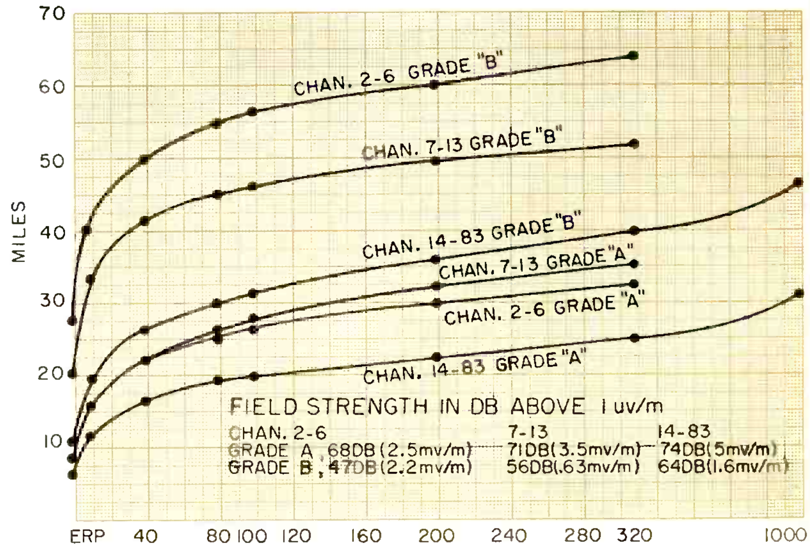


Fig. 3. A 500′ high antenna generally provides adequate coverage. Obvious here are propagation characteristics at various frequencies.

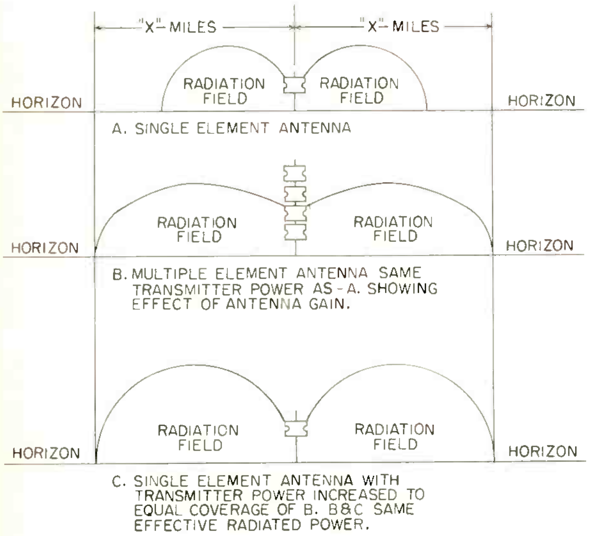


Fig. 2. A multiple element antenna covers more area with less transmitter power.

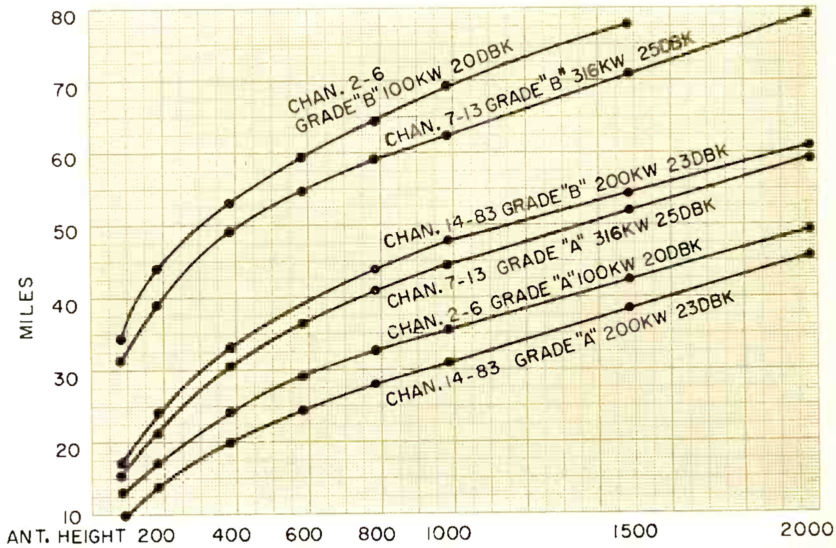


Fig. 4. Antenna height increases coverage when the ERP limit has been reached.

FCC Rules Governing Coverage and Site

Paragraph 73.685 of Vol. III.

☐ Minimum field intensity in db above 1 mv/m (dbu) over the entire principle community must be: 74 dbu, Channels 2-6; 77 dbu, Channels 7-13; 80 dbu, Channels 14-83. The antenna must be located at a point where the shadow effect on propagation, caused by hills and buildings, is reduced to a minimum over the principle area. In no event should there be any obstruction in the line-of-sight path from the antenna over the principle community. In cases of questionable locations, propagation tests should be conducted to indicate expected field intensity in the principle area.

☐ Directional antennas may be used to improve service upon an appropriate showing of need. Stations operating on Channels 2-13 will not be permitted to employ a directional antenna having a ratio of maximum-to-minimum horizontal radiation in excess of 10db; stations operating on Channels 14-83 with transmitters delivering a peak visual power output of more than 1 kw may employ directional antennas with a maximum - to - minimum horizontal radiation of not more than 15 db; stations operating on Channels 14-83 with less than 1 kw visual transmitter output are not limited.

☐ Applications proposing the use of directional antennas must include a complete description of a proposed system and horizontal and vertical plane radiation patterns.

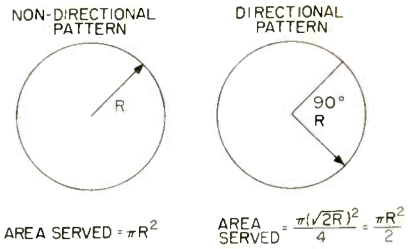
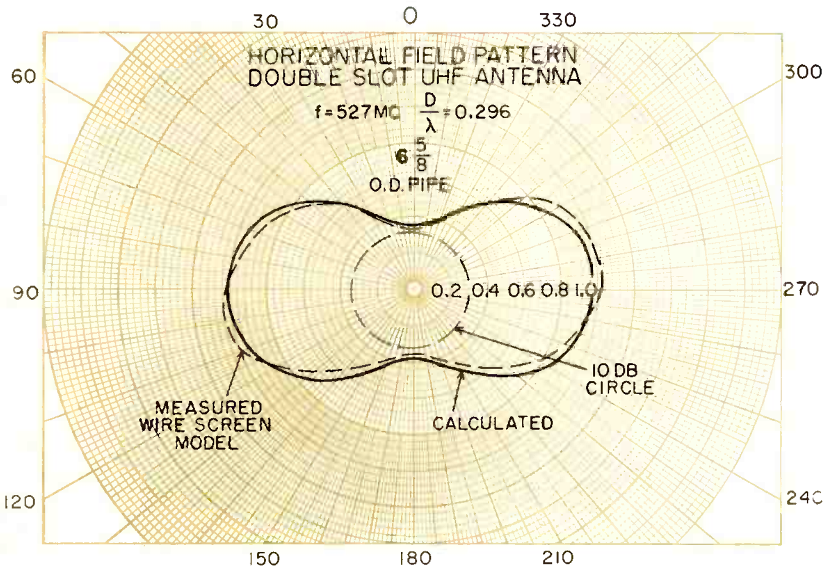
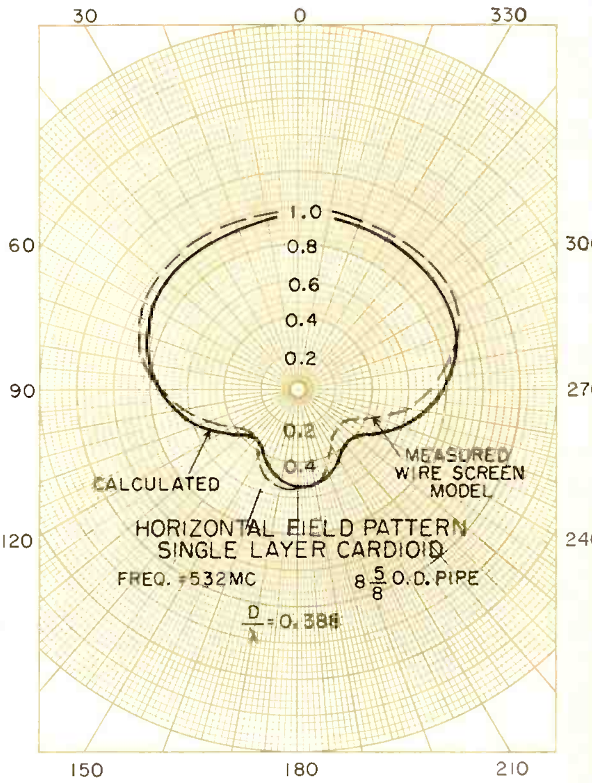
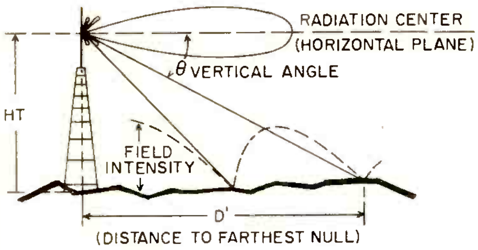


Fig. 5. Mathematical relationship between directional and non-directional antenna patterns.





▲ Fig. 6. Typical directional patterns. (A) cardioid. (B) peanut shaped.



◄ Fig. 7. The effect of vertical pattern nulls on close-in coverage.

peanut-shaped, etc. — may be achieved. With the cardioid pattern in Fig. 6A, one major population area can be covered from a transmitter location at the edge of the principle area. Fig. 6B shows a peanut-shaped pattern which will cover two major areas with a centrally located transmitter. Each antenna type requires specific mechanical or electrical modification to achieve the desired directional radiation.

VHF vs UHF

Low and high band VHF and UHF signal propagation characteristics differ; hence, the FCC power limitations (see box). Coverage at UHF frequencies will not equal coverage at VHF frequencies when antenna height and ERP are equal; however, planned adjustments in antenna height and power will permit UHF coverage to be competitive with VHF. UHF has one advantage over VHF in that man-made interference and natural static are practically non-existent, depending of course on TV receiver noise level and sensitivity under low signal levels.

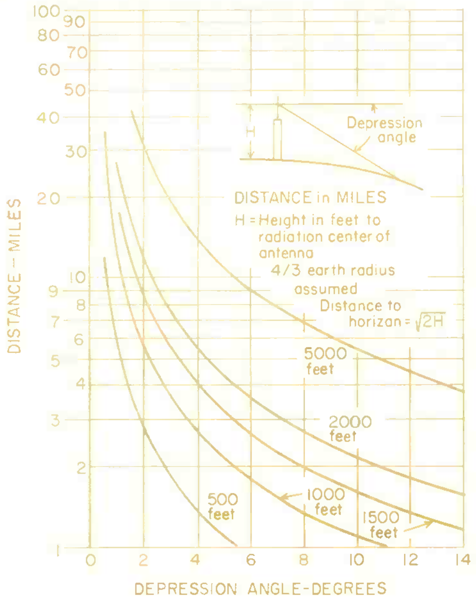


Fig. 8. Vertical angle vs Distance curves for various antenna.

The directional coverage of an antenna may be further modified by controlling the *vertical* plane radiation. The vertical pattern is considered to be a cross-section of the relative radiation in a plane perpendicular to the horizontal. In any given direction from the antenna, the vertical pattern has a major lobe, or main beam, which radiates most of the RF energy, and several minor lobes which of course radiate lesser amounts of RF.

Beam Tilt and Null Fill-In

Nulls occur between major and minor lobes at certain angles in the vertical pattern; the distances from the antenna to the nulls is a function of antenna gain and height. Close-in coverage is affected by these nulls (Fig. 7), and therefore must be considered in any coverage problem.

As antenna gain is increased (to improve horizontal radiation), the main beam thickness in the vertical plane decreases; as the main beam is narrowed, more and more radiation will tend to miss the horizon and go on into space (Fig. 8).

It is fairly obvious that antenna height, as well as gain, has a direct bearing on radiation angle. But rather than lower the antenna (and lose distant coverage), the main beam may be tilted downward so that it just grazes the horizon. Since simple beam tilt also moves the location of the vertical pattern nulls, it may improve close or medium distance coverage. Were it not for beam tilt or null fill-in, the principle city area may have large variations in signal level. Beam tilting, without appreciable null fill-in, in the range of one to two degrees does not basically change the location of vertical pattern nulls; beam tilts of this order assures the best possible coverage with minimum power loss in the vertical region.

(Continued on page 47)

Selecting the Antenna Type

This information is furnished to aid the system designer in selecting the most desirable antenna for a given set of conditions.

Batwing and Superturnstile (VHF)

The batwing and superturnstile design is popular for directionalizing VHF systems. Mechanical design reduces antenna weight, resulting in lower erection and supporting tower costs. In a typical multi-bay installation, equal power fed to both sections will result in a vertical pattern null approximately 8° below the horizon. Thus, at level terrain, with a tower height of 500′, the first null will occur at approximately ¾ mile. If the antenna tower is located on a hill or mountain, contouring the vertical pattern is very important. An antenna located on a hill 1500 feet high and overlooking the principal city two miles away, would produce a null over the service area. Nulls can be changed by using the proper antenna gain, or by null fill-ins. Null fill-in is achieved by supplying unequal power in the various bays. Common practice is to feed 70/30 split to the top and bottom sections. Another method is to delay the phase of the current to the lower bays. Both methods provide null fill-in with only a small reduction in gain. Power required for null fill-in is usually not large. Additional costs for such special variations will be small. When the service area is located only on one side of the tower, a batwing or turnstile directional antenna can be used to advantage. This type of antenna is designed for applying numerous electrical and mechanical variations for the best area coverage in any situation.

"V" Element or Corner Reflector (VHF)

Where the service area is located in a mountainous region, the use of the "V" element or reflector in a directional system would be desirable. Directivity is affected by positioning of reflector and radiation elements; beam tilt and null fill in is achieved by distribution of power and phasing between upper and lower elements. Structural members of the tower and radiating elements are usually light in weight. Simplification in design and flexible performance make this type of antenna acceptable for good coverage of service areas in mountain ranges. Spacing of the radiating element in a stacked antenna array is critical.

Helical (VHF and UHF)

The helical antenna is designed to radiate in "side-fire" fashion. Thus, the beam maximizes at right angles to the helix axis. Since the gain achieved with most helical antennas is usually high, the desirability or need for pattern contouring must be carefully considered. This antenna is designed especially for ease of contouring and an infinite number of patterns are available. In selecting a particular antenna for a specific application, vertical beam tilt, null fill-in, and horizontal directivity should be considered.

Beam tilting without appreciable null fill-in may be achieved easily by introducing phase shift between successive sections. This is accomplished by using a different length of feed line between the power divider and feed elbow of each section, or by rotating the individual sections with respect to each other. The most distant or first null is generally the one which

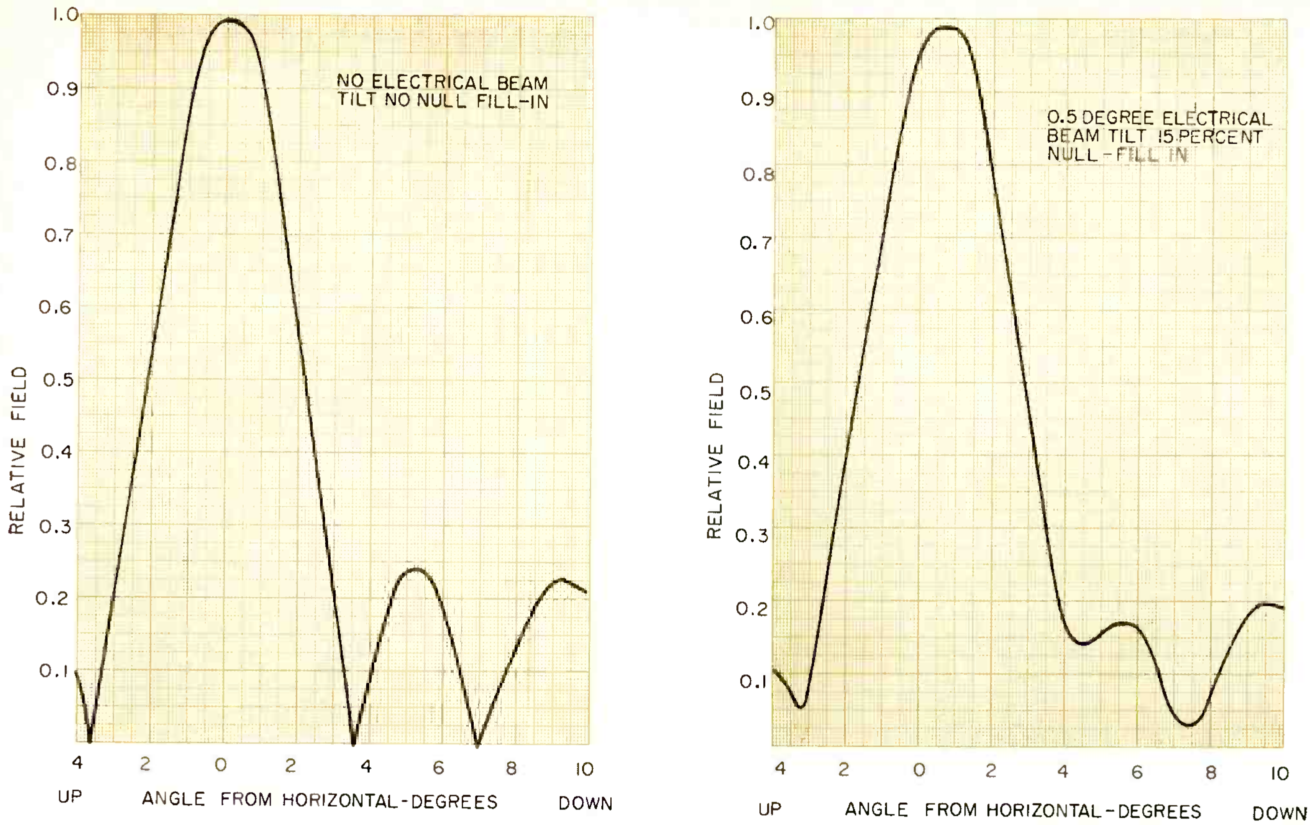


Fig. 9. The effect of null fill-in and beam tilt.

causes concern (most likely to fall in populated areas close to the transmitter site). Null fill-in is obtained by proper power distribution and current phase in each bay.

Directionalizing the horizontal patterns may prove to be advantageous in certain geographical locations such as coastal areas, near a lake or large unpopulated areas. In horizontal directionalizing, power gain in certain directions can be approximately double that of a standard omnidirectional antenna. Horizontal directionalizing may be changed in the field by adding or taking off stubs. Vertical pattern may be contoured, main beam may be tilted for better coverage, special horizontal directional patterns may easily be achieved.

Zig-Zag (VHF and UHF)

The Zig-Zag panel antenna uses the traveling-wave principle to excite a large wide aperture from a single feed point. This antenna is an excellent building block for many different types of antenna arrays. An unlimited range of patterns can be achieved with panel arrangement. Maximum gains of 75 or more have been attained with practical directional patterns.

Zig-Zag panels are normally assembled on a tower section in custom arrays. A wide variety of orientations and arrangements is possible, depending on requirements for gain, directivity, beam tilt and vertical contouring. It provides for vertical pattern contouring for special coverage requirements, electrical beam tilt adjustment for unusual terrain conditions, and directional horizontal patterns for coastal installations. Thus, this design is generally the best available for special coverage or special structural considerations.

Slotted Ring (VHF)

The slotted ring antenna is designed for VHF service. Arrays can be supplied with null fill-in and beam tilt to provide close-in coverage. This is achieved through the proper selection of line transformers and transmission line lengths in the coaxial feed line between bays. Measurements show that the length of the beam-shaping elements used for directionalizing is not critical in the sense that an inch or two has small effect on the pattern. The angle between the beam-shaping elements has substantial effect on the shape of the pattern, and therefore stabilizing members are used to make sure these angles remain fixed. Special horizontal patterns for particular locations may be achieved with relative ease. The antenna itself is rugged and can be used for all types of environment and terrain conditions.

Traveling Wave and Pylon (VHF and UHF)

In the traveling wave and pylon antenna (slotted cylinder), electrical beam tilt is usually built into each antenna and cannot be changed after construction. Mechanical beam tilting may be incorporated by using shims. Since the dead weight of the antenna is added, antenna and tower stresses must be recalculated. When the antenna is located on a plateau or mountain range overlooking a valley and where little coverage is required to the rear, electrical and mechanical beam tilt in conjunction with horizontal directionalizing may be employed advantageously to improve signal level in a particular direction. Hence, it is important to evaluate not only gain but also the amount of horizontal directivity, beam tilt, null fill-in and the general shape of the vertical pattern for the terrain involved.

Building An FM Station — From CP to Sign-On

By Carl B. Haeberle and James W. Davis

Part IV—Details of the transmission system

THE DESIGN and installation of our FM antenna and transmission line called for a series of necessarily well-timed, coordinated operations — the night-time AM DA had to be taken apart, the FM antennas added, and then the system put back together again. We had our moments of mixed emotions in trying to time the arrival of all equipment and supplies, but when construction finally started Dame Luck was pretty much on our side.

Tower Replacement

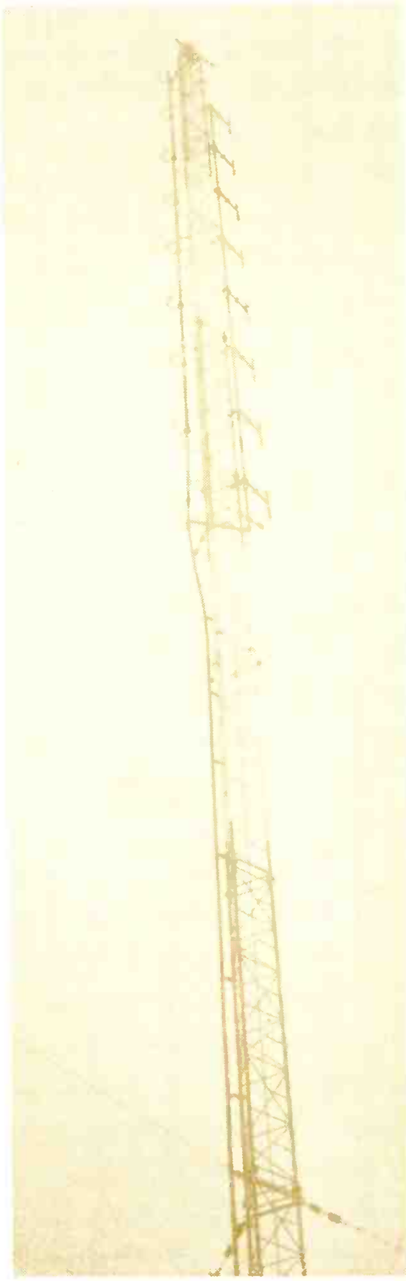
Our plan was to mount the FM antenna on our #3 AM tower, chosen because it is used only on the night-time pattern. Disturbing the daytime pattern would have been more upsetting to the station economy. The weight of the new antenna, approximately a ton, was much too heavy for the existing tower; therefore, a stronger tower had to be installed. To replace the tower, we obtained permission to operate with reduced night-time power, using a single tower.

Installing a heavier tower meant starting from scratch—new guys, new base, new insulator. A very important consideration in tower structure is the relationship between tower strength and the number of essential guys. Stronger towers, of course, require fewer guys, and additional guys up the cost—cable, insulators, earth anchors, etc. Then, too, the presence of guying cables will disrupt the electrostatic field around the antenna unless they are properly broken up with insulators so that each continuous length is a submultiple of a wavelength.

The original 12″ face triangular cross-section tower had to be replaced with one 24″ wide on each side. The heavier tower required heavier guys; the original 3/8″ cable was replaced with 1/2″, but we eliminated one set of guys. The suitably larger base insulator and heavier tower required a new concrete tower base. By exercising a bit of care, we were able to use the existing ground system. A new beacon and side lights required by the larger tower cross-section were installed, but we didn't have to replace the lighting choke since no additional power was necessary. The FM antenna de-icers called for a separate circuit (their use may be necessary when the lights are off). Since the de-icers consume about 1400w, we used a 1600w choke to get the AC across the tower base.

FM Antenna Mounting

After the new tower was erected, we mounted the FM antenna. The 8-bay ring type horizontal section, including de-icers (Collins 37M-8), was mounted on a tower face and the 8-bay vertical dipole section (Collins 300-8) was mounted on the opposite leg. This configuration was used to minimize interaction between the antennas and to more evenly balance their weight. The power divider was mounted on the tower at the base of the antenna assembly. The antenna radiation center is 18 feet from the top of the tower and the antennas occupy 36 feet of vertical tower length



The FM antennas shown installed on the new tower.

Mr. Haeberle is production director and **Mr. Davis** is C.E., WAJR-FM Morgantown, W. Va.

(space between antennas is approximately 5 feet, Fig. 1).

Transmission Line

After the new tower was erected, a 130-foot length of 3 1/8″ diameter coax transmission line (Andrew HJ8-50A) was attached to the tower, the outer conductor bonded to the tower just beneath the FM antennas and two feet above the tower base. This length runs from the power divider to the isolation coil at the base. Another 100-foot length was used to wind the isolation coil and an additional 100-foot length runs from the isolation coil to the transmitter, supported on the AM transmission line carriers. The outer conductor of the transmitter run is grounded at both ends with a 2½-inch copper strap running to the antenna ground system and common station ground. The coax shield of the isolation coil is also grounded at the bottom end by virtue of the transmitter line ground.

Two coax splices were necessary, one at each end of the isolation coil. This procedure is tricky. We used the recommended connectors and followed the manufacturer's instructions to the letter. If the outer and inner conductors of the coax aren't solidly attached to the connectors, many problems (fortunately none for us) may crop up.

The air dielectric transmission line is pressurized with 5 lbs. of dry nitrogen. We've had some leakage problems at the antenna junction, but even so, a 2,000-lb. tank of nitrogen lasts about 30 days. The line pressurization fitting and gas tank are located inside the transmitter building where operators periodically check the pressure and gas supply. Since the RF diplexer, combining the output of the 10-kw amplifiers, is not pressurized, a gas barrier was inserted between it and the transmission line.

Tower Base Isolation

Obviously, the tower must be insulated from ground at the AM carrier frequency. To maintain this condition and at the same time get the grounded outer conductor of the transmission line across the tower base, we constructed a coil to form a parallel resonant circuit with the base capacity of the tower (base capacity and the inductance of the coil formed by the outer coax shield). The resonant circuit offers a high impedance to the AM carrier when tuned to the carrier frequency, 1440 kc. A 20-180 mmf vacuum capacitor, connected in parallel with the coil, serves as a trimmer to tune the circuit precisely (Fig. 2).

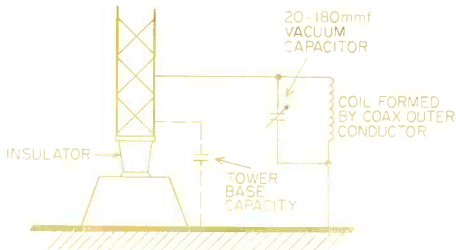


Fig. 2. Schematic of tower base isolating circuit.

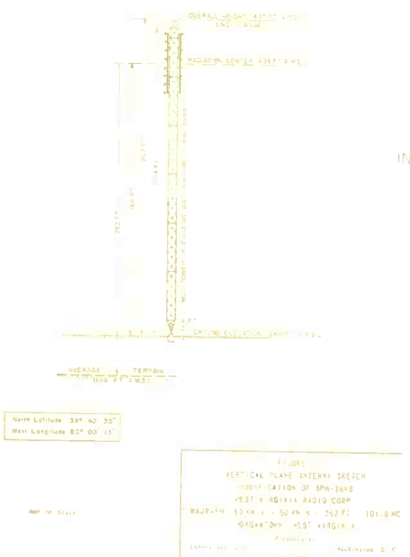


Fig. 1. FM antenna tower mounting configuration.

Winding the 3″ diameter coax on the coil form required a bit of patience and improvisation. The form had been prepared in advance, with notches (12″ on center) cut deep enough into the form members to receive the coax. The minimum bending radius of the coax was 30 inches (according to manufacturer's data); therefore, the coil had to be 5 feet in diameter. Calculations indicated that we would need 6 turns on 12″ centers to give us the 40-uh inductance, requiring a form 5 feet long. To wind the coax on the form, we stretched out the 100-foot length of cable on a clean area, then placed the coil form on the cable at the point where winding was to start. Slowly, we rolled the form, carefully placing the cable in each notch, until the end of the transmission line was reached. As the cable was placed in each notch, a 3/4-inch wide stainless steel strap was fastened across the notch to hold the cable. As it may sound, this was a slow process, but with the almost unwieldy stiffness of the cable, it was impossible to hurry. The

Table I. Elevation & Contour Data-WAJR-FM

Radial and Bearing (Degrees)		Average Elevation 2-10 Miles (Feet AMSL)	Effective Antenna Height (Feet)	Effective Radiated Power (kw)	Distance to Predicted Contour 1 mv/m (Miles)	0.05 mv/m (Miles)
A	0	1117	291	50	26.5	76.5
B	45	1040	368	50	29.5	78.0
C	90	1089	319	50	27.5	77.0
D	135	1254	154	50	20.5	70.0
E	180	1079	329	50	27.5	77.0
F	225	1215	193	50	22.5	72.0
G	270	1195	213	50	23.5	73.0
H	315	1183	225	50	24.0	74.0

Height of radiation center above mean sea level, 1408 feet.
Height of average terrain above mean sea level, 1146 feet.
Height of radiation center above average terrain, 262 feet.

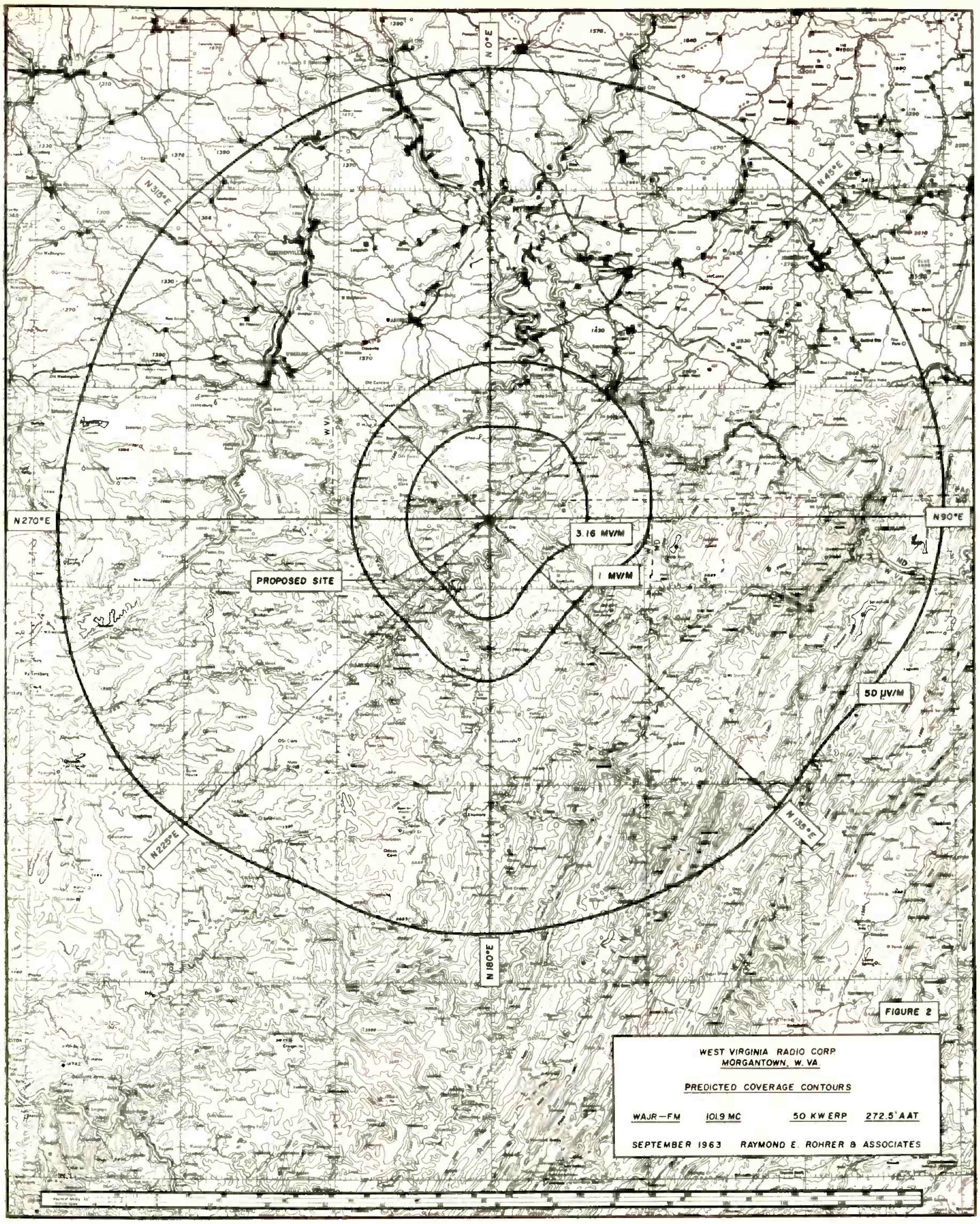


Fig. 3. WAJR-FM coverage contours.

vacuum capacitor was attached to the inside of a coil form member and connected to each end of the coil by 2 ½″ copper straps. It is tuned by reaching through the coil turns.

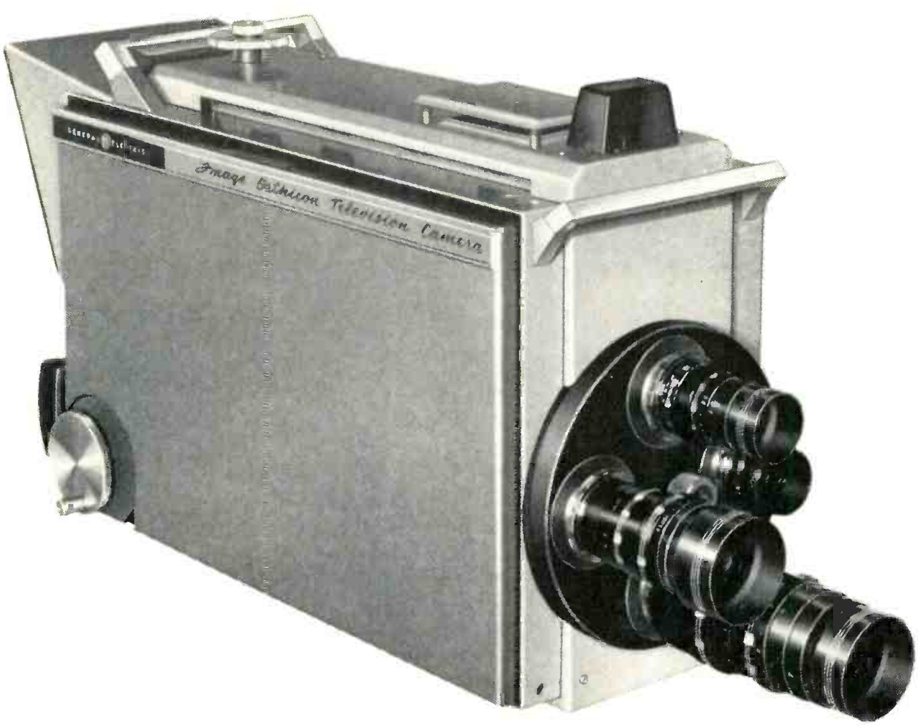
Operating Parameters

Each antenna section, horizontal and vertical, has a gain factor of 8.3. This required 6.03-kw input to each antenna for the licensed radiation of 50 kw, and an input at the power divider of 12.06 kw. The manufacturer's specifications indicate a transmission line efficiency of 91%; therefore, the transmitter output was adjusted to 13.26 kw to overcome the transmission line loss of 1.20 kw. The design and pretuning of the system was such that our vswr was nil when it was put into operation. Had we not been extremely careful during construction, including transmission line splices, the situation may have been different.

Effect On AM Pattern

The new tower and associated circuitry changed the base impedances of all three towers used in the night-time pattern, necessitating recomputation of all parameters. Upon completion, the new engineering data was submitted to the FCC and permission granted to resume operation after reproofing the entire system. ●

(To be continued next month)



Circle 35 on Reader Service Card

Locating Off-Air Signals for CATV

By Robert B. Cooper, Jr.

Since good clean signals are the only products a cable operator has to sell, finding a suitable off-air pickup site is of vital importance.

UNLESS a CATV system is fed entirely by microwave, the head end must be located where reliable signals are available on all desired channels. Ideally, the site must be accessible by road in all types of weather, be close to the cable plant, be interference free, and finally, be located so that signals from future stations (UHF independents) can be received.

Locating Signals

There is no easy "divining rod" method of finding strong signal areas; the surest way is to painstakingly probe all possible sites with portable equipment. Valley-Vision has been using a G.E. TR-805 battery-operated portable receiver and a Blonder Tongue FSM-2 field strength meter with excellent results.

All preliminary tests are made with just the receiver, particularly if the terrain is too rough for one man to carry the receiver and another man to carry the portable antenna. When a fair signal is picked up with the whip antenna, we erect the portable antenna and measure audio and visual carrier levels, the rate of fading, and the long term stability of each signal. Signal measurements should be made over a period of at least a week to ten days, ranging from early morning sign-on to sign-off. If this seems a needless chore, just remember that the entire system depends on reliable signal reception. For overland paths (i.e. paths not traversing large bodies of water) the worst time of day is almost always late afternoon, from 3 to 5. If signal strength holds during this period, you can be relatively sure that it will be reliable during other periods.

In the hills above San Francisco, we were probing for a reliable signal from either Channel 30 in Fresno, Channel 12 in Chico, or Channel 8 in Reno, so that we might carry the 49er football games. The first morning we were on the two most likely sites, the Fresno UHF signal was overpowering on a 1400′ elevated bluff, but nonexistent on top of a 2600′ mountain. Naturally, we were suspicious. Toward late afternoon, the Fresno signal dropped out almost completely at the 1400′ elevation, but came in very nicely at the 2600′ spot. A week later, the early morning signal at the 1400′ elevation was present but poor; the signal at 2600′ was strong and steady, exactly the opposite of the previous test. By 10 A.M., the weak signals at 1400′ level had disappeared, but at the 2600′ elevation, the signals were as strong as before. The 1400′ spot, at first, was very tempting, because it was on a paved road with available easements and 2.9 miles closer to the plant than the 2600′ level. Only proper signal surveys prevented us from making a disastrous decision.

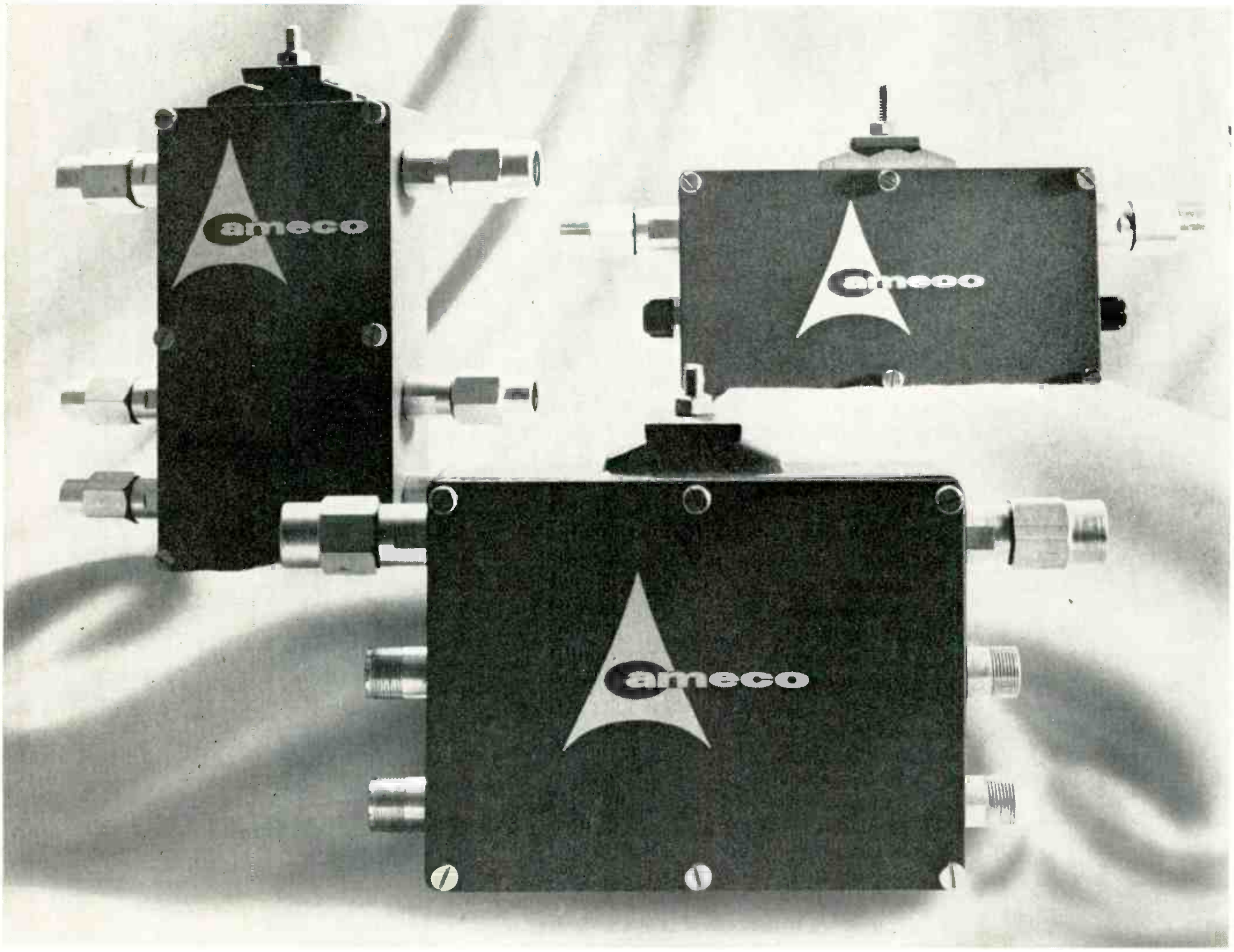
Another town, located on a flat

Mr. Cooper is v.p. of engineering, Valley Vision, Inc., Modesto, Calif., and President of R. B. Cooper & Associates, a CATV consulting firm.

Field strength meter puts the finger on critical antenna location for Channel 30 Fresno.

AMECO, INC. 2949 West Osborn Road • P. O. Box 11326 • Phoenix, Arizona 85017 • Phone (602) 262-5500

Performance Tested Ready to Go!



Why wait for unproven amplifiers . . .

when you can count on immediate shipment of Ameco's Performance-Proven 70 Series amplifiers. These units are performance tested in hundreds of CATV systems across the nation and are ready for "off the shelf" delivery. 6,000 Ameco units are now being used in CATV systems throughout the United States and Canada. Is your system ready to make profits? *It can be with Ameco amplifiers!* For immediate delivery — call our sales order department today.

Performance-Proven Products

ameco

OFFICES IN ALL PRINCIPAL CATV AREAS

Circle 16 on Reader Service Card

plain approximately 8 miles east of a 40-mile wide mountain range with peaks up to 3800′, had never been able to pick up San Francisco, due to the 80 mile distance and the mountains, of course. Initial surveys indicated that even a 400′ to 500′ tower would not provide reliable reception; the only solution seemed to be a microwave relay on top of one of the peaks. Fortunately, we had already leased a peak site for another purpose. That, however, wasn't the problem. Nine miles of cable would be required to wire the town; cost: $35,000. The microwave would add another $38,000. With only 700 possible hookups, a $75,000 investment seemed too high for a reasonable return.

Our only real hope of getting any signals into the town depended on a rare form of propagation known as knife-edge refraction. This phenomenon is caused by a high mountain peak located at or near the center of the signal path and high enough to be line-of-sight to both the TV transmitters and the projected receiving sight. Acting somewhat like a prism, the peak causes TV signals to bend as Fig. 1, from A to B. By careful computation, using National Geodetic Survey maps (7.5 minute series), we located the area of probable knife-edge signal illumination to a quarter square mile area on the western edge of town. Sure enough, the signals were there, in a small area roughly 300 by 600′. Channels 2, 4, and 9 (San Francisco) measured over 150 microvolts with a dipole antenna 6′ above the ground. The signals were extremely stable, fluctuating less than 10% from hour to hour, day to day. Needless to say, plant construction began immediately, *without* the cost of microwave!

Sometimes, in mountainous terrain, signals are found in surprising places. Valley-Vision had purchased an existing system in Angel's Camp, Cal. The head-end site was not in an advantageous location, and since we were planning to make it a 12-channel system, we had to pick up two more channels. With the head-end situated on a hill surrounded by mountains on all sides, there didn't seem to be much of a chance of picking up UHF signals. However, as I was probing with the portable receiver, I made a quick pass over the UHF band looking for Channel 30 in Fresno. I caught a bit of frame bar and some raspy sound. Quite surprised, I quickly hooked up the portable UHF antenna and began searching in earnest. In a area approximately 6′ square and 4 to 6′ off the ground, Channel 30 produced 150 microvolts and Channel 24 measured 125 microvolts.

Strangely enough, that was the *only* antenna height where any usable signal could be found. We cranked the portable tower up to 88′ without any improvement. Therefore, we simply mounted two UHF dish antennas about 5′ above the ground, looking directly into a mountain 2000′ higher than our receiving site and only 9 miles away.

In another mountain town, buried in a canyon 1500 to 1800′ below average terrain, the path to the most desirable stations (San Francisco) was nearly 140 miles over and across the San Joaquin Valley (elevation 100′). For as many as three winter months, the 50-mile wide valley is fogged in by heavy Tule Fog, layered from 1200′ to 1800′ above the valley. Signals crossing the valley must pass through the fog to reach the Sierra range where the town is located, and unless the head-end receiving site was situated above the fog, the signal would be wiped out by the fog-created inversion.

To get above the fog meant find ing a 4500′ high peak near the town; the nearest such peak was 8.5 trunkline miles away. Another alternative was to locate a receiving site on the west side of the valley and microwave the signals across the valley and then up into the Sierras. For a town of 4,000 residents, this was out of the question because, with the 12-kmc CARS band, a 4-hop system would be required.

The final solution involved using *two* head ends, a master on a 2500′ peak and another at an elevation of 900′, down below the fog layer. From March through November, the dry months, the higher head end was used; from December through February, the foggy season, the lower head end captured the signals *in* the fog layer. Automatic equipment switches from one head end to the other when conditions warrant. The additional expense for the second head end was less than the cost for either a microwave system or 8.5 miles of trunk line.

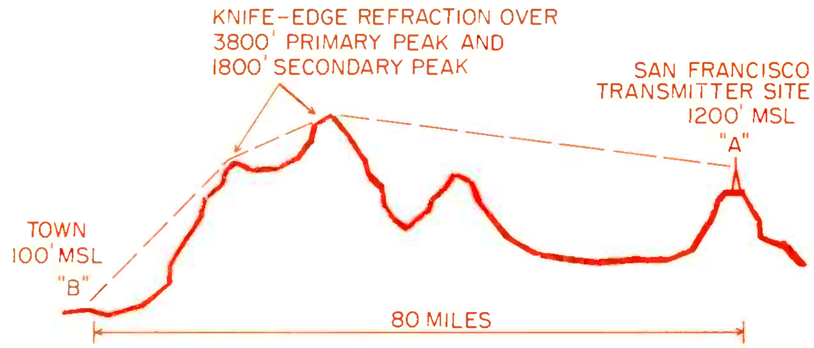


Fig. 1. The "knife-edge refraction" phenomenon. The high peak (3800′) and the secondary peak (1800′) act as prisms, "bending" the signals downward.

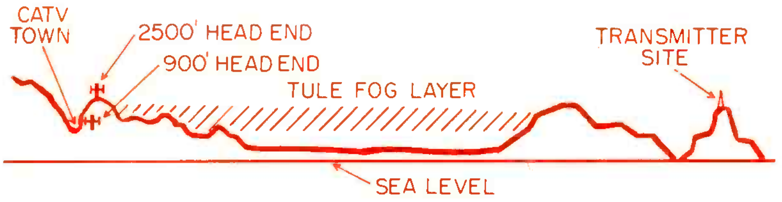


Fig. 2. An auxiliary head end at the 900′ elevation level solved a valley fog problem.

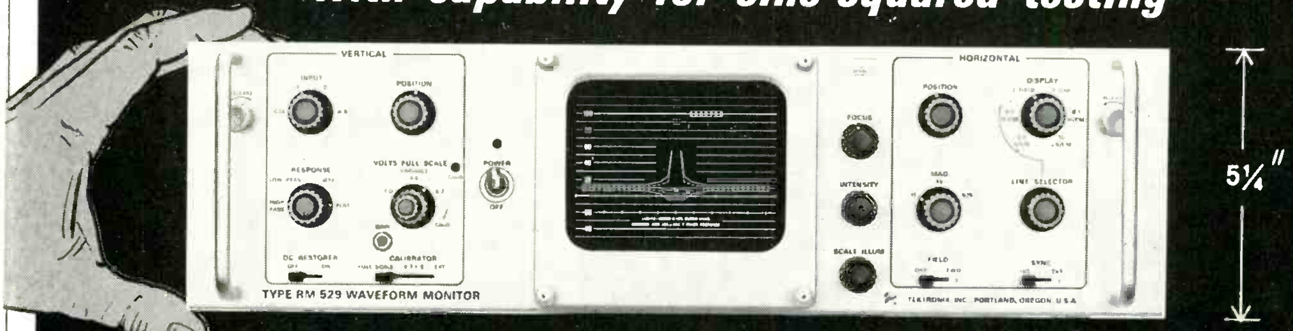
Land Costs

Initial equipment cost and maintenance must be considered in any site selection. In one case, a suitable site requiring 2400′ of trunk from head end to plant had been chosen. Careful measurements indicated that 8 of the 12 channels would require stacked arrays and numerous AGC-controlled preamplifiers, and a total

(*Continued on page* 44)

v.i.t. displays with TEKTRONIX® video-waveform monitor

with capability for sine-squared testing



Type RM529

frequency responses—Four response characteristics necessary to monitor Video Test Signals are provided:

1. FLAT to 5 MHz ±1%, to 8 MHz ±3%. *This flat response position to 8 MHz assures waveform fidelity and makes the video-waveform monitor ideally suited for sine-squared testing.*
2. HIGH PASS 3.58 MHz center frequency, 30% down at ±400 kHz.
3. LOW PASS -18 dB at 500 kHz.
4. IEEE 1958 STD 23-S-1. Color subcarrier -20 dB.

YRBG or RBG display capability—For monitoring output of color processing amplifiers.

line selector—Provides stable displays of the Vertical Interval Test signals. Adequate brightness is provided even at the fastest sweep speed. Can display any line desired. Brightening pulse automatically intensifies the displayed line as viewed on the associated picture monitor. No modification to the picture monitor is required.

field selection—Positive acting circuit allows selection of field one or two for display. Noise will not cause random field changing.

dc restorer—A feedback-type restorer acts during the backporch time. Not affected by presence of color burst. Does not distort the burst. Front-panel switch can disable the restorer—when other than video waveforms are viewed.

Cabinet Model also available. Same features as RM Model and designed for side-by-side mounting with a picture monitor in standard racks. Takes only 8¾" of rack space. Field case offered as an optional accessory for Type 529.

Type RM529 Video-Waveform Monitor	$1100
Type 529 Video-Waveform Monitor	1050

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

Available throughout the world

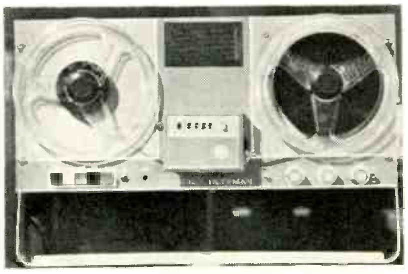
Tektronix, Inc.

Circle 17 on Reader Service Card

BROADCAST EQUIPMENT

Logging Tape Recorder

Stancil-Hoffman Corp., Hollywood, Cal., has developed a tape recorder capable of recording from one to eight speed tracks

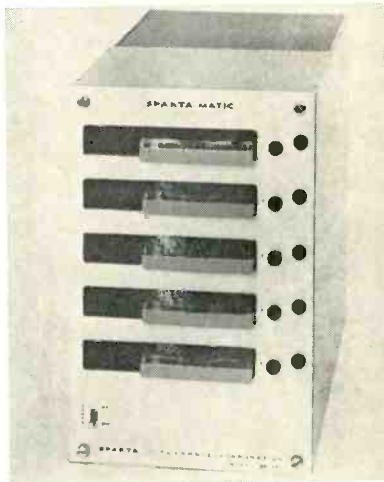


on ¼″ tape. The model R70 operates at speeds from 7½ to 15/32 ips (program logging). Remote control is available; local control of all operational modes is handled by five colored pushbuttons. The unit is designed for automatic operation—start/stop from time clocks, optical or foil changeover, and auto-stop or transfer in case of tape breakage. At 15/32 ips, the equipment will record 48 hours continuously. Prices range from $775 for single track to $1215 for four track models.

Circle 74 on Reader Service Card

Multiple Cart Playback

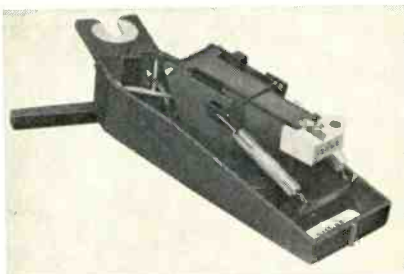
A multiple cartridge playback with an individual motor and capstan for each deck will soon be in production at Sparta Electronic Corp., Sacramento, Cal. Shown here is the initial prototype; the final production model is scheduled to be introduced at the 1966 NAB Convention. All-transistorized electronic options for auxiliary 2nd and 3rd tone burst cueing, for integration into a fully automated system will be featured. Unit price is expected to be $1500 to $1700.



Circle 52 on Reader Service Card

Elliptical Stylus Cartridge

Shure Bros., Chicago, has introduced a new Gard-A-Matic cartridge assembly featuring a retractile safety suspension system and an elliptically-shaped diamond stylus. For use on Garrard Lab 80 and Type A70 turntables, the Model M80E includes a Shure M55E cartridge mounted in an assembly designed for bounce-proof, scratch-proof



operation. If tracking pressure exceeds 1½ grams, a plastic safety bumper comes into contact with the record. Stereo channel separation is said to be over 25 db at 1 kc, output is 6.6 mv per channel, and frequency response is 20 cps to 20 kc. Price is $38.

Circle 113 on Reader Service Card

Microwave Towers

Microflect Co., Inc., Salem, Ore., has announced a new microwave tower design in heights from 15 to 30′. Designed as the "Q" Series, they are said to offer maximum versatility by allowing multiple parabolic antenna mounting in almost any configuration. Pipe mounts are available for corner, side, or overhang installations, including figure-4 mounting kits. All hardware, step-bolts, and anchor-bolts are included. Material is hot-dip galvanized after fabrication. Prices range from $400 to $1250.

Circle 78 on Reader Service Card

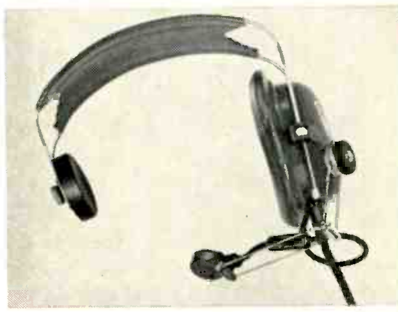
ETV Microwave Gear

Solid-state microwave transmitter/receiver units for 2500-mc ETV links is being marketed by Jerrold Electronics Communications System Div. The 440 Series equipment uses a crystal-controlled oscillator delivering 2w output. Features include a 12-mc baseband flat within 0.25 db, frequency stability of 0.005%, and individual self-contained power supplies. A complete transmitter or receiver will fit in 10½″ of rack space. Transmitter and receiver together sells for approximately $8,000.

Circle 61 on Reader Service Card

Dynamic Mic Headset

Roanwell Corp., NYC, is marketing a Commentator's headset with dynamic noise-canceling



mic. Mic impedance of Type 106040 is 150 ohms; the 275-ohm receiver is housed in a

FOR EASIER, FASTER INSTALLATION

SUPERIOR COAXIAL TRUNK CABLE

SEQUENTIALLY FOOT-MARKED

Guaranteed accurate to the critical tolerance of ± 1%

- **SUPERIOR CELL-O-AIR® for AERIAL USE**
- **SUPERIOR "SOLID-D" for DIRECT BURIAL**

Know the lengths of cable between amplifiers . . . *to the foot* . . . and assure positive checks of cable attenuation measurements and amplifier performance.

Know the *exact cable footage* installed . . . without time-consuming physical measurement.

Know the cable footage received. . . . and easily verify the footage in stock.

The numerical markings are permanently printed in white at two-foot intervals on the cable jacket. . . . and one-foot increments are designated by a white horizontal line midway between each numerical marking.

To simplify installation, handling and inventory procedures, order SUPERIOR Sequentially Foot-Marked Coaxial Trunk Cable . . . at no extra cost! Every reel is 100% sweep-tested.

AVAILABLE FROM STOCK . . . AT NO EXTRA COST!

For detailed information and prices, write

SUPERIOR CABLE

SUPERIOR CABLE CORPORATION • HICKORY, NORTH CAROLINA

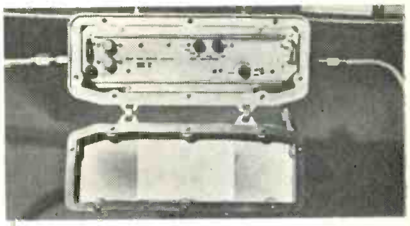
Circle 18 on Reader Service Card

hard-shell circumaural earcup, with a foam-filled ear cushion, and the temple pad is covered with soft hypalon. The mic circuit is shielded within the 4-conductor 5′ long cable. Price varies with quantity.

Circle 119 on Reader Service Card

CATV Amplifiers

Viking Industries, Hoboken, N.J., has introduced its Goldline Series solid-state CATV amplifiers. The Model 574 trunkline amp (shown)

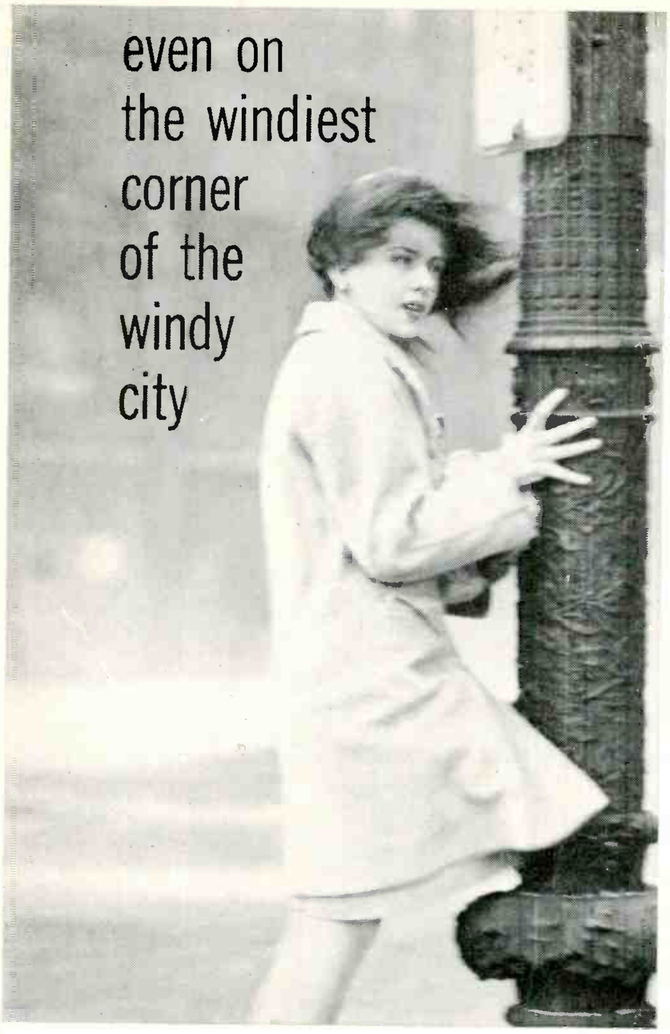


is said to offer a 12-channel system cascadability of 60 amplifiers, or better than 1400 db of cable can be built for a system signal-to-noise ratio in excess of 40 db. Noise figure is 10 db max and output is 50 dbm minimum at —57 db cross modulation. AGC functions after 2nd amplifier stage and offers temperature compensation and variable tilt. A bridger amp in the new series, Model 577, has either 2 or 4 individually fused outputs; Model 577/2 has 27 db min gain with 47 dbm at each output, and Model 577/4 has 24 db min gain with 24 dbmv at each of 4 outputs. Model 576 bridger, with 2 outputs at 18 db, supplies 43 dbmv; and with 4 outputs at 15 db, 40 dbmv at each output. All units are of inline construction and encased in cast aluminum housings.

Circle 85 on Reader Service Card

Video Clamper

A video clamper amplifier, said to be capable of eliminating over 6v of hum superimposed on 1v of video, has been developed by Dynair Electronics, Inc., San Diego, Cal. The Model CL-1050B will handle composite video, color or b&w in broadcast or CCTV applications. Controls include precise tip-of-sync clamping, continously variable gain on the front panel, variable hum phase control for optimum hum cancellation and adjustable high-frequency boost. The clamper is composed of modules and is all solid-state, except the clamping nuvistor, and one looping input and two video outputs allow dis-



Shure's remarkable new SM50 omnidirectional dynamic microphone is SELF-WINDSCREENED! It is strikingly immune to wind noises and explosive breath sounds—making it ideal as a dependable "workhorse" microphone for remote interviews, news, sports pick-ups and a variety of field and studio applications. The five-element built-in windscreen makes it virtually pop-proof in close talking situations. And unlike other "built-in" windscreens, this one is "unitized" and self-contained with no bits or pieces to re-assemble after cleaning. In fact, you can actually rinse dirt, saliva, lipstick and other screen-clogging foreign matter out of the windscreen assembly under running water as often as needed—or replace the "unitized" assembly if necessary in a matter of seconds.

Additionally, the SM50 is the cleanest sounding professional microphone at anywhere near its price class. It delivers highly intelligible, natural and pleasing speech and vocal music that is especially full-bodied and rich in the critical mid-range.

It is extremely rugged and will require little or no down time as the years go by. Too, when comparing it to other moderately priced omnidirectionals, it is lighter in weight, supremely well-balanced for "handability," has a detachable cable, and a rubber mounted cartridge for minimizing handling noises. The SM50 is worthy of your most serious consideration.

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

SHURE SM50

OMNIDIRECTIONAL DYNAMIC MICROPHONE

SHURE STATION-TESTED AUDIO CIRCUITRY EQUIPMENT

Shure stereo equalizer and preamplifiers are praised as MAJOR contributions to upgrading station quality by broadcasters.

SE-1 Stereo Transcription Preamplifier
Provides precise RIAA equalization from magnetic phono reproducers at line levels. Separate high and low frequency response trimmers. Lowest distortion, noise level, susceptibility to stray RF fields.

M66 Broadcast Stereo Equalizer
Passive equalizer compensates recorded frequency to three playback characteristics: RIAA, flat, roll-off. Provides precise equalization from magnetic pickup at microphone input level.

Circle 21 on Reader Service Card

tribution of the processed signals.

Circle 101 on Reader Service Card

Variable-Speed VTR

Slow, stop, and reverse motion, and double speed video playback, is possible with a portable VTR in production at Precision Instrument Co., Palo Alto, Cal. The 90-lb PI-7100 provides continuously variable playback speeds from zero to 16 ips. Record speeds are 7½ and 8.46 ips. Featuring stacked coaxial reels and helical scan closed-loop recording on standard 1" wide magnetic tape, the transistorized, 3.5-mc bandwidth machine will record up to 96 minutes on a single 10½" reel.

Circle 75 on Reader Service Card

SWR Meter

Hewlett-Packard, Palo Alto, Cal., has developed an SWR meter designed for measuring attenuation, gain, or any parameter which can be determined

from the difference in two signal levels. The Model 415E has a noise figure specification of less than 4 db, and an expand-offset feature which allows any 2 db portion of its 70 db range to be expanded to full scale at a specified ±0.02 db linearity. The unit will operate with crystal or bolometer detector, with

How to climb aboard the color bandwagon easily, economically, with RCA-4415/S,-4416/S image orthicons...

Color TV is really rolling in high gear... And now, you may be facing the question of creating a color facility—with new studios, lighting, air conditioning and other equipment.

Being old-timers at color, we anticipated some of these facility problems and developed the RCA-4415/S, -4416/S, a matched-set of three image orthicons. They perform well in cameras for color at lighting levels usually available in black-and-white studios and eliminate the need for extra air conditioning equipment as well.

Another good feature of these tubes is that they behave more like the old faithful 5820A or 7293A's that you have been using in black and white during the past years. In the color camera, they can stand more over-exposure and are a little less finicky on the operating controls. For example, when you have a suntanned actress working in a gleaming white kitchen, you can operate with the highlights fairly far above the image orthicon knee without having the color picture going to pot.

We make up carefully matched sets consisting of two 4415/S Image Orthicons for the red and green channels, and one 4416/S Image Orthicon for the blue channel where a lot of "umph" in blue sensitivity is needed. The three mates of the set are matched to track very well and produce a nice uniform color picture. In addition, the sensitivities are balanced so that each tube is just about working at its maximum sensitivity and you are not throwing away extra light in the optical system to favor one low sensitivity channel. The result is good color pick-up at black-and-white studio lighting levels.

For further information about RCA Image Orthicons contact your RCA Broadcast Tube Distributor.

Available From Your
RCA Broadcast Tube Distributor

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

RCA ® **The Most Trusted Name in Electronics**

Circle 25 on Reader Service Card

capability to operate from both low (1k ohm) or high (5k ohm) source impedance crystals, and has isolated recorder and amplifier outputs. Price is $350.

Circle 115 on Reader Service Card

Cable Powering Unit

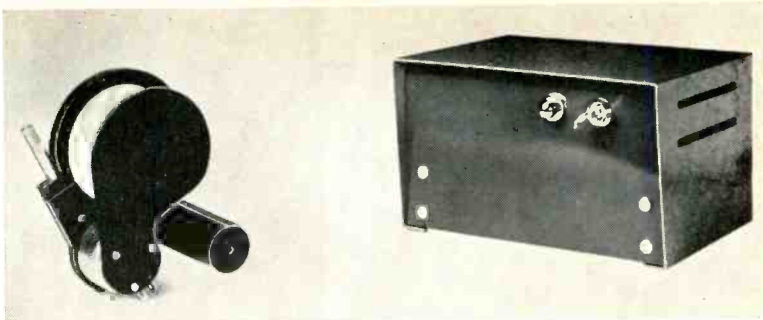
Kaiser Aerospace & Electronics, Phoenix, Ariz., has announced a cable powering unit, Model KCP-12, designed to be unaffected by a short-circuit of the secondary or load terminals. No fuse or any overload protection is required on the cable supply

side, and power will reappear as soon as the short disappears. Price for regulated unit is $120. Kaiser has also announced that field tests indicate an unusual degree of AGC control capability for the KAA-25 mainline amplifier. In actual operation, the unit has been found to adjust gain and tilt to compensate for attenuation changes in 75 db of cable over a 60° temperature change. The KAA-25 all-band amplifier sells for $400.

Circle 121 on Reader Service Card

Mobile I.O. Camera

Sony Corp., Inglewood, Cal., is marketing a 3" I.O. camera which



Vidicon Burnout Protector

Cam-Trol, a device designed to automatically protect against vidicon burnout and damage due to flashing or reflecting bright light. is available for CCTV applications. Manufactured by Centurion Products, Inc., St. Louis, Mo., Model CT 4, consists of a protective shield connected to a power pack control. The shield, easily attached to any TV camera, automatically covers the camera lens when light exceeds a predetermined level. When the light returns to a normal level, the shielda utomatically opens. The device, effective indoors and out, can be set to be activated at various bright light levels. Cam-Trol automatically caps the lens when camera power is turned off.

Circle 51 on Reader Service Card

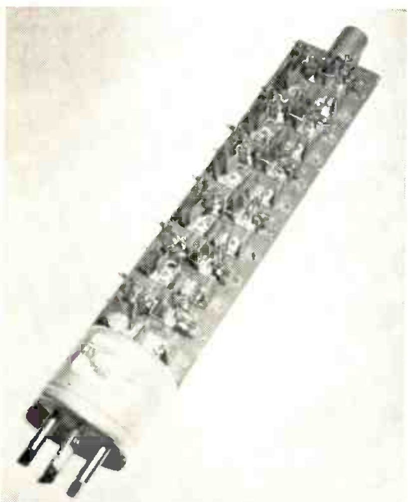
Circle 26 on Reader Service Card

is compact, lightweight and applicable for mobile use. Silicon transistors provide low power consumption and superior temperature characteristics. The camera is compatible with EIA TV standards and is said to require no alignment in the field. Best picture quality is achieved for outdoor use by combining the optical filter and iris, and an electrical shutter makes possible the most advanced photographic techniques. The model IIC-500 is furnished with a 5″ viewfinder and can be mounted on a standard tripod.

Circle 99 on Reader Service Card

Silicon Rectifier

Wilkinson Electronics, Inc., Woodlyn, Pa., reports the development of the SR-24-15, a direct replacement for the 869B mercury-vapor tube. Rated at 24 kv PRV



@ 15 amps average current, the unit will withstand surges in excess of 200 amps and peak transient reverse voltage of 28,800v. The manufacturer adds that the SR-24-15 is non-encapsulated and individual diodes in the stack may be replaced. A light indicator for each diode warns of failure and serves as high-voltage warning. Price is $225 f.o.b. Woodlyn.

Circle 111 on Reader Service Card

CATV Mainline Amp

A solid-state etched-circuit mainline amplifier for CATV systems has been introduced by Ameco, Inc., Phoenix, Ariz. The all-band ATM-70 is said to use less power, provide higher output at lower noise, and offer greater cascadability. An inline housing eliminates the need for jumper cables, and separate input and output external test-point receptacles make possible quick performance checks without taking the amplifier out of service. All popular cable sizes are readily adaptable to the hermetically-sealed unit.

Circle 60 on Reader Service Card

UHF-VHF Sweep Gen

Blonder-Tongue Labs, Inc., Newark, N.J., has available a solid-state UHF-VHF dual-range sweep generator for the 470-890 and 10-240 mc ranges. Sweep widths are continuously variable from 5 mc to the entire bandwidth of each range, and automatic level

control is said to assure flat sweep output. The sweep oscillator is varactor tuned, and a 60-cps horizontal sweep rate is available at the front panel for scope connection. RF output level is adjustable over a 60 db range. Model 4122 is $595.

Circle 122 on Reader Service Card

Film Processor

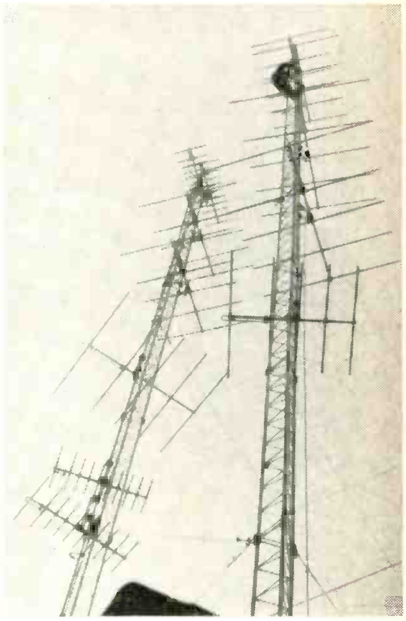
A new 16mm b & w film processor has been introduced by RFP Corp., Los Angeles, Cal. Featuring compact design and portability, Model 618 weighs only

250 lbs. and mounts on heavy-duty casters. Designed for daylight loading and operation, it will process perforated or nonperforated reversal, microfilm, and negative-positive emulsions at speeds up to 70 fpm.

Circle 123 on Reader Service Card

CATV Signals

(Continued from page 34)



Twin 100′ tower array for 10 of the 12 channels carried on Angels Camp system. Stacked yagis are used on 4 channels, single yagis for others.

of 200′ of vertical tower space for the antennas.

An alternate site, requiring 6500′ of trunk cable, had been located but never checked, simply because the property owner had never been available. Since the alternate site would take an extra 4100′ of trunk, it seemed the most expensive. However, the day before the lease on the selected site was to be signed, the owner of the alternate site came back to town and we checked the site. To our surprise, the alternate site had nearly three times the average signal levels. Some quick computations indicated that the alternate site would require stacked antennas on only one channel, a entirely new channel was available, and when all factors were considered, the savings (antennas, preamps, tower space) would more than pay for the 4100′ of trunkline.

In some areas of the country, it is possible to purchase your head-end site, but not in California. Mountain or hilltop sites are almost like gold due to the demand for two-way radio repeater stations and home building lots. Obviously, you want to get the site for as little as possible on a monthly or yearly rental basis, and you want the lease to last as long as you do. Mountain-top sites lease for $75 per month and up in our country. This is for the site alone; you may have to cut your own access road and bring in your own power. Power line installation costs average $1.40 per running foot for 220-volt service in our section of California.

Close-to-town sites run the gamut, some as much as $100 per month, others for as little as $100 per year. When you have two or more possible sites at widely divergent rates, a few minutes spent computing differences in rentals and initial installation costs will be time well spent.

If you are in flat country, and your head-end site is going to be "up in the air" on a 400′ plus tower, do not assume that one spot is as good as another simply because the terrain is flat. Even over flat or gentle rolling terrain, there are "hot" and "cold" spots. More than one operator has run aerial tests at various elevations, carting along a portable receiver and/or field strength meter. Flights over the area in a figure-8 pattern will quickly determine if there are *slots* of signal which run at levels higher than average.

Again, tests should be made at various times of the day over a period of a week to ten days. Because signals tend to layer (in horizontal strata) over flat or rolling terrain, vertical checks from near ground level up to 500 feet or so are equally important. Our experience with air checks indicates that it is always best to set up a portable ground reference measuring point against which air level checks can be compared. Inversions over flat terrain are frequent as weather fronts move across the area, and such inversions can change the character of horizontal layering.

Planning for the Future

Obviously, your head-end site should be so chosen and designed as to allow direct off-air reception of the planned new UHF independents. We have at the moment two antenna sites under construction which are literally *too good* (better and more expensive than need be) for the VHF-only reception they will immediately provide. However, within the next year several new UHF outlets in the area are expected on the air, and then we will be able to replace existing duplication VHF network stations with the new UHF independents at the same head-end site.

Nearly all microwave installations are engineered by the equipment supplier, a factor that usually removes these considerations from the hands of the CATV operator. Recently, however, there have been new developments in head-end antenna configurations; paramount of these is the parabolic. Basically, a huge curved screen concentrates the signal on a single focal point, where a dipole with or without additional direction and/or reflector elements receives the signal. The larger the curved screen, the sharper the antenna's directivity and the higher the gain. Often the parabolic antenna will work as far as 250 miles from the station.

Conclusion

The head-end site is literally the key to the ultimate success or failure of the planned cable system. Careful site selection, and careful weighing of all factors involved, will prevent costly errors. To paraphrase a quotation of the rooftop antenna industry, "The cable system signal is only as good as the head-end signal." ●

Valley Vision system in Jackson, Cal. utilizes 105′ tower alongside abandoned water tank once used to supply famous Argonaunt gold mine.

LITERATURE of INTEREST

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

Speech input console, Collins 212S-1, described in 4-page brochure. 163

Transmission line dehydrators, pressurizers and mobile power units described in literature from S & G Mfg. Co. 177

Miniature phone jack, Tini-D Jax by Switchcraft, in catalog sheet containing application data and specifications. 124

"Bucket" truck, Servi-Lift, for CATV line work, described in brochure from Hunt-Pierce. 112

Strand cable - lashing materials and methods, "rapid-lash helix," described in 7-page brochure from Channell Splicing Machine Co. 165

Audiodisc physical data and products listing presented in a folder from Audio Devices 120

Plastic film cans and reels and magnetic tape reels listed in catalog sheets from Plastic Reel Corp. Includes sheets describing polyethylene bushings and bearings and idler/drive rollers 141

Panel/switchboard meter quick reference catalog illustrates cross-section of Hickok's custom-built meters. 186

Vidicon tubes for CCTV cameras described in technical data sheet from Cohu Electronics. Includes selection table, performance data, and recommended uses. 114

Portable 3" I.O. TV camera G.E. PF-26, described in brochure which also lists component makeup of one-camera and two-camera systems. 142

Stereo mixing console, 7-input, 3-channels output solid-state model described in catalog sheet from Melcor Electronics Corp. 157

Microwave power measurement discussed in 80-p Application Note from Hewlett-Packard. Analyzes measuring devices by type. 131

CATV advertising aids offered in AD-101 ad package from Ameco. 132

Video line equalizer and low distortion feedback audio amplifier described in catalog from C-Cor Electronics. 133

Standby electric plants, a guide to selection and installation from Onan, includes plant capacity, engine type, output, etc. 134

Film inspection machine, all solid-state, Model S/S Inspecto-O-Film, described in flyer from Harwald Co. 135

UHF-TV translator systems described in brochure from Litton Ind. Outlines advantages to commercial and ETV. 136

Background music programming brochures from National Musitime Corp. include library and franchise information. 137

Silicon semiconductor specifications listed in catalog from Raytheon. Includes descriptions of more than 500 integrated circuits and transistors. 138

Coax cable terminations for CATV, video, RF applications, described in two bulletins from Holland Electronics. 139

2500-mc ETV antenna catalog from TACO lists receiving and transmitting types. 140

CCTV Vidicon camera described in flyer from Ampex. Includes specifications, application data. 143

Audio limiter with switchable VU meter, fast attack time, described in data sheet from Bauer. 144

Audio level control amplifier with 60 db linear gain, described in data sheet from CCA Electronics. 145

CATV equipment line described in 12-page brochure from Stromberg-Carlson. 146

Spectrum analyzer plug-in units, offering phase lock, 100-mc dispersion, described in technical data from Tektronix. 148

Program boards for switching, patching, matrixing, detailed in catalog from Sealectro. Describes customized systems. 149

Automatic power transfer switches described in brochure from Automatic Switch Co. Includes specifications, prices. 150

Prefabricated buildings for housing tower site equipment described in 4-p brochure from Ft. Worth Tower. 151

Dynamic microphone designed for field use covered in Model SM50 data sheet from Shure Bros. 152

Tape recorders and microphones, described in 20-p catalog from Sony. Includes stereo units. 153

Transistor Engineering Bulletin from Sprague lists characteristics, specs, for 3N114, 3N115, 3N116, 3N117, 3N118, 3N119. 154

Video monitor, 14" picture, 5" waveform, described in brochure from Marconi. Includes specifications, operation, mounting data. 155

Xmitter remote control, radio telemetry system, 48 control, 24 metering functions, described in brochure from Marti. 156

Bolex camera conversion kit increases film capacity to 400' or more. Brochure from S.O.S. Photo-Cine-Optics. 158

Communication towers specifying guide, covering requirements, codes and standards, materials, fabrication, erection, etc., from Optimum Designs. 159

Books on all phases of radio-TV-CATV, many unavailable from other sources, fully described and illustrated in 8-page catalog from TAB Books. 164

CATV information-channel equipment —Weather-Scan, Tri-Scan, and Roto-Scan—described in literature from R. H. Tyler Co. 147

Quartz-iodine lighting equipment, portable/powerpack electronic dimmers, explosion-proof fixtures, described in catalog sheets from Colortran. Also price sheets. 188

TV Antennas

(*Continued from page* 27)

Nulls may be eliminated, or their effect minimized, by proper power distribution and phasing in each antenna bay. Some gain must be sacrificed to fill in nulls; therefore, the more null fill-in required, the less actual gain possible from a given antenna. However, the higher signal level over nearby areas usually justifies the gain loss. The calculated effect of null fill-in in conjunction with a 0.5° beam tilt, is shown in Fig. 9.

Table I. Maximum Effective Radiated Power for Visual TV Transmitters

Channel No.	Maximum ERP in db above 1 kw (DBK)
2-6	20 DBK (100 kw)
7-13	25 DBK (316 kw)
14-83	37 DBK (5000 kw)

Table II. Typical Antenna Costs

No. Bays	Channel	System Input (kw)	Price
VHF Batwing and Turnstile			
1	2-3	20	$ 9.500
3	2-3	50	$19.000
6	2-3	50	$39,000
1	4-6	20	$ 9,500
3	4-6	50	$19,000
6	4-6	50	$36,000
2	7-13	20	$ 9,200
6	7-13	50	$21,000
12	7-13	50	$47,000
VHF Helical			
1	2	50	$30.000
3	7-13	60	$55,000
VHF Slotted Ring			
1	7-13	—	$ 9,000
3	7-13	—	$32,000
5	7-13	—	$52,000
UHF Helical			
4	14-56	60	$23,000
4	57-68	45	$23.000
4	68-83	30	$23,000
6	14-56	60	$35,000
6	57-68	45	$35,000
6	69-83	30	$35,000
12	14-43	60	$100,000

Prices will vary according to channel, power, gain and directional requirements. Prices include transmission line but exclude de-icers which range from $900 to $3,000. Prices for supporting mast and tower are extra.

Conclusion

TV viewer demands for better pictures gives the broadcaster little choice—he must either put out a good strong, high quality signal, or his wares will go a-begging. By careful design, an economical and efficient antenna system will spread a strong signal, over desired areas, from a relatively low power transmitter. ●

Acknowledgment for source data and photos is due Alford Mfg. Co., General Electric Co., Jampro Antenna Co., and Radio Corp. of America.

BROADCASTERS SPEAK

While we sincerely appreciate the plug by John Battison in your November issue for our Standard Broadcast Allocation Map Book, we hasten to notify your readers that this service has been discontinued.

Under certain circumstances we can accommodate requests for specific frequencies while cautioning the inquirer that the charts are not current, revised only to April 1963.

Dr. Robert a Nottenburg, V.P.
Education and Training
Cleveland Institute of Electronics

My company recently bought a new Standard Electric 25-kw AM transmitter and a new antenna tower, but still needs FM link equipment, good band recorders, mobile link, modern microphones, etc., etc., and think seriously, for the future, to buy a low or medium power TV equipment. Encarnacion (Paraguay) and Posadas (Argentine) are only parted by the big river Parana and there are around 600,000 people in a 100 mile circle.

Will you be so kind as to send your very interesting magazine directly to my particular address, so that I no lose it.

R. Godefroid
Radio-Encarnacion
Paraguay, S.A.

Wish my Spanish was as good as your English! Request granted.

In the January 1965 issue reference was made to stations improving their antenna efficiency by changing to the unipole type. Could you refer us to any published articles on the practical or theoretical design of such an antenna, or put us in touch with Mr. John H. Mullaney?

We recently changed frequency from 1450 kc to 540 kc and have towers 220' high, top-loaded with 8 wires, in a directional setup with a figure-8 pattern, and like everyone else wonder if we can improve the efficiency of the installation.

I wish to compliment you on a publication which has brought us quite a lot of help by keeping us in touch with the happenings in the broadcasting industry in the U.S.

B. Scetrine, Manager/Engineer
North-East Tasmanian Broadcasters
Scottsdale, Tasmania

As reported previously, information on the "unipole" may be obtained from John H. Mullaney & Assoc., 5712 Frederick Ave., Rockville, Md. A new series on DA's begins in this issue.

We enjoy the monthly issues of BM/E very much. Your magazine provides a real service to the broadcast field.

However, we have a bone to pick with Mssrs. Hillstrom and Layton, co-authors of the microwave article in the November issue. Not with the subject material, but with the chart listing the various manufacturers of TV microwave gear. It is possible that the "big boys" just didn't have the time to furnish the authors with needed information about their equipment. Nevertheless, the younger technical personnel who read this type of article should also be made aware that RCA, G-E, and Motorola also make this type of gear, and have made it for years! It would be a conservative estimate that RCA, G-E, Raytheon, and Motorola have more TV microwave auxiliary equipment installed than all of those listed, combined.

W. B. Cox, Tech. Director
KBTX-TV Bryan, Texas

The fault is ours. As stated in the footnote, authors Hillstrom and Layton supplied only the material on the KOOL-KOLD microwave link. Apologies to omitted manufacturers and their stockholders.

Would you be kind enough to send me a list of FM receiver manufacturers? We are interested primarily in low-price units, preferably with ONE frequency only. If the price is low enough, we will consider buying them in large quantities.

A. V. Bamford
K-BER San Antonio, Texas

Try Auditron Corp., 509 Madison Ave., New York, N. Y.

Recently I have had occasion to read your magazine and know that I would find it extremely helpful in my business.

I own a recording studio business, and additionally, my associates and myself are establishing an FM Stereo station in the Vancouver area.

I would be grateful for any back issues covering the subject of FM stereo broadcasting.

Donovan D. Drewlo
Vancouver, B.C.

Welcome aboard! Issues sent as requested.

For some 18 months now I have been looking for a small AM station to purchase. The front cover of your November issue lists an article of great interest to me, but inside is no mention of "Full-Time vs Daytime Operation." Or did I miss something?

Harry F. Gray, Jr.
Columbus, Ohio

The article was held over for lack of space. Watch for it in next month's issue.

BM/E

ADVERTISERS INDEX

ADVERTISING SALES OFFICES
Bryce Gray, Jr., President
Mal Parks, Jr., Publisher

NEW YORK AREA
820 Second Ave., New York, N. Y. 10017
Ralph Richardson 212-MO 1-0450
F. F. "Pete" McAdams

NEW JERSEY/PHILADELPHIA
820 Second Ave., New York, N. Y. 10017
Charles C. Lenz 212-MO 1-0450

NEW ENGLAND
228 Main St., Stoneham, Mass.
Harold Short 617-438-3743

MIDDLE ATLANTIC
18 Frederick Rd., Thurmont, Md. 21788
Mal Parks, Jr. 301-271-7151

MIDWEST
612 No. Michigan Ave., Chicago, Ill.
Charles E. Moodhe 312-MI 2-3774
22310 Blossom Dr., Rocky River 16, Ohio
Allen "Bud" Prymmer 216-228-1550

SOUTH CENTRAL
Media Representatives, Inc.
7900 Carpenter Freeway, Dallas, Texas
Joe Sissom; Parker Harris 214-ME 1-4480

WEST COAST
1245 E. Walnut Street, Pasadena, Calif.
Lawrence C. Papp 213-795-1528
Los Angeles: 213-684-0590
Jules E. Thompson Co.
681 Market Street, San Francisco, Calif.
Jules Thompson 415-DO 2-8547
William Healey

JAPAN
Nippon Keisoku Inc.
P.O. Box 410, Central Tokyo
Yoshi Yamamoto

ENGINEERING
CASEBOOK

Measuring Operating Impedances

by C. Ward Yelverton

UNFORTUNATELY, the measured impedance and the actual operating impedance of a circuit are sometimes two very different quantities. This is particularly true when the circuit is nonlinear with respect to changes in power or voltage (an incandescent light bulb, for example, or most transmitter dummy loads). In the case of a directional antenna system, on the other hand, the circuit may be so complex that it is impossible to introduce a conventional bridge without some effect on its operation.

Directional Antenna Measurements

A diagram of a simple two-tower array is shown in Fig. 1, and its simplified equivalent circuit is depicted in Fig. 2. Measuring the input or drive point of one tower in such a system is not a simple problem. If Tower No. 2 is disconnected and properly "floated" so that it draws no current, or better yet physically removed completely, input impedance Z_1 is eqaul to the self impedance Z_{11} and is easily measured with a conventional bridge. However, considerable effort is involved in adding tuning networks to all the elements in a multi-tower array in order to float all the towers except the one actually being measured.

In the operating configuration, the input impedance of Tower No. 1 is given by the equation:

$$Z_1 = Z_{11} + Z_{12}\left(\frac{I_2}{I_1}\right),$$

where $Z_{12}\left(\frac{I_2}{I_1}\right)$ is the coupled impedance Z_c. Mutual impedance Z_{12} is a function of the physical configuration of the towers and is constant for a given array. The complex current vector ratio is a function of the self and mutual inductances and the circuitry in the current paths.

Since the feed circuit for either tower is connected through the phasor to the other tower, the input impedance of one affects the current in the other. Thus, placing any impedance in the feed to one tower also affects the current in the other tower through the interconnecting phasor circuit. From the equation, it is obvious that a change in the current vector ratio results in a change of the coupled impedance and thus the input impedance.

Introducing a conventional bridge into the circuit so radically changes input impedance that measurements are meaningless. As a matter of fact, the only place a conventional bridge may be introduced into a directional array without changing the circuit parameters is at, or before, the common point. However, with an Operating Impedance Bridge (OIB) the voltage-current vector can be measured on the line. As shown in Fig. 3, the measuring circuit utilizes two controls in a null-balance circuit; the resistance control is calibrated in ohms normalized to 1 mc.

Conventional Antenna Measurements

Making accurate measurements on a conventional antenna is often difficult due to the adjacent co-channel and interference received in the detector. This problem is easily overcome for initial tune-ups by simply using higher power signal generators with the OIB. Even if transmitter power levels are not permissible due to FCC Rules, a higher power signal generator and the use of an external detector with the IOB will allow accurate measurements in the presence of the most persistent co-channel signal.

Adjusting Matching Networks

Once the rough setup on a directional array has been accomplished, the tower matching network may be readily set by measuring the operating impedance of the tower and then calculating the required values of the matching section components to give the impedance match and phase shift. The components may be set to their calculated values by operating the OIB as a conventional bridge with the low level signal and an external detector. With the components set to their required values, the OIB is connected in series with the input to the matching section and final touch-up of the components is made to give the exact match required. It is necessary, of course, to readjust the phases and current ratios at the phasor when a change is made in the matching network.

Monitoring the Common Point

One of the greatest difficulties involved in the final adjustment of a directional antenna system is the interaction between all of the phasor controls and the common point impedance. Without monitoring an excessive number of field points, it is impossible to determine if a field strength change is due to a radiation pattern change, or to a change in the overall radiated power. Even the common method of ratioing field measurements against a non-directional radiation pattern is not usable unless the input impedances to both the phasor common point and the non-directional antenna's drive point are accurately known.

When measuring tower operating impedances, it is easy to overlook shunting circuits feeding the tower particularly the lighting circuits. The safest approach is to connect the OIB directly in series with the base current ammeter at the ammeter terminal. ●

Mr. Yelverton is Chief Engineer at Delta Electronics, Alexandria, Va.

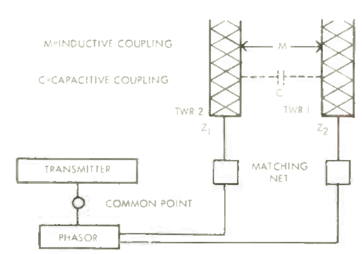


Fig. 1. Diagram of 2-tower antenna network.

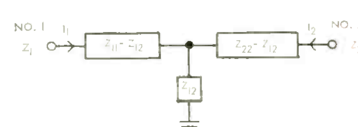


Fig. 2. Equivalent circuit of 2-tower antenna system.

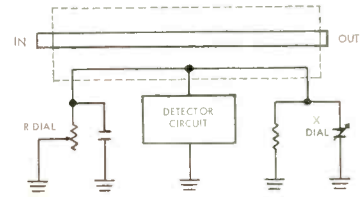


Fig. 3. Simplified schematic of the OIB.

COLOR RIKER
COLOR RIKER
COLOR RIKER
COLOR RIKER

New

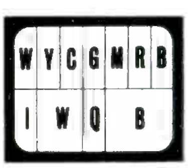
ENCODED COLOR-BAR GENERATOR

SPECIFICATIONS

INPUTS—Sync, Blanking, Burst Flag, 3.58 MC/S

OUTPUTS—two—either Comp or Non-Comp—White, Yellow, Cyan, Green, Magenta, Red, Blue—I, Q, B, W

CONTROLS—Split Screen, Full Raster, 75% amplitude, 100% amplitude.



Now it is no longer necessary to tie up an encoder in order to produce color test signals.

The new RIKER MODEL 5618 provides standard ENCODED COLOR BAR SIGNALS. With a front panel switch you may select full raster or split screen presentations. A second switch selects color bars at 100% or 75% amplitude. All-transistor circuitry assures ultimate accuracy and stability.

This new precision color test signal generator is designed for use in checking studio facilities, setting up video tape recorders, and mobile vans. Color testing at transmitters can now be performed without requiring a video source from the studios, thus freeing facilities and personnel. The RIKER MODEL 5618 ENCODED COLOR BAR GENERATOR releases your studio encoders for program use.

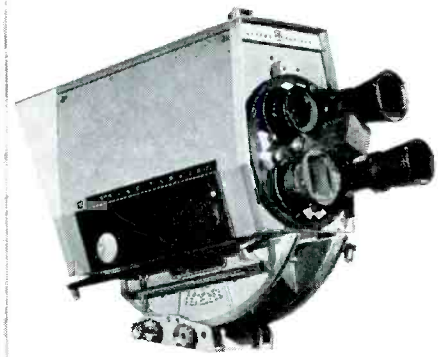
The MODEL 5618, comprised of 2 RIKER all-transistor video modules, may be used as single test instrument or plugged-in with other RIKER test modules.

Call or write today for complete details.

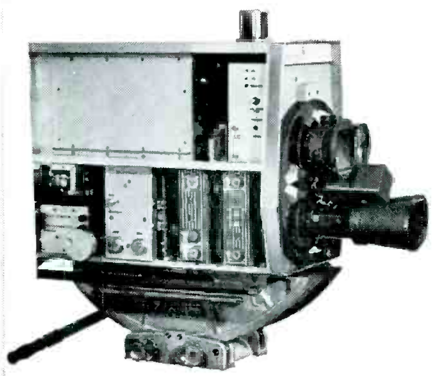
RIKER INDUSTRIES, INC.
...thinking always of tomorrow
Norden Lane, Huntington Station, New York Phone 516 HA 1-3444 Atlanta Los Angeles, Detroit, Washington, D.C.

Circle 3 on Reader Service Card

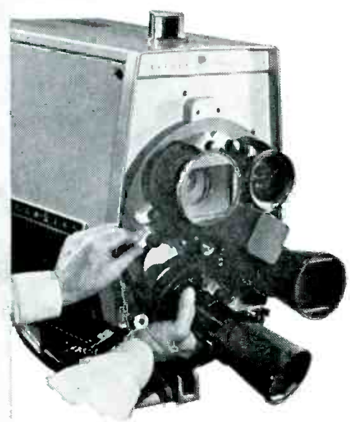
A FEW REASONS WHY YOU CAN'T BUY A FINER TELEVISION CAMERA ...AT ANY PRICE



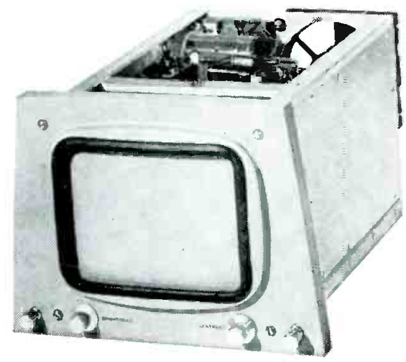
Impressive, designer-styled exterior. Clean lines, ultra-compact package houses field-proven Tarzian 3" Image Orthicon camera system. Highly portable. Easy to handle. Uses conventional camera cable.



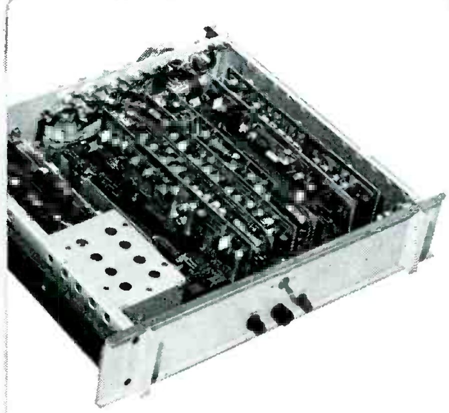
100% transistorized plug-in electronics for reliability and fast, convenient troubleshooting. Hinge out yoke assembly allows rapid change of IO tube.



Built-in remote iris control. Quick-change lens insert system accepts variety of lenses, fixed focus and zoom.



Plug-in, self-contained 8-inch viewfinder assembly, interchangeable with other Tarzian live cameras. All circuits accessible without removing viewfinder.



Modular proc amp completes camera system. (Also interchangeable between cameras.) Totally transistorized electronics on plug-in circuit cards. Compact, highly portable.

SPECIFICATIONS

Scanning rate	525 lines, 30 frames, 60 fields, 2:1 interlaced
Line repetition rate	15,750 cycles per second
Resolution (horizontal)	600 lines picture center 500 lines picture corners
Signal-noise ratio	Limited only by image orthicon
Remote iris control	Time for full range, 3 seconds accuracy of setting ± 0.25 lens stop
Output signals	Horizontal drive, 4 volts ± 0.5 volts; Vertical drive, 4 volts ± 0.5 volts; Sync, 4 volts ± 0.5 volts; Blanking, 4 volts ± 0.5 volts. Viewfinder video (external) 0.7 volts intercom audio.
Viewfinder size	8" tube
Intercom	Dual transistorized

These are but a few reasons. For all the rest, call, or write, for 8-page brochure, "3000L 3" Image Orthicon Camera System."

SARKES TARZIAN

BROADCAST EQUIPMENT DIVISION BLOOMINGTON, INDIANA

Circle 4 on Reader Service Card