$1.00

FEB. 1962

tv horizons

TUNNEL DIODE

FOR UHF-TV

serving the television reception industry

KCOP
AMOS T. BARON, GEN. SALES MGR.
915 N. LA BREA
HOLLYWOOD 38, CAL.

Channel 1

CATV
MATV
Fringe TV
ETV
UHF-TV
Associated Industries' News

OKLAHOMA!

Horizons Publications is now located in Oklahoma City, Oklahoma. All editorial offices, sales offices and circulation offices are in full swing from this growing mid-western metropolis, although our Business Offices remain in Modesto, California.

With this issue of Television Horizons, we hope you will notice a suitable improvement in quality and delivery. We are exceedingly pleased with our new printing liaison with the *Times-Journal Publishing Company,* and from comments received following the December special Directory issue (it was printed here in Oklahoma City) we feel we will be better able to serve the growing television reception industry from our modern new plant.

Located as we are at a central point, with a number of major airlines serving the city, we hope you will take the time to "drop in and say hello" when between flights or in town for business.

Holland to Adopt 'Piped-TV'

It has been announced that the PPT Holland — the Dutch Post and Telegraph Services — is to foster a scheme of VHF radio and television broadcasting via coaxial cable.

The system is to be launched in The Hague, and it is estimated that more than 15 miles of cable will be used to carry the signals to some 5,000 receivers.

Wide-band EMI equipment has been chosen for the installation, so that when further programmes are available, no new aerials or converters will be required. EMI equipment is widely used in Great Britain, and features some of the characteristics of wide-band equipment produced in the United States.

(*Gordon J. King*)

FCC YEAR-END REPORT

In its annual year-end report on activities for 1961, the Federal Communications Commission had these comments about its work in the area of TV broadcasting for the year just passed.

"TV Operation — The Commission has taken actions to promote the use of UHF to extend and augment competitive TV service not possible with the limited number of VHF channels. These include proposals to relax certain UHF technical requirements, make certain areas either (all) UHF or VHF, test UHF for large metropolitan area coverage, and has recommended legislation to require TV sets to also receive UHF broadcasts. Meanwhile, added TV translator and repeater stations are bringing outside programs to small, remote communities unable to support regular TV stations."

Trouble in NYC UHF Test

Perhaps you have wondered why there have been no reports in this or other publications on the currently in-operation New York City UHF testing program.

The FCC has clamped a censorship over all personnel associated with the testing program. The Jerrold Electronics Corporation, which holds one of the prime contracts for making receiver installations and recording field strength results, has TV reception ace Jack Beever on the job in New York City. When Television Horizons asked Beever to prepare a series of exclusive reports on the subject for publication, we were referred to the Commission. There we were told ". . . our contract with the Jerrold Corporation will not permit the firm to furnish any information directly to you. This information must be transmitted directly to the Commission for evaluation and official releases will be made from time to time."

While this would seem to be an insurmountable problem, TVH is in hopes that a solution will be found allowing us to bring readers factual reports on the progress of this most important project.

Annual NCTA Panic Button

Every year about this time the *National Community Television Association* blows the whistle and re-warns its members that "legislation time is just around the corner." This year is no exception and the NCTA point is well taken.

Once again this year broadcasting interests are negotiating with members of Congress for the presentation of 'anti-CATV' bills aimed at bringing all community antenna systems under the thumb of the Federal Government.

The NCTA now boasts a substantial membership encompassing practically every large CATV system in the country. However there are a number of medium and smaller sized systems which apparently have not taken the time to think out the advantages of being represented in Washington by a strong industry organization. If you fall into this category, think about this for a minute.

Do you want Uncle telling you which programs you can and cannot provide to viewers on your system? Do you want Uncle to have the power to stage a hearing on whether your CATV system should or should not operate; on whether it is or is not in the public's interest?

FEBRUARY 1962
VOLUME 3 • NUMBER 2

TELEVISION HORIZONS

PUBLISHED MONTHLY BY HORIZONS PUBLICATIONS
Post Office Box 1557 • Oklahoma City 1, Oklahoma

EDITORIAL

"The industry has long needed just such a Directory of equipment" one manufacturer wrote "but it took someone with courage and foresight to put it together and get it out."

"I hate to pick a bone" another manufacturer wrote "but our listings were not alphabetical, were not complete and you didn't list our cable taps!"

And so the letters poured in. Fortunately for our sake, the *pro's* were 10-1 over the *con's*. There was one thing everyone agreed on . . . the printing and photography work were out of this world!

But the fact that some manufacturer's did have a complaint led us to do some serious thinking as to how we would go about improving the 1962 Television Horizons Directory (due out in December of this year) so that it will be more useful, more factual, more complete and most of all, more truly representative of the entire interests of the off-the-air reception and re-broadcasting industries.

Here is what we have done, are doing, and will do.

Preparation for the 1962 Directory is already underway. In the next 60 days all manufacturers in the field will receive detailed questionnaires asking of them information as to which sections they wish to list equipment in. Then each manufacturer will be supplied with Directory forms which he himself will utilize to prepare his own Directory copy, within the limits of the space available. The Directory forms, prepared and written by the manufacturers, will then be coagulated by Horizons, set into type, and galley sheets will be returned to the proper manufacturers so that proof reading for correctness and last minute changes can be made.

Finally late in the fall of this year page galleys showing photographic layouts and copy layouts will be provided each manufacturer.

R.B.C.

TABLE OF CONTENTS

FEATURES

DEPARTMENTS

STAFF

R. B. Cooper, Jr., W5KHT
Publisher-Editor

Thomas S. Kneitel, W5KDR
Executive Editor

Jim Kyle, K5JKX
Managing Editor

Carlyne Silva
Associate Editor

Les Farey
Lon Cantor
Charles Wigutow
Marv Mitchell
Vic Nicholson
Contributing Editors

Gordon J. King
"Our Man In Europe"

Jackie Johnson
Business Manager

Stanley M. Searle
Art Director

Bonnie Fanter
Circulation Manager

EDITORIAL OFFICES
4 NW 7th Street
Oklahoma City, Oklahoma
CEntral 2-1108

BUSINESS OFFICES
1518-9th Street
Modesto, California
U.S.A.
LAmbert 4-7395

ADVERTISING: Television Horizons accepts commercial display advertising from bona fide manufacturers of electronics equipment and apparatus dealing with the CATV, MATV, fringe-TV, ETV and rebroadcast TV industries. Advertising rate card and circulation data upon request.

CIRCULATION: Television Horizons is circulated through the mails and in person on the 5th of each month to an average of 7,500 readers in the CATV, MATV, TV servicing, fringe-TV, ETV and TV broadcast (and rebroadcast) industries. Circulation is both paid and controlled. Detailed circulation breakdown, by reader occupation, is available upon request.

SUBSCRIPTION: Subscription rates in the United States and Canada $5.00 per year. Subscription includes the Annual Directory edition, issued every December. Single magazine copies $.50 each. Single Directory Editions $1.00 each. Subscription remittances should be made by bank money order or check. Two year subscription rate U.S.A. and Canada—$8.00. Subscriptions outside the U.S.A., Canada $6.00 per year.

TELEVISION HORIZONS (title registered U.S. Post Office) entered as second class postage material December 30, 1960. Second Class Postage Paid at Oklahoma City, Okla. Address of publisher in Oklahoma City is 4 NW 7th Street.

TELEVISION HORIZONS . . . Serving an Industry

AVAILABLE FROM BLONDER-TONGUE

The new Benco T-6 VHF Translator Is Priced at $845.00

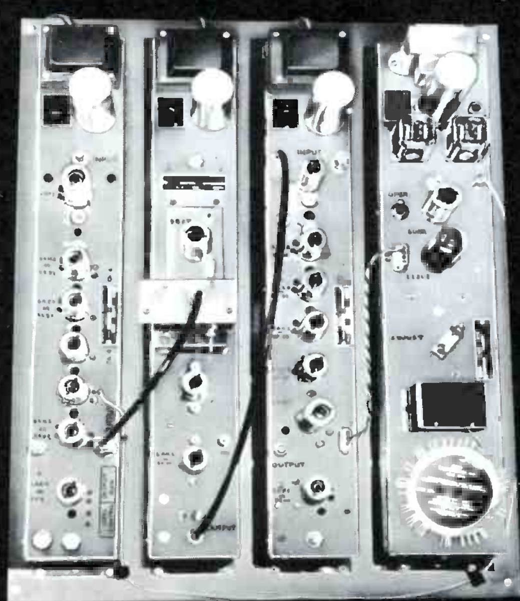
(Suggested User price)

...It is

FCC Type Accepted

Rugged and Reliable

Available for Prompt Delivery



The Benco T-6 offers these advantages:

1. Meets all FCC specifications.
2. Provides constant output even in weak signal areas—preamp AGC activated by signals as low as 50 microvolts.
3. Automatic shutoff and identification.
4. Remote shutoff for any location up to 5 miles from the translator. (with RC-1).
5. Covers from 8 to 30 miles or more.
6. Prompt delivery to those who must have a low cost unit immediately to meet their 'on-the-air' time-schedule.

TECHNICAL SPECIFICATIONS

Primary Power Source	117 v ± 10% 60 c/s
Power Consumption	120 W
Temperature Ambient	—30°C to + 50°C
Overall Noise Figure	
Low Band	4 db ± 1 db
High Band	6 db ± 1 db
Recommended Input	50—4000 microvolts
Max. Permissible Power	1 Watt (Peak Power)
Frequency Stability	.02%
Gain (maximum)	105 db
Band Width	6 Mc (3 db points)
Dimensions (metal base)	18"x22½"
Weight	27 lbs.

BENCO VHF AND UHF TRANSLATORS FOR EVERY TYPE OF INSTALLATION

MODEL T-1 VHF TRANSLATOR, FCC type-accepted. 1 watt output for U. S. use • ideal for future expansion • meets all FCC specifications • noise-proof automatic shutoff • regulated power supply for stable operation, even at the end of poor quality power lines • underrated output section for continuous service; weather-proof housing; quick easy coding of identification unit • built-in direct reading power meter.

MODEL T-14 VHF-TO-UHF TRANSLATOR. FCC type-accepted. 2.5 watts output. For U. S. use. Includes identification units with automatic "on/off," power indicator and voltage regulator. VHF input, channels 7-13.

MODEL T-13 VHF-TO-UHF. Same as T-14 except: VHF input, channels 2-6.

If you're planning a translator installation, contact Blonder-Tongue. Free layout service and field engineering assistance are available at nominal cost

engineered and manufactured by
BLONDER-TONGUE
9 Alling St., Newark, N. J.

Canadian Div.: Benco Television Assoc. Ltd., Toronto, Ont.
Export: Morhan Export Corp., New York 13, N. Y.
home TV accessories • UHF converters • master TV systems • Industrial TV systems

The Application Of Low Noise Tunnel Diode Amplifiers To UHF Community Antenna Television Installations

By ALFRED GRAYDON

Micro State Electronics Corporation
152 Floral Avenue, Murray Hill, New Jersey

Introduction

The improvement of system sensitivity is one of the prime objectives of the systems designer. With the advent of low noise amplifiers, in recent years it has become possible to significantly enhance the system sensitivity in UHF community antenna TV installations. Frequently, the cost of a more sensitive receiver is more economical than that of a more powerful transmitter. Other times, the combined performance of higher power transmitters and low noise receivers is needed for reliable system performance for areas of fringe reception, and for very long hops.

Of the three available types of low noise amplifiers, maser, parametric, tunnel diode, only the tunnel diode amplifier offers the additional features to the system designer of completely solid state reliability, simplicity, battery operation, small size, light weight, low total cost. Furthermore, because of these features, it is possible to mount the amplifier on top of the master antenna tower and directly at the antenna in UHF CATV systems, thereby obtaining an overall system noise figure which is lower than that obtainable by other techniques.

Recognizing the importance of the above features, Micro State Electronics has been actively engaged in the development of low noise tunnel diode amplifiers for UHF CATV systems.

Theory of Operation

The tunnel diode amplifier is a reflection type negative resistance device. Examination of the expression for reflection coefficient, from transmission line theory, shows how gain is achieved in such devices.

$$\Gamma = \frac{Z_L - Z_o}{Z_L + Z_o}$$

Γ = reflection coefficient
Z_L = load impedance
Z_o = characteristic impedance of the line

This expression shows that gain is achieved when Z_L is negative, for, under these conditions, the reflection coefficient, Γ, is greater than one. For example, a 50 ohm transmission line with 25 ohm load impedance has a reflection coefficient of 0.33, indicating a reflected wave smaller than the incident wave. On the other hand, the same line with a negative 25 ohm load impedance as a reflection coefficient of 3.0 indicating a reflected wave greater than the incident wave, which means that the system has produced gain or amplification.

In a tunnel diode amplifier the negative resistance is achieved by biasing a tunnel diode in its negative resistance region. Typical tunnel diode I-V characteristics are shown on figures 1 and 2. It is seen that in the region from Vp to Vv, current decreases with increasing voltage, thereby producing a negative resistance. This negative resistance holds over the frequency range from dc to the cutoff frequency of the diodes, usually 5-10 kmc. It has been found that the optimum bias point for minimum noise figure is at ½ the peak current or Io on Figure 1.

Since the tunnel diode is a two terminal device, steps must be taken to separate the incident and reflected energy. This is accomplished by using a ferite circulator which permits energy to flow from port to port in only one direction. A second circulator is usually added with a matched termination

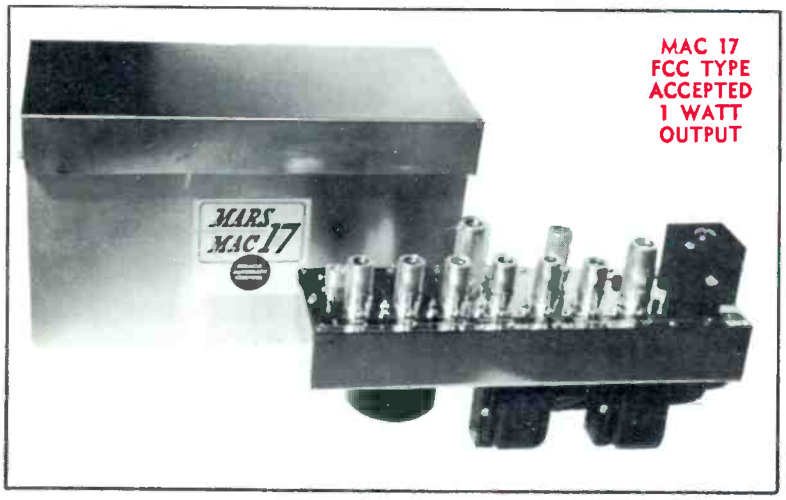
MARS MAC 17

VHF TRANSLATOR

AND THE

MARS MARK-4

MULTIPLE OUTPUT AMPLIFIER

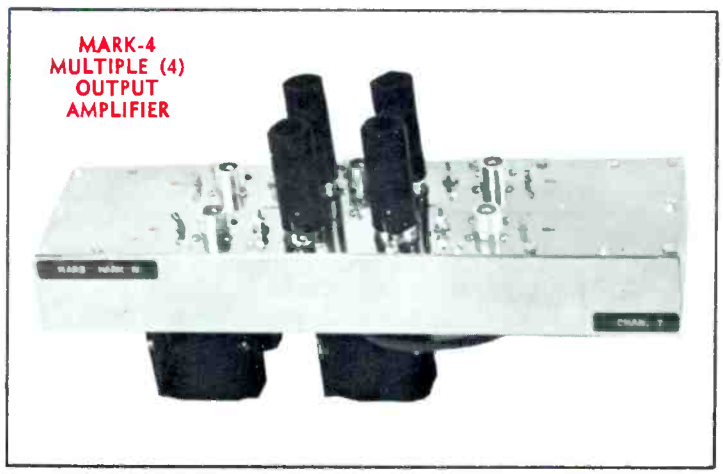


ONLY THE MAC-17 OFFERS:

- ★ ALL INDUSTRIAL TUBES
- ★ OPTICAL IDENTIFIER
- ★ LESS THAN 50 WATTS AC POWER DRAIN
- ★ SINGLE UNIT CONSTRUCTION
- ★ 100% VOLTAGE REGULATED
- ★ SMALLEST AND LIGHTEST TRANSLATOR
- ★ $933.00 LIST PRICE

NEW FROM MARS – MARK 4 MULTIPLE OUTPUT AMPLIFIER

- ★ MULTIPLY EXISTING COVERAGE AREA BY FOUR
- ★ DESIGNED TO SUPPLY ONE WATT PEAK VISUAL POWER TO ANTENNA SYSTEMS SERVING FOUR DISTINCTLY SEPARATE COMMUNITIES.
- ★ MAY BE DRIVEN BY EITHER 1/3 OR 1 WATT VHF TRANSLATOR.
- ★ FOUR 6360 OUTPUT TUBES, INDIVIDUAL MONITORING OF POWER OUTPUTS
- ★ FULL VOLTAGE REGULATION, WEATHER-PROOF HOUSING
- ★ $395.00



MID-AMERICA RELAY SYSTEMS, Inc.

A Subsidiary of Miratel Electronics, Inc.

918 Tilford Street, Sturgis, S.D.

Dealer, Distributor Inquiries Invited

to provide absolute stability against oscillations by further suppressing load reflections. A block diagram of a tunnel diode amplifier is shown in Figure 3. (More recently, four port circulators have become available and these are often used in place of the two, three port units shown.)

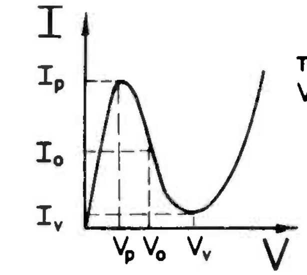


FIGURE I
TYPICAL STATIC
V–I CHARACTERISTICS

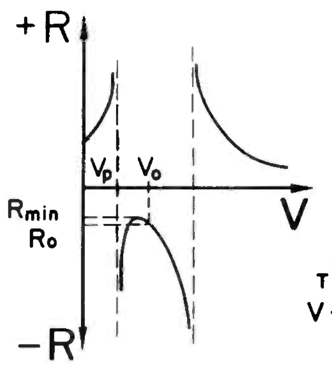


FIGURE 2
TYPICAL STATIC
V–R CHARACTERISTICS

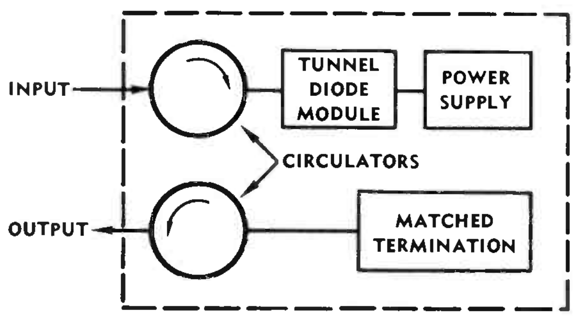


FIG. 3 CIRCULATOR COUPLED
TUNNEL DIODE AMPLIFIER

Specifications

A commercial tunnel diode amplifier is shown in Figure 4. This completely self contained unit includes internal power supply and requires no external supply of any kind. A simple connection of this amplifier to the front end of existing or future receiver systems, and turning on of the switch, are all the requirements for putting the amplifier into operation. No tune-ups of any kind are required.

Typical specifications for a UHF tunnel diode amplifier designed for CATV application are:

Frequency	800-900 mc
Bandwidth	60 mc
Gain	17 db
Single Channel Noise Figure	4.5 db
Impedance	50 ohms
Power	Battery or 115v 60 cycles
Size (inches)	8 w x 9 h x 6½ d typ
Weight	15 lbs. typ

Because of the simplicity of this type of amplifier, it may be mounted on top of the tower directly at the antenna. This minimizes cable losses and makes the tunnel diode amplifier superior to other low noise receivers that must be mounted at the bottom of the tower following a 200-300 foot cable run.

The noise figure of the entire receiver system is given by the expression:

figure)

$N = N_1 + N_2 — 1 — G_1$

N = System Noise Figure

N_1 = Noise Figure of First Stage

N_2 = Noise Figure of Second Stage (Normally includes cable runs plus mixer noise

G_1 = Gain of First Stage

(Computations made in terms of power ratio)

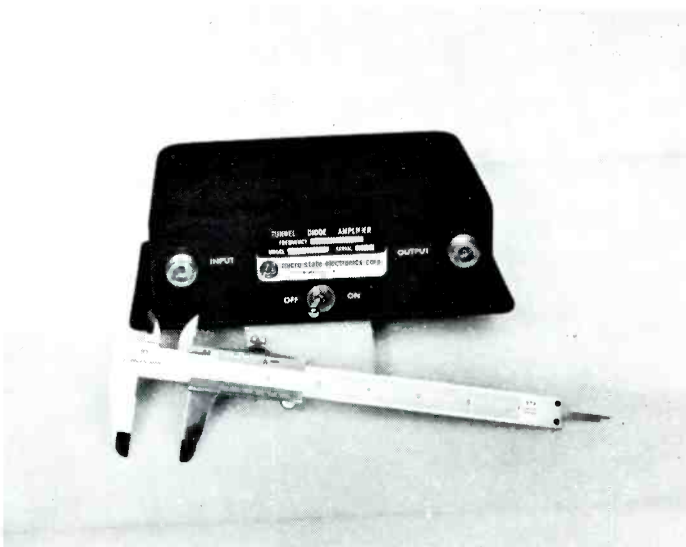
The amplifier described above permits the following receiver system noise figures:

Second Stage Noise Figures N2	System Noise Figure N
7 db	4.62 db
8 db	4.65 db
9 db	4.71 db
10 db	4.77 db
11 db	4.84 db
12 db	4.94 db
13 db	5.05 db

Therefore, since most present systems operate at about 10 db noise figures or above, the addition of this amplifier offers a minimum 5-6 db improvement in noise figure. This is directly related to the sensitivity of the receiver which is given by the expression:

Sensitivity = —114 + 10 log bw (in mc) + NF (in dbm)

Addition of the amplifier described above thus offers a substantial improvement in the fading of a CATV system, or permits construction of a smaller antenna and tower for the same sensitivity.



To simplify the design for mounting amplifiers on top of towers, the tunnel diode amplifier should be housed in a roughly temperature controlled environment. A simple heater element and thermostat can regulate the ambient at the tunnel diode amplifier between 70 and 110°F. This coarse control is adequate for proper tunnel diode amplifier performance.

Features

The product features that make the tunnel diode amplifier most applicable to CATV systems may be summarized as follows:

1. Simple, light weight construction, requiring no tuning, permits the tunnel diode amplifier to be mounted on top of the tower right at the antenna. This minimizes the effect of cable losses and permits low noise figure and high system sensitivity.

2. No klystron is required for operation, there is little dissipation, and no high power cable runs are required to the top of the tower. There are no filaments to burn out. Units can be battery operated with an estimated life of 5-6 months per battery, or may be run off 115 v 60 cycles by including a simple solid state supply within the amplifier package.

3. The tunnel diode amplifier is a reliable, passive device. No other frequencies are introduced into the system, and the unit is maintenance free. Mean time between failure is calculated at 50,000 hours.

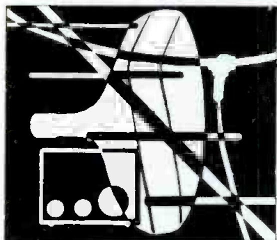
4. Tunnel diode amplifier bandwidth limitations are due to circulator limitations and not limitations on the tunnel diode circuitry. At present, bandwidths up to 10% are feasible, accommodating 4-5 UHF channels without any tuning. As circulators improve, and they are improving rapidly, bandwidth characteristics of tunnel diode amplifiers will be increased.

5. The tunnel diode amplifier is a fail safe device. In the rare instance that a tunnel diode either opens or short circuits, there is still a path through the amplifier, with the front end noise figure rising to the noise figure of the second stage.

6. The tunnel diode amplifier is absolutely stable against oscillations with any combination of source and load impedance, ie it is absolutely stable both open or short circuited.

Conclusion

Low noise tunnel diode amplifiers have been purchased for radar, telemetry, communication, troposcatter, and CATV installations. Within the last two years, this simple low noise preamplifier has carved out a vital role in the receiver field.



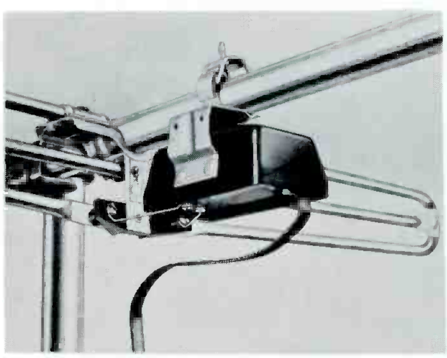
Product SHOW CASE

Manufacturers of CATV, MATV, fringe TV, closed circuit TV and broadcast TV equipment are invited to submit product news releases to this column. Address all mailings to "New Products, Dept. C, Television Horizons, P. O. Box 1557, Oklahoma City 1, Okla."

ADLER • AMECO • AMPEREX • ARF • BENCO • BLONDER TONGUE • CAS • CECO • CHANNEL MASTER • COLLINS • COLUMBIA WIRE • CONRAC • CRAFTSMAN • DAGE • DYNAIR • EITEL • ELECTRON • EMCEE • ENTRON • FOTO-VIDEO • HOLT • INTEC • JAMPRO • JERROLD • KTV • MARS • MASTER VIDEO • MIRATEL • RCA • ROHN • SITCO • SKL • SUPERIOR CABLE • TACO • TELSON • TIMES WIRE-CABLE • TPT • VISUAL ELECTRONICS • WINEGARD

NEW Transistor Tenna-Boost, Winegard

In line with the Winegard Powertron antenna series, The Winegard Company, Burlington, Iowa has announced a new model transistorized antenna mounting booster-amplifier, dubbed the MA-300.



The new Tenna-Boost fits any antenna and has a rated gain up to 19 db for both TV and FM. A 3-way mount permits mounting on the antenna, wall or mast. The power supply is all AC, completely shockproof and is equipped with a local-distant switch, and power polarity switch. A Winegard six set coupler can be used with the Tenna-Boost if more outlets are desired.

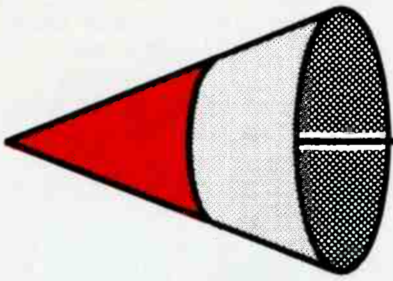
Winegard notes that "unlike other low cost amplifiers, the Tenna-Boost has an input high pass filter that rejects interfering signals such as ham and citizens band radio, garage door openers, etc. Nothing is amplified except TV and FM signals between 54 and 108 mcs and 174-216 mcs.

The Tenna-Boost is packed in a counter type display set-up package, and has a suggested list price of $34.95.

CECO Video Amplifier-Solid State

A completely solid-state wideband amplifier, "CECO Model 1019, is designed for a frequency response of 5 cps to 12 mcs plus or minus 0.5 db. Whereas video amplifiers are generally limited in upper frequency to 8 or 10 mcs, the new CECO model 1019 is able to go to 12 mcs under any gain setting and as high as 25 mcs under certain conditions of fixed gain. Besides its extreme bandwidth, CECO model 1019 is characterized by its high 8 volt peak-to-peak output level. Minimum gain is 40 db, continually adjustable; minimum range of gain control is 25 db. Input and output impedances are 75 ohms with a vswr of 1.5 to 1. Distortion is less than 2% at rated output, sine wave. Hum is 84 db below input of 1.0 volt. An integral power supply operates from 117 vac, 50-60 cps."

Model 1019 can be supplied as a flat amplifier for general laboratory and other uses, or it can be supplied for use as a video amplifier with an internal equalizer for phase and attenuation capable of equalizing and driving up to 1½ miles of Foam 11 cable. Enclosure is in a standard 19 inch panel, 3½ inches high, or unit can be packaged to customers requirements. Contact CECO at 234 East College Avenue, State College, Pennsylvania.



G LINE FOR —A REPORT

PART ONE
Prepared from Material Submitted by
George M. Frese, P.E.
East Wenatchee, Wash.
and
Archer S. Taylor, P.E.
Missoula, Montana

Surface Wave transmission lines (swtl) or as they are more commonly known, "G-Lines," have been around since 1954 when a Signal Corps engineer at Fort Monmouth, New Jersey revealed his experimental data in the field. The engineer (George Goubau) showed that long stretches of distance, between antenna and receivers, need not necessarily be bridged by coaxial cable or microwave at VHF-UHF frequencies. Goubau's method for transmitting VHF signals from point A to point B was so simple that at the outset it defied explanation. But in test after test it proved workable, and with such good results that a number of CATV systems in the northwest picked up the idea. Instrumental in bringing the G-line concept to the television field were George Frese of East Wenatchee, Washington (a registered Professional Engineer with a long history of aiding CATV systems in the northwest) and Archer S. Taylor of Missoula, Montana (also a registered Professional Engineer). Taylor has had considerable personal experience in CATV systems, notably in his Helena, Montana system. A good portion of the early data to be cited in this report evolves from his work in Helena.

George Frese estimates a half dozen CATV systems in Washington are currently utilizing G-line transmission systems. The Helena, Montana system continues to utilize an swtl system which was first installed in 1955.

Considerable experimentation has also been done in this field by engineers at the Antennavision Company, Phoenix, Arizona, covering a number of their Arizona CATV systems. Part two of this report will be devoted to their experimental work in the southwest.

Theory

What is a G-line, you might ask? What makes it work, what are its dis-advantages, and is the G-line system worthy of evaluation in my installation?

The G-line is a single wire transmission line. It utilizes only a single solid conductor, and unlike a coaxial cable, has no second conductor, or shield. Its radiation away from the single wire is exceptionally low (comparable to most coaxial lines, single *or* double shielded), and if properly constructed, the vswr is also exceptionally low. Much lower in fact than most coaxial systems are able to attain.

The lines of electrical force in an ordinary coaxial cable are radial, from the center conductor to the outer conductor. If the dielectric constant in the coaxial line is greater than unity, the velocity of propagation is reduced and the lines of force crowd a little closer together. If, however, the outer conductor is enlarged without enlarging the dielectric, we find that the lines of force take on a "tilt," producing a longitudinal component as well as the radial component. *Now, if we enlarge the outer conductor to infinity,* under proper conditions the majority of the energy is transmitted along the line in longitudinal lines of force *within* the dielectric.

With this in mind, it is obvious at this point that a G-line is a single conductor, solid, with a dielectric covering, but no second conductor or shield, as you find in coaxial cable.

Launchers

To load into the G-line, a method of matching the line to the feeder cable (usually coaxial) is needed. Goubou developed what he called the "launcher," a device to provide uniform impedance matching between the unbalanced coaxial line and the G-line. Essentially, the launcher is (or can be) equivalent to tapered sections of coaxial cable as was used and is still in use in Helena. The configuration used by Goubou and later by Taylor in his Montana installation took the form of a cone (see figure one). While this device provided a method of uniformly matching the two impedances of the coaxial line and G-line, Engineer George Frese differs on this point.

Said Frese: "Cone type launchers are expensive, by my way of thinking. You have the physical problem of getting the cone spun out and mounting the balun in the neck of the cone. With this in mind I developed a simpler launcher which is based upon a method commonly used to series feed a BC station antenna (see figure two). Four spires are used as ground plane radials. The spires can be ⅜ inch aluminum tubing, mounting as shown in figure two on an aluminum disc. The total cost of these launchers, now built commercially in Washington, is approximately $25.00."

Frese is quick to point out, however, that he has done no real research work on the Goubou cone type launchers as versus his own spire launcher, and he does not know how they would compare.

TELEVISION TRANSMISSION

ON EXPERIMENTAL DATA–

Taylor adds "I do not believe our Helena installation was an unqualified success. This is in part due to the problems we had with the Goubou launchers which brought up problems of oscillation or regeneration."

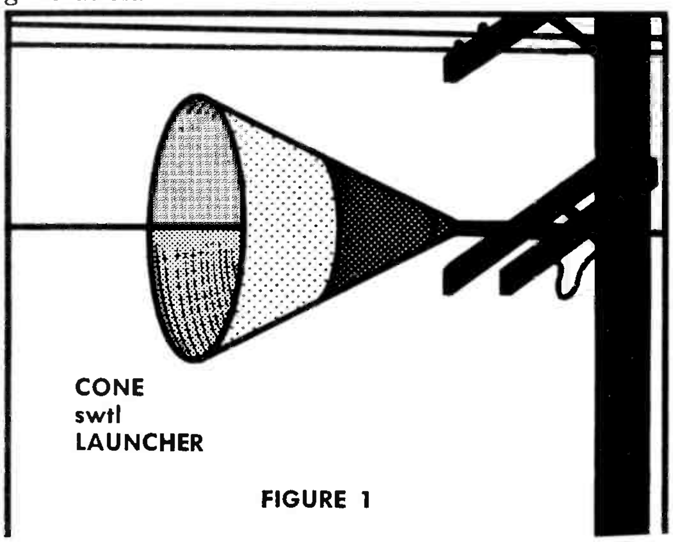


FIGURE 1

It should be pointed out here that the basic G line system consists of the following layout, as shown in figure three. At the head-end of the system or the antenna site, the received signal (or signals) is amplified as in conventional systems, diplexed onto a common coaxial feedline, and then fed into a launcher-impedance matching device which actually "boosts" the signal onto the line. Here the signal travels along the G-line until it reaches a level where amplification is needed again. At this point another launcher is needed to back the signal down to the coaxial feedline impedance for transference into the amplifier for re-leveling. Once the signal has been re-amplified, back it goes onto the G-line through a third launcher. This process is repeated until the signal(s) reach the destination point, the distribution end of the CATV system.

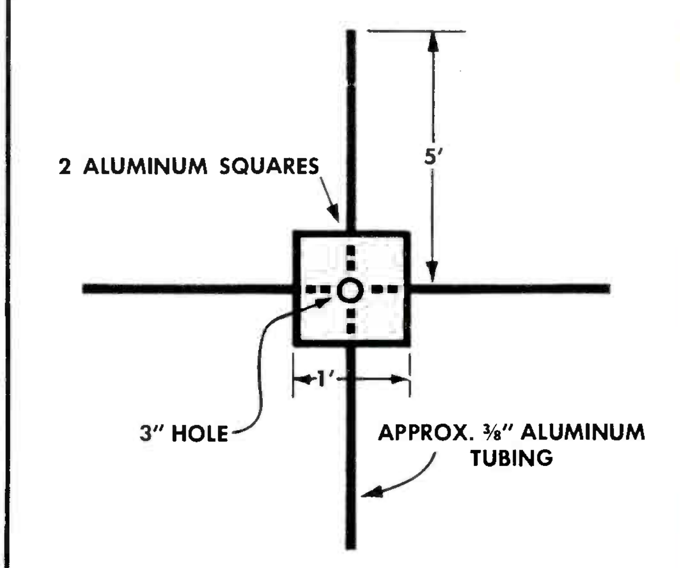


FIGURE 2
FRESE SURFACE WIRE LAUNCHER

Losses

Up to this point the discussion has been theoretical and all remarks about G-line losses have been in generalities. How *much* lower is G-line loss, you may be asking yourself?

George Frese supplies a table of losses measured during 1956. Table 1A shows losses over the frequency range 65 to 220 mcs. for a 3107 foot swtl. The line itself was number 8 copperweld, the dielectric was 2/64 inch polyethylene cover.

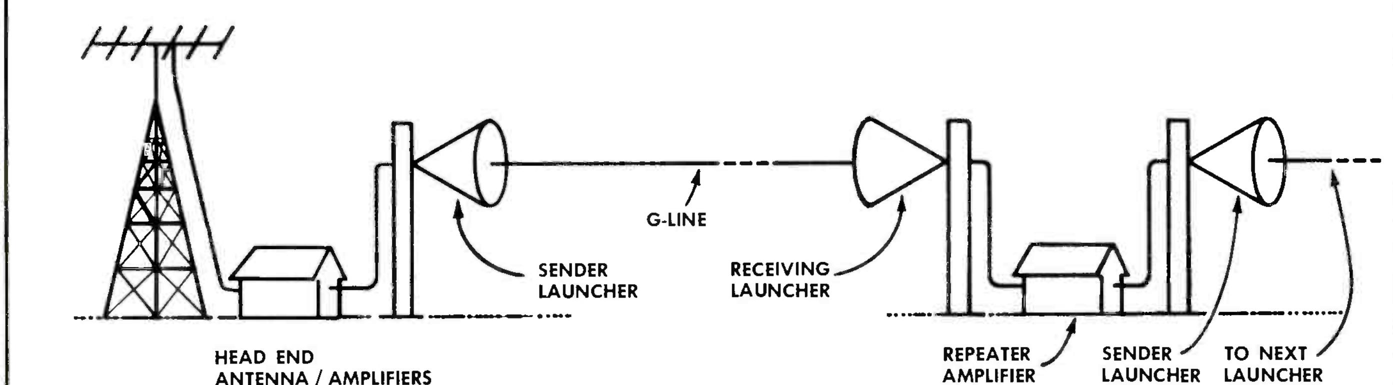


FIGURE 3

Table 1B shows losses over a 7,640 foot swtl utilizing number 8 copperweld, 2/64 inch polyethylene.

It should be obvious that merely stringing number 8 copperweld with poly covering will not assure you of uniform G-line results! But more about that shortly.

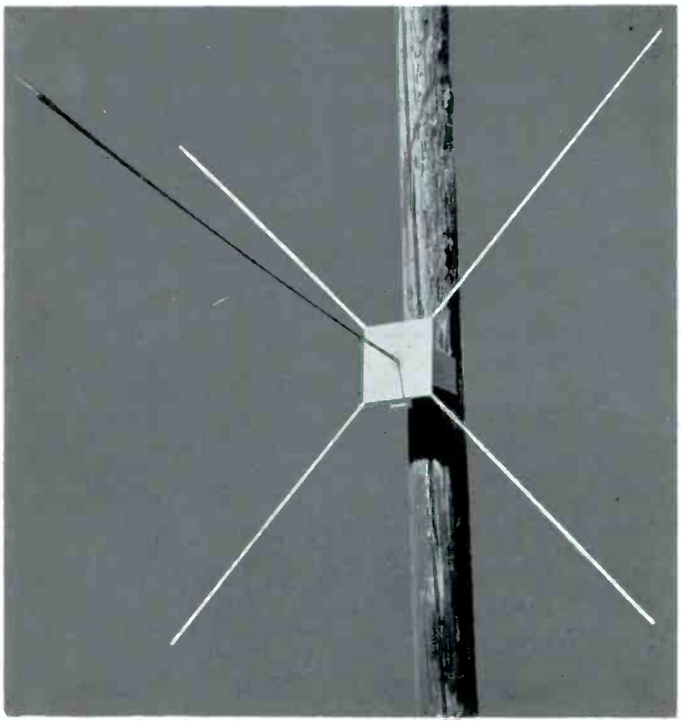
Frequency	System Loss in db	Loss/100'
65	12	.387
80	13.5	.435
170	16.5	.531
220	14.2	.457

Table 1A

Frequency	System loss in db	Loss/100'
55	50	.655
90	30	.393
170	26.5	.347
210	30.5	.399

Table 1B

In the Helena, Montana system, Engineer Taylor added repeater amplifiers whenever the signal along the swtl dropped below his standards. The entire length of the line was 14 miles. 9 amplifiers were utilized in the system or approximately one repeater amplifier every 1.55 miles. This included the pre-amplifier at the head-end site.



Frese Spire Launcher

Note 5 foot ⅜ aluminum tubing (4), square (1 foot) aluminum plate, and micalex plate. See figures 2, 6 for construction details. G-line radiates towards left of picture from center of micalex plate.

Frequency Versus Loss

Coaxial cable does, of course, increase losses with the increasing frequency. Engineer Frese found that his 3107 foot system (see table 1A) losses at 65 mcs were .387 db per 100 feet, while his losses at 220 mcs were .457 db per 100 feet. However, his 7,640 foot system (see table 1B) losses were .655 db per 100 feet at 55 megacycles, and .399 db per 100 feet at 210 mcs.

Clearly, something besides the frequency of the signal along the swtl must affect the G-line losses!

Archer Taylor found out what the problem was (as did Frese). The G-line must have a supporting medium during its long run, ie. something to hold it up, off of the ground. In some cases this may be telephone poles, in other cases you may have to erect your own support posts. G-line originator Goubou recommended that when passing a support pole, you keep the G-line away from perpendicular poles by approximately ¼ wavelength for the lowest frequency carried on the line. Frese adds you should also stay at least ¼ wavelength away from parallel lines, such as telephone systems etc. Goubou noted you can expect 0.05 db loss for each support pole, regardless of how careful you are, more if you are not careful. Taylor found in his Helena G-line installation that he could do better with amplifiers at channel 4 than at channel 13. His G-line signal at the head end came in on channel 13, which he later converted to 4. He had constructed his system so as to maintain 15 inches clearance between the line and the poles at all support points. 15 inches at channel 13 is a little over ¼ wavelength. At channel 4 it is less than 1/10th wave length. His Helena system had 46 support poles per mile, and for this reason he feels this system had unduly high losses.

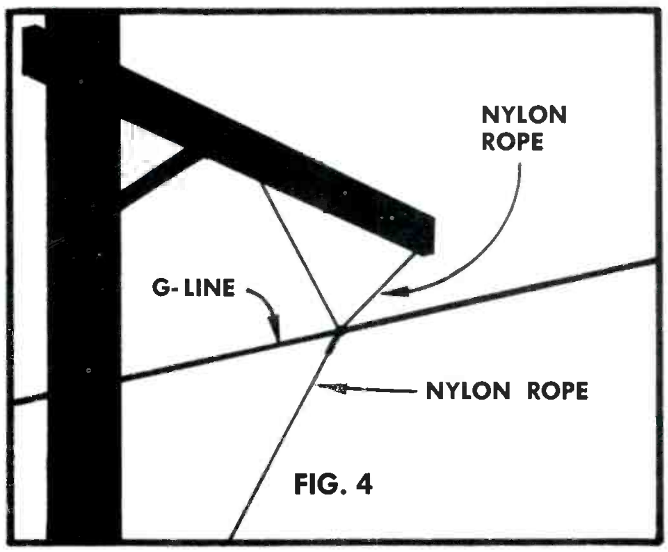


FIG. 4

As figure four points out, you must not assume that conventional pole supports are worthy of G-line use. His system used nylon rope to suspend the G-line away from the poles.

Bend Losses

Seldom will you find an installation where the G-line can be run from head end to distribution system without a bend or two along the way. If you are following already set telephone or power poles, you have to go where the poles go. So what happens when the G-line must bend around a curve?

As Taylor found out, you don't come up to a support from one direction, and then go away at an entirely different angle. Goubou found that loss at bends in the cable increases approximately with the square of the deflection angle, and is only slightly (if at all) dependent upon frequency.

Since one of the major purposes of a G-line installation is minimizing loss, and going as far as possible without costly amplifiers, every db counts.

Taylor had a number of bends to make at Helena. He found it best to break the large bends into several smaller bends (see figure five). One bend in the Helena line was a 90 degree turn, which was broken up through several nylon supports (10 in all) into deflections of less than ten degrees each. This bend was distributed over two pole spans so the ten degree deflection angles were separated by several wavelengths along the line. As a result of this treatment, Taylor calculates he was able to reduce loss at this bend from 3 db (square of the deflection angle) to 1 db.

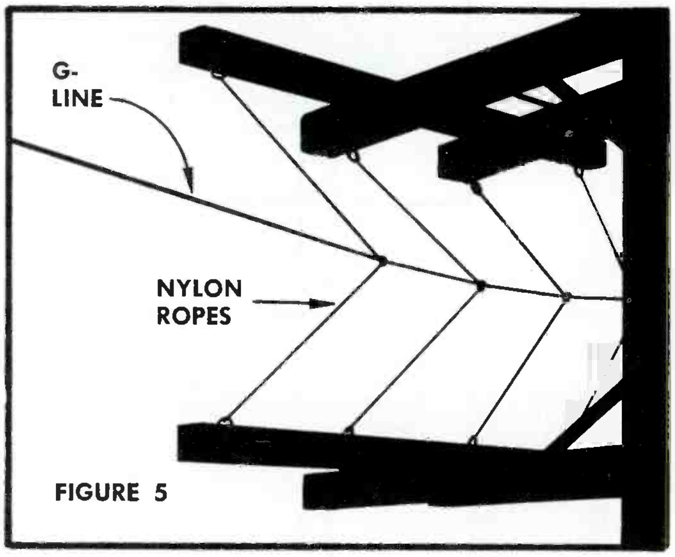


FIGURE 5

G-Line Radiation

It may surprise some to learn that not only is radiation loss very low from properly constructed G-lines, but the pick-up by the line of passing auto ignition, etc. is also very low. In the Helena, Montana system for example, nearly 1/3 of the 14 mile run is along U.S. highway number 10, at distances varying from 15 to 20 feet from the traffic lane. There are several places along the line where the signal level reaches its minimum value (just prior to a repeater amplifier) close to the highway. Yet to date there has never been detectable ignition noise interference.

Field strength measurements have also been made along the line, both at low signal level points and at points immediately following amplifiers. Field strength measurements at the low level portions of the line were less than 0.1 uV per meter at a distance of 9 feet from the line. At a point some 900 feet from a sending end launcher (as opposed to a receiving end launcher which usually precedes an amplifier) where the signal level is near the maximum line level of 53 db above 1 millivolt (at 75 ohms), 1.5 uV per meter was measured at a distance 9 feet from the line.

Nothing resembling standingwaves (reflections showing up as smear in the video, garbled audio) have ever been detected in the system.

Not So Good

With all of its plus factors, the G-line has a few points working against it. For example, while it is low in maintenance, it is often mistaken for unimportant cables of other types, and pulled down by parties ignorant to its purpose. In Helena, wet snow building up on the line to a circumference of 1 inch wiped the signal out completely at the receiving end. But as soon as the sun came out and the snow dropped from the line, the signal popped back in fine shape.

The line must be kept taut all along its run, and this is a mechanical problem. It has already been pointed out that launchers can be a problem, and bends in the line and support poles require some engineering skill.

In 1955 the 14 mile Helena system cost Archer Taylor approximately $12,000. to install. He felt at the time that since his system of G-line brought only a single channel (KMSO-13 converted to 4) that a microwave circuit would have proved an equally good bet. However in 1955, as is the case once again now, microwave permits and equipment were scarce. Today it is the FCC's attitude about 6 Kmc operations and the high cost of 12 Kmc Business Band equipment which makes G-line seem attractive. In 1955 it was the lack of 6 Kmc permits and the high cost of 6 Kmc equipment.

However with a multiple channel system (two or more) the use of the G-line in many instances would prove a more logical approach than multichannel microwave. The added cost of the extra channels on the G-line would be represented in multiple single channel or broad- band amplifiers along the line, and careful ¼ wave isolation (at support posts) engineering plus launcher engineering.

On microwave, the added costs are more apparent with multiple transmitters-receivers or multiplexing operations.

In individual installations, the different G-line runs (i.e. distance from antenna site to distribution points) would also prove a factor for consideration, when G-line is weighed versus microwave.

Incidentally, in 1955 Taylor estimated the 14 mile run installed in K-14 cable (then in wide use) would be a $40,000. to $50,000. installation. When he weighs this against his $12,000. cost for the G-line, his reason for selection should be obvious.

Feedback

Feedback between launchers proved a problem to Taylor in Helena. Although he doesn't come right out and say so, he apparently blames the design of the Goubou launchers for a good deal of these problems. Taylor found that at the low level points on the cable, where he had to go from the G-line to a receiving launcher, and thence into a repeater amplifier — then back into a sending launching and to the next run of G-line, *he had troubles!* With amplifier gain of 40-45 db on channel four, using 58 inch diameter Goubou launchers, the separation between the launchers had to be at least 120 feet or the resulting feedback would produce a ghost image or even oscillation. In one section of the Helena line it was found necessary to use 53 db of amplification because power for the amplifier was not available for closer amplifier spacing. To eliminate the feedback here, it was necessary to separate the receiving and sending launchers by 240 feet of coaxial cable.

Impedance

George Frese made a series of measurements for G-line impedance during March of 1959. Frese's measurements were on systems utilizing his spire design of launcher, as shown in figure six. He notes that by no means are the measurements conclusive as no exhaustive checks on the impedance factors have been carried out by him to date.

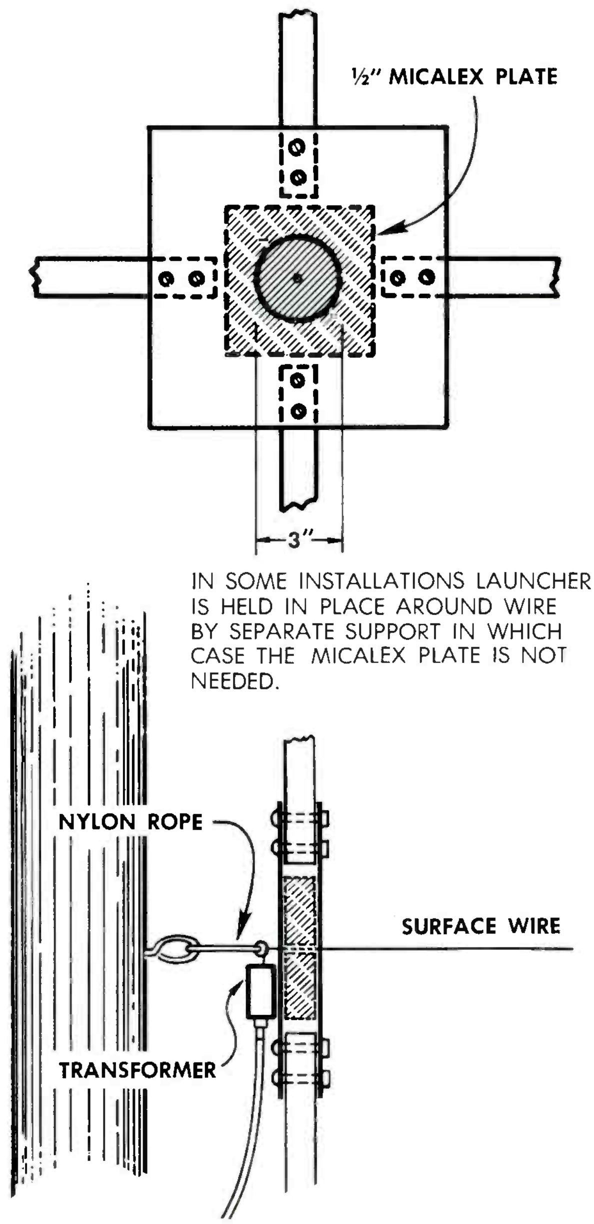


FIGURE 6 SURFACE WIRE LAUNCHER

Table 2 does show his results, however, which may be of interest. Note that even the seeming uniformity of declining G-line impedance from channel 2 through channel 11 is broken by the channel 2 measurement of 325 ohms.

Ch	R Component
2	325
4	355
6	330
7	220
9	200
11	175

Table 2

(*Continued — Page 24*)

TVH Calls For Re-Evaluation Of FCC Fringe Attitude Policies

In the past 60 days the Federal Communications Commission has instituted a policy of refusing CATV microwave applications which would keep CATV systems located in one-station television towns from bringing in out of region video programs on microwave for wired distribution. The pretense is the clarification of Common Carrier rules and regulations. The result is a new found Commission power to deny a CATV system the right of access to microwave frequencies below 10,000 megacycles for the transportation of television programming from a distant pickup point to a CATV wired town.

The Commission has cited "unfair economic competition" as a reason for their decision to deny CATV access to 6 Kmc microwave frequencies. The Commission, using Thermopolis, Wyoming as an example, has stated that Thermopolis station KWRB cannot exist as an on-the-air entity as long as CATV systems microwave out of town and out of state stations into the three major towns served by KWRB. In short, the Commission has found it necessary to develop what it considers "a right of judgment" on the economic impact imparted on a local television station by CATV systems in the region.

In a round-about way, this is FCC control of a large percentage of the nation's CATV systems (i.e. those utilizing microwave).

At the same time, the Commission has chosen to completely overlook competition afforded the Thermopolis station by VHF translators. This is a strange "passing of judgment" for only last spring an FCC Commissioner sat in a hearing in a Wyoming town and listened to a representative from the same KWRB-TV decry the licensing of VHF translators in the area. The KWRB representative, at the time, made no mention of CATV, for the hearing was concerned only with the *booster question*. But the official transcript of that hearing shows the station representative proclaiming that "if VHF translators are allowed to bring out of town signals into Thermopolis, Lander and Riverton, KWRB will be forced to leave the air for it cannot compete in this limited market with signals from out of town stations."

Perhaps the FCC Commissioner who sat in on the hearing smiled to himself and wondered why one or a half-dozen 1 watt VHF Boosters posed an economic threat to a multi-kilowatt mountain top located VHF telecaster. Perhaps he assumed it was impossible, and wrote the whole matter off as "a broadcaster trying to get everything he could with as little competition as possible."

Whatever the case the VHF translators in Thermopolis, Lander and Riverton were licensed during the past summer, and today they serve these towns with the same out-of-town *type* signals that the FCC has since decided do not belong in town, on CATV systems, via microwave.

In light of this example, *Television Horizons* feels the FCC should do some soul searching. IF the Commission feels it must protect one-horse telecasters from out of town signals, in order to assure economic survival by the single local service, then the policy to protect the local service must be all encompassing. It must include either all out-of-town services, or none. We fail to see how it can be discriminatory and include only CATV.

Perhaps the KWRB-TV case *will not* be precedent setting. But this we doubt, for now that the National Association of Broadcasters (NAB) has armed itself with a "win" in this department, it will utilize this example whenever possible in the years ahead, if it appears that CATV competition can be eliminated through FCC regulation of CATV microwave.

Perhaps the KWRB-TV case should not be precedent setting at all, even if the Commission chooses to ignore this editorial plea and flounder along on a course of regulatory sailing that seems dictated by the NAB. *Perhaps* . . . KWRB-TV and its mighty service area should be researched by the FCC. Were the Commission to send a team of engineers into Thermopolis, Lander and Riverton, *we think* they might find that KWRB-TV is not living up to the engineering promises which it specified when it took out its license. Were the FCC to send a team of program analysis experts into Thermopolis, Riverton and Lander, *we think* they might find that KWRB-TV is not living up to the programming promises which it specified when it took out its license.

We think the Commission would be surprised to measure off-the-air signal strengths in any of the three towns in question, and find that these signal levels are only in *rare* spots higher than the off-the-air signals available from the 1-watt VHF translators operating there.

We think the Commission would be surprised to learn that the studio-transmitter link (stl) linking the studios with the transmitter site works only sporadically, and that the programming often carried by KWRB is nothing more than off the air reception from KOOK-TV, Billings, Montana. The KOOK-TV signal, from which KWRB-TV picks up its network service, frequently must be substituted for the "regularly scheduled" local origination programming at KWRB-TV, which more often than not does not make it to the mountain top transmitter site, because of the state of dis-repair of the stl. More than once in an evening viewers are treated to the complete KOOK (Billings) identification, and complete series of Billings local spot announcements, over KWRB-TV, because the engineer on duty at the mountain top forgets to switch in the local ID and announcements.

We could go on . . . but we hope the FCC sees our point. Is it any wonder that KWRB-TV wants no competition? It can't stand any . . . *not even that afforded by the flea powered 1 watt VHF translators!*

We believe the people of west-central Wyoming deserve better television reception and programming than they are now getting from KWRB-TV. We believe that the Carter Mountain CATV microwave application was justified and realistic, for only on the cable can the people of Thermopolis, Lander and Riverton receive the quality and strength of television programming that would be considered acceptable by the majority of the American public today.

Think about it FCC . . . don't let the NAB be so quick to rush you into a precedent setting case that will ruin *the right of free-choice television reception* of an acceptable standard and quality for so many American viewers.

RBC

CATV CABLE DROP

PUBLIC NOTICE FOR CATV MICROWAVE

As announced December 18, the FCC has swung into action to specify in detail applications for private point-to-point microwave systems to be utilized in relaying television programs to CATV systems.

The Commission now lists, in the weekly public notices, all such applications detailing the area to be served by the proposed CATV microwave fed system, relay locations, and technical considerations.

All applications filed will be reported in detail by Television Horizons in our regular Washington news section "FCC in Review," found on the last page of this publication every month.

A WAY OUT?

If you operate a single CATV system, or even multiple systems within a confined geographic area, you cannot legally operate a 6 Kmc Common Carrier microwave system as a means of bringing off-the-air video reception to your system or systems. You can, if you can show the Commission that your microwave operation carries 50% of its traffic for 'other customers', operate a 6 Kmc microwave system as a bonafide Common Carrier under the Common Carrier regulations.

The question confronting CATV system operators in most areas is simply this. *"Who do I find as a customer to use my microwave service, so that I can qualify to use Kmc microwave?"*

Here is a possibility, the results of which we do not guarantee. It is merely food for thought.

Find a nearby CATV system operator (or operators) who also likes the idea of microwave. Form a joint corporation to bring microwave signals to both systems. Each CATV system would own 50% of the new microwave company, and each would use 50% of its traffic bearing services. In short, the new corporation is a bonafide Common Carrier (or so it would seem) because it leases service to two (or more) customers, and conceivably is in business for this leasing purpose.

It may have to get a little more involved than our outline to meet Commission Common Carrier regulations, but TVH believes you will see the point by the following example.

Eastern Microwave, Inc., 21 Elm Street, Oneonta, New York has been granted a construction permit for new fixed video radio station, to be located on Graham Mountain, 10 miles SE of Margaretville, New York. The new system proposes to bring a 3 channel service utilizing the signals (off-the-air reception at Graham Mountain) of WABC-TV, WPIX-TV and any one of the signals of WNEW, WOR or WNTA (all New York City area), as requested by the CATV customer, into Oneonta and Norwich, New York, for CATV service to systems in these communities. The Eastern Microwave Company also proposes to bring the signals of WABC-TV and WPIX-TV via a two channel service to Sidney, New York and Delhi, New York; and the signals of WPIX-TV and any one of the signals of WNEW, WOR-TV, or WNTA-TV (as selected by CATV customer) with a 2 channel system into a CATV system at Walton, New York.

Frequencies of 5060,6049 and 6138 mcs. will be utilized, and all are 6 Kmc in the Common Carrier service.

WORLD'S LARGEST CATV NOW LARGER

Cable TV Ltd., now the world's largest integrated community antenna system, announces the acquisition of Master TV Ltd. Master TV previously operated a community antenna service in Verdun, Crawford Park, and a segment of downtown Montreal, all in the Montreal, Quebec region.

Master TV was the third largest in Montreal, which has long been the *"most cabled city in the world."* With the addition of Master TV's 5,500 paying subscribers to the Cable TV system, some 25,400 homes are now served by the common organization.

Cable TV distributes the programs of three United States television channels, and a closed circuit operation on channel 9. The closed circuit operation is unique in that it offers kinescope recordings of recent world championship sporting events, and the Sunday night "away" games of the National Hockey League Canadiens team.

Cable TV owners told TVH they feel the exclusive offering of the NHL contests over their system, and their other exclusive features of sporting events, has contributed materially to their growth into the largest closed circuit video system in the world. Cable TV also offers its local origination studios for interested groups in the Montreal area. During periods when the channel 9 closed circuit operation is not in operation, CKVL-FM, Montreal, is relayed over the channel to the 25,000 system subscribers. Cable TV points out this coverage for CKVL-FM is the largest single audience the station has, including off-the-air receivers.

DANIELS—AGAIN

Sale of the 3,000 subscriber CATV system located in Barstow, California has been announced by *Daniels & Associates,* the brokerage firm handling the transaction.

Purchaser of the system was Frontier Vision, Inc., which is headed up by H. J. Griffith, pioneer theatre owner and operator in Dallas, Texas. The former owner was CATV pioneer Dean De Voe, long active in CATV circles in the west.

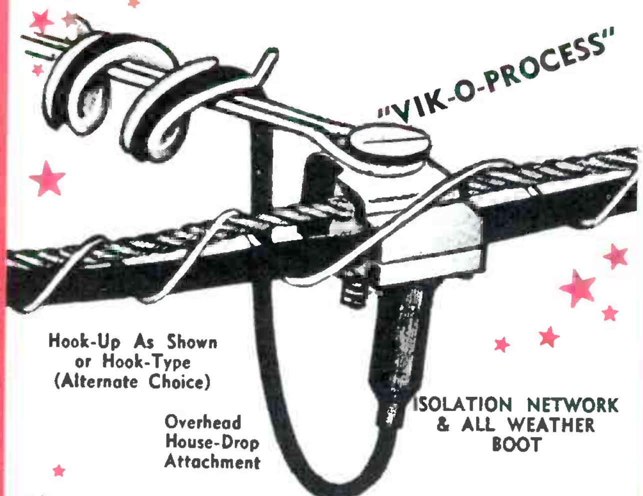
First 12Kmc CATV Micro Grant

The Federal Communications Commission, on January 3, instructed the staff to grant the applications of Community Television Systems of Wyoming, Inc., for fixed point-to-point microwave facilities using frequencies in the 12,000 megacycle band in the Business Radio Service for relaying TV programs to a community antenna system at Casper, Wyoming. This is the first private microwave system for such CATV purposes which has been authorized by the Commission.

Presenting

VIKING'S ALL-STAR HOOK-UP TEAM!

ALL-WEATHER PRESSURE TAP

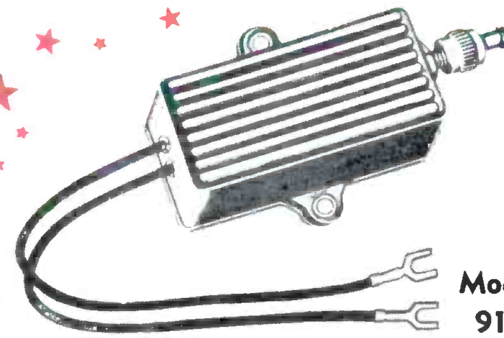


Capacitive and Resistive Types

Model No. 902
for single shielded coaxial cable
Model No. 903
for double shielded coaxial cable

VIK-O-PROCESS—A protective film applied to the metallic surface of the pressure tap that assures you of a completely **corrosion-resistant** unit that is ideal for salt air and all rugged outdoor climatic conditions.

72-300 OHM MATCHING TRANSFORMER



Model
910

The new Model No. 910 increases the signal from a 72 ohm coaxial cable to a 300 ohm TV set, by matching the impedance from 72 to 300 ohms—providing an excellent match and efficient signal transfer. Also available with screw terminals for wall mount (Model No. 911).

Full 6 db voltage step up.

Featuring our new fully symmetrical true transformer circuit.

High impact case with internal aluminum shielding.

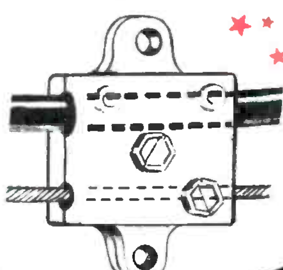
Bandpass: Channels 2-13.

AC-DC isolation.

Standard RG59 coax connector supplied with unit.

ALL-PURPOSE GROUNDING BLOCK

The simplest and easiest installed grounding block ever designed. No cable or jacket cutting. Just insert the RG59U cable into the block. The stainless steel pins make contact with the copper shield of the cable. The grounding wire slips through the other opening and tightens with just one set screw. Simply screw block in place and you have the finest and surest grounding unit possible. Block is vik-o plated. Complete with screws.



Model
920

Call Us Collect
For Special Low Quantity
Prices On All Our Items—
And To Discuss Your
Special Needs.

VIKING CABLE COMPANY

Manufacturers of Coaxial Cable and Products for the Community TV Industry

830 MONROE STREET - HOBOKEN, NEW JERSEY   Telephone: WHitehall 3-5793 or OLdfield 6-2020

OUR MAN IN EUROPE

Gordon J. King
Assoc. Brit. I.R.E.
Brixham, Devon, England

A big problem in Great Britain has been local oscillator radiation from sets tuned to a particular Band I channel causing patterning on nearby receivers obtaining their signals from a different Band I channel. The trouble was aggravated two-fold. Firstly, because of the white areas between two powerful Band I stations where either could be received at almost equal strength; and secondly, because of the sound and vision i.f. combination adopted in early receivers.

It was such trouble that put Oxford on the piped-TV map. The BBC programmes could be obtained either from a Northern station on Channel 4 or from an Eastern station on Channel 1, and there was virtually no difference in signal field. Many receivers at about the time that Oxford was launched were using sound and vision i.f.'s. of 19.5 Mc/s and 16 Mc/s respectively — with the local oscillator high.

Thus, a viewer tuned to Channel 1 (45 Mc/s vision) put out a nice CW signal on 61 Mc/s (45 + 16 Mc/s) which fell neatly in the centre of the vision passband of Channel 4 (61.75 Mc/s vision), thereby putting his Channel 4 neighbours off the screen. The trouble flourished and something had to be done quickly.

In those early days little was known about large-scale cable propagation, but a small group of enthusiasts got together and your writer was given permission by the City Council to launch a wired-system in the most affected area embracing a population in the region of 10,000. Eventually, however, the Viewline group of companies was formed — now under the control of the Rank Organisation — and a franchise for the entire City was obtained. Additional Borough franchises brought the potential total for cable propagation to the fantastic figure of almost 200,000 population.

Finding a Clean Signal

The aim was to distribute three TV programmes, the National programme of the BBC and two different programmes of the ITA. Engineering-wise this was done by translating the two ITA programmes on Band III to unused Band I channels and shipping the three programmes (sound and vision) onto the cable at Band I channels.

Adjacent channels are difficult to use in this country owing to the adjacent-channel selectivity limitations of commercial receivers. The Band I channel combination finally adopted was Channel 2 for ITA, Channel 4 for BBC and Channel 5 plus 1 Mc/s for the second ITA programme. The "plus 1 Mc/s" satisfied the selectivity problem without much trouble and avoided the translation of the BBC carriers.

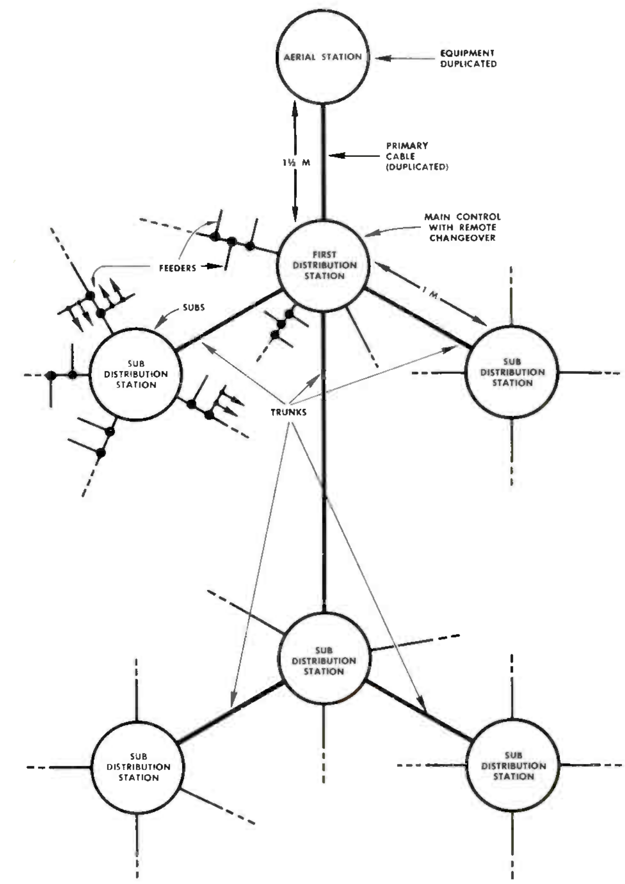


FIGURE 1
THE GENERAL PATTERN OF DISTRIBUTION NETWORKS EMPLOYED IN THE UK

Channel 1 was difficult to use at the time since the cables had to pass through areas of extremely low signal strength, and as certain off-air viewers were tied to Channel 1, very small radiation from the cables would have affected their viewing, particularly since it would have been necessary to translate to Channel 1 from another channel. This was, in fact, tried with very disturbing results. Small radiation at Channel 4 was nowhere near as bothersome because translation was unnecessary and the worst that happened was a barely visible ghost, but I shall have more to say about radiation later. Channels 2 and 5 were dead channels in the area anyway.

Aerial Site

Fun and games were had in finding a site for the aerials and aerial station, and after many weeks of signal chasing a site some three miles from the centre of the City was located. This was about 400 ft. above town level and boasted, at a desirable vantage point, a broken-down wind-pump with a substantial tower of some 50 ft.

Negotiations were put in hand for its aquisition, much to the disconcertment of the local "hams" who used to employ the tower for their aerial arrays on field days and for DX-ing. The wind mechanism was removed, the tower was given a face-lift and the system's aerials complete with mastheads were secured thereon for prolonged propagation tests.

Signals from the various stations required were monitored over several months for signal strength, quality and interference. A caravan rigged with receivers and signal strength testing equipment was towed to the site for this purpose, and comprehensive graphs of the signal conditions during the whole of the daily transmission periods were maintained. Having in mind the distance of the site from the transmitters (average 50 miles), the results were highly encouraging and the site was eventually established permanently.

Main and standby aerials were erected at the top of the tower adjacent to an observation platform on which the "line powered" masthead amplifiers were accessibly positioned. The installation was finalised by a station-controlled inspection light at the top of the tower to facilitate night servicing.

Aerial Station and Primary Cable Run

The aerial station was built in faced-stone at the base of the tower, and the source equipment was duplicated and fed from the main and standby aerial systems. Power for the station equipment was obtained normally from the public electricity supply, but a standby power plant was also incorporated as an automatic guard against failure of the public supply.

The next problem was to convey the signals through coaxial cable to the first distribution area about 1½ miles distant. This was accomplished by an underground cable run. This exercise took several days, since the cables also had to cross a major trunk road underground.

Several repeaters were required on the primary run, and these together with the cable, were duplicated. Again, line powering is adopted for the primary repeaters, the source being at the first area distribution station and the pressure 65 volts r.m.s.

The first distribution station consists of a building rather like that at the aerial station, but finished in a brick to match the surrounding properties. The equipment here comprises filter networks which split the various sound and vision signals into their appropriate channels, a.g.c. amplifiers and equalisers for resetting the levels of the carriers after their trip down the primary cable, combining networks for feeding the signals into the trunk distribution cables and line powering equipment.

There is also a monitoring desk featuring several television receivers and signal strength measuring equipment. A special changeover set-up operating in conjunction with equipment at the aerial station permits an immediate changeover from "main" to "standby" in the event of failure of the primary cable or aerial station source equipment.

The first distribution station is staffed by an "operations engineer" whose job it is to monitor the outgoing signals and to maintain constant the incoming signals. He is able to change the aerial station to standby, but in the event of local trouble the duty engineer takes over.

Trunk System

The first distribution station supplies signals to outgoing trunk cables of a mile or so in length. If continuation of any trunk is required, then this is first terminated at a subsidiary distribution station, which is rather the same (though less involved) as the first main distribution station.

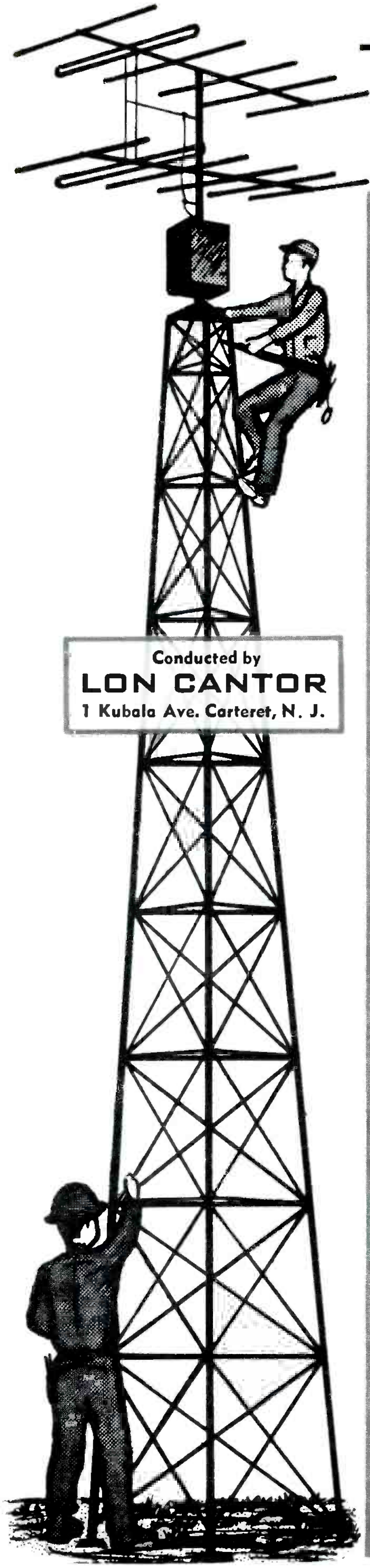
(*Continued — Page 24*)

BENCO APPOINTS LOVELY

Benco Television Associates Ltd. has announced the appointment of John D. Lovely to their Engineering Staff. Born and educated in England, Mr. Lovely came to Canada in 1955 where he served as Chief Engineer-Consumer Products for Canadian Aviation Electronics in Montreal. Before joining Benco, Lovely was Chief Development Engineer with Rediffusion Incorporated, a division of the English Rediffusion Group.

MATV / CATV

FIELD ENGINEERING



Conducted by
LON CANTOR
1 Kubala Ave. Carteret, N. J.

MPATI* SYSTEMS

*Midwest Program on Airborne Television Instruction

Bob had just finished sorting through the morning's mail.

"Say, Hank," he said, "Here's a school wants to receive the Stratovision broadcasts. Whatever happened to that MPATI program, anyhow?"

"Well," reflected Hank, "you know educators are traditionally slow to adopt new methods. The plane is up there flying OK and telecasting a regular schedule of classes. They not only teach ordinary subjects like science and math, but they have special courses that couldn't be offered by individual schools: for example, classes for gifted children. They also have classes for teachers, explaining how they can best use the TV classes. But a lot of schools in the MPATI area aren't even equipped to receive the stratovision telecast. Each school seems to be waiting to see how the other guy makes out."

"You mean they're spending all the money to tape courses and send the plane up and the schools aren't even watching the MPATI programs?" asked Bob incredulously.

Hank nodded ruefully.

"Then how do they know how large an area they can cover?" demanded Bob.

"Well, Blonder-Tongue and Jerrold have equipped a number of demonstration schools in various locations. Signals are being received pretty well in a radius of over 200 miles from Montpelier, Indiana."

"That's pretty good," said Bob. "Anyhow, at least here is one school that wants to receive the TV classes. Is there anything unusual about an MPATI installation?"

"Yeah, I guess you would call it unusual," mused Hank. "For two reasons. One, the signals are UHF and have to be converted to VHF for master system use."

"How come?" Bob interrupted.

"Well, you know that coaxial cable attenuates higher frequencies more than it does lower frequencies. The loss of RG-59/U at Channel 13 is higher than it is at Channel 2, right? Well, Channel 13 is only at 216 MC. The lowest UHF Channel, 14, begins at 470 MC. Cable losses are so high at UHF that it is just impractical to distribute UHF signals over a system of any size. But you didn't let me make my point. What's really different about receiving MPATI is that the transmitter is up 23,000 ft. and it moves. That Stratovision plane flying over Indiana gives us some problems we've never run into before."

"What kind of problems?"

"Well, for one thing, most antennas are oriented to receive a signal from a horizontal direction. But the MPATI signals come from overhead, in a somewhat vertical plane. The closer you are to Montpelier, Indiana the steeper the angle. You have to orient the antennas accordingly. Another thing is that you have to worry about reflected signals.

"Look," he drew a diagram (see Figure 1). "The receiving antenna actually gets two signals: one direct from the transmitting antenna and one that bounces up from the ground. Now, depending on whether they arrive in phase or out of phase, these signals can either add or subtract. In other words, let's suppose the two signals hit the antenna exactly 180° out of phase. They'd cancel each other out and no voltage at all would be developed across the antenna, right?"

"Right—I guess," murmured Bob. "But would the reflected signal be as strong as the direct signal?"

"A good point. I was assuming that two signals were of equal strength and they probably are not. The earth would probably absorb part of the reflected signal. But you see what I'm driving at. The phase of the reflected signal can cause the signal developed across the antenna to be either very weak or very strong."

"How do you control the phase of the reflected signal?" asked Bob.

Hank pulled on his ear with a grin. "Ah! That's the rub. If you were a good enough engineer, you could figure the wavelength of the incoming signal, the distance from the transmitter, the point from

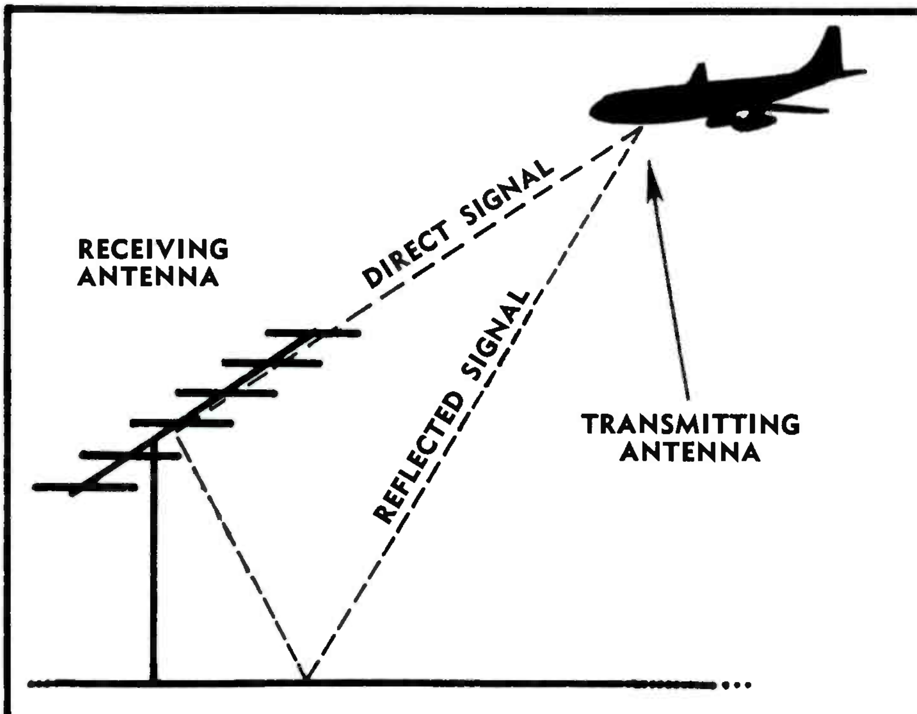


FIG. 1 DIRECT AND REFLECTED SIGNALS

which the signal was reflected—and you'd probably still come up with the wrong answer. In my opinion, the only thing to do is cut and try. Use a field strength meter and probe for the best signals."

"Heck, that's what you recommend on ordinary installations," observed Bob. "Why try to snow me under with this reflected signal jazz? I mean if you're just going to stick the antenna up and hope for the best, come right out and say so."

Hank laughed. "Don't get belligerent. There is a difference in MPATI antenna installations and it's caused not only by reflected signals but by the fast that the transmitter moves. The Stratoplane flies in figure 8's. And he has to turn into the wind. If the wind is right, there may be as much as 20 miles difference between one point on the 8 and another. It's not so much the changes in distance that bother you, but the phase of the reflected angle changes too."

"Okay," shrugged Bob, "so the reflected angle changes. What am I going to do about it?"

"In the first place, you keep the antenna as close to the top of the school roof as you can and still get a good signal. Also, mount the antenna toward the side of the roof away from the transmitted signal. The idea is to keep the reflecting surface as close to the antenna as possible. You want the building to block the signal reflected from the ground. If you can't keep the reflected ground signal from hitting the antennas, you might have to erect a screen to stop it. Of course the reflecting screen has to be mounted so that it doesn't interfere with the direct wave."

"Very interesting," said Bob. "Is that all there is to it?"

"Unfortunately, — no," chuckled Hank. "Remember I told you before that the plane flies figure 8's and makes all its turns into the wind? So what happens if the wind shifts? The plane has to fly a different pattern. In other words, a given antenna height and orientation can give you a good signal one day and a very poor signal the next."

"Oh, great," said Bob ruefully. "I see what you meant about unusual problems. Is there any way to make sure you get a good signal every day?"

"The answer seems to be two separate antennas," replied Hank, "oriented in different directions and at different heights. But don't get me wrong. The MPATI signals are pretty strong in most areas. You can make a lot of mistakes—or at least do a lot of things that prevent you from getting the maximum possible signal—and still get excellent results. You only use reflecting screens and double antennas where you have to."

"Got it," nodded Bob. "Now what are we going to do for this school?"

"We're going to let you lay out a system for it. By now you shouldn't have any trouble with the distribution system but let me give you a few pointers on the head-end.

"We've discussed the antenna. Remember, though, that there are two MPATI Channels involved, 72 and 76. So you may want to use two separate antennas. In that case, your head-end would look like this (see Figure 2).

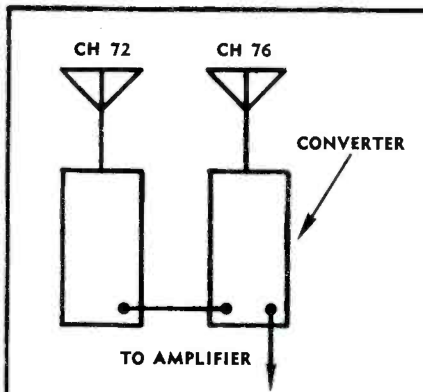


FIG. 2

SIMPLE MPATI HEAD-END

"On the other hand, Channels 72 and 76 are close enough in frequency to be received quite efficiently on a single antenna. The problem is that you have to divide the signal into two parts, to feed into the two converters.

"There aren't too many UHF splitters around, but this Blonder-Tongue model UDC-1 will do the job nicely. Then we can have a head-end like this (see Figure 3).

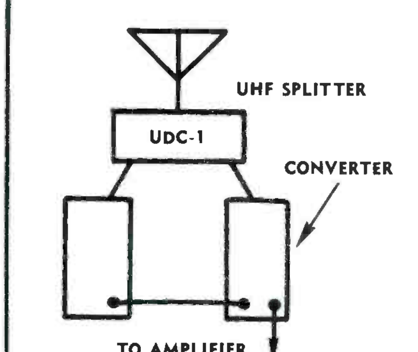


FIG. 3

MPATI HEAD-END USING SINGLE ANTENNA

"That's what you use in a good signal area. In a weak signal area it's a different story. To get really good results, you'll need a UHF pre-amplifier, such as the Blonder-Tongue model UB. The UB Strato-booster gives you about 20 db gain on both 72 and 76. If you mount it close to the antenna like this (see

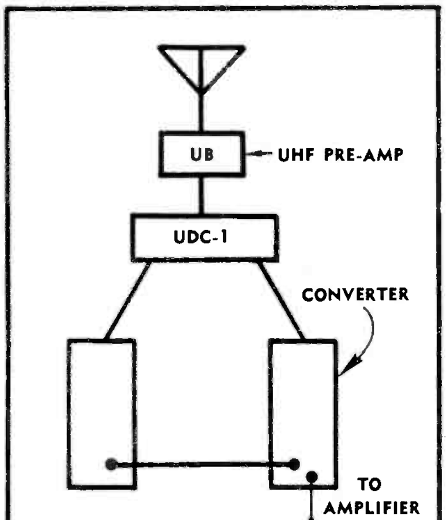


FIG. 4
WEAK SIGNAL AREA MPATI HEAD-END

Figure 4), you not only make the signal 10 times stronger, you wind up with a good signal-to-noise ratio. As you can see, these systems assume you're going to use a broadband amplifier. But if you're in an area where signal fading is a problem—and this can happen in spite of your efforts to put up the antenna properly—you'll probably have to use single channel amplifiers with built-in AGC (see Figure 5). The AGC gives you a constant output in spite of fairly big changes in the input signal."

"Gotcha," Bob enthused. "Let me get at this school layout."

"Wait a minute," cautioned Hank. "Maybe you could use a few practical tips too. For instance, are you going to install the converters indoor or out?"

"You always recommend indoor installation, don't you?" demanded Bob.

"Not always. What if the signal is weak? Are you going to attenuate it further by using a long lead-in wire? That will really foul up the signal-to-noise ratio. If you can afford the signal loss, by all means install the equipment indoors where it is protected from the weather and easy to service. But in weak signal areas, the equipment must go outdoors. The UB is made for mast mounting and should always be mounted outdoors. Then you can mount the converters indoors.

"If you do mount the converters outdoors, though, protect them with a weatherproof housing. In fact, if you don't want trouble with the FCC, the housing should be radia-

(Continued — Page 24)

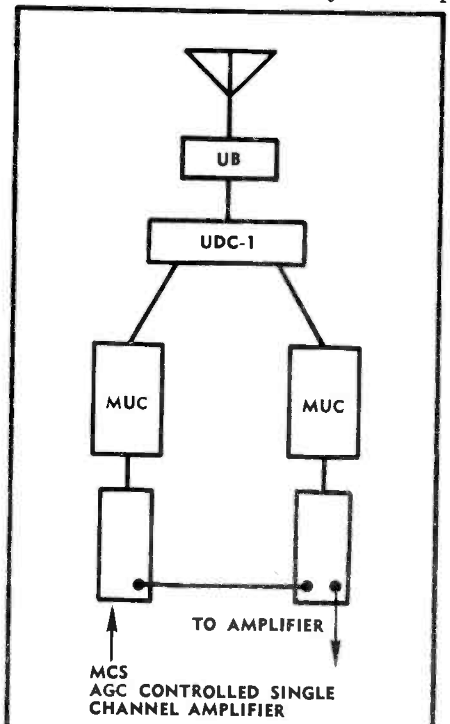
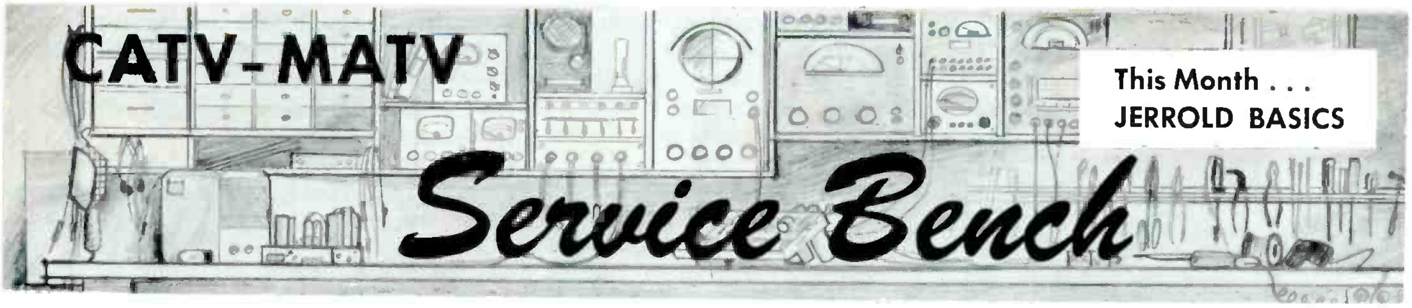


FIG. 5
MPATI HEAD-END FOR FADING SIGNALS



By MARV MITCHELL

The Blonder Tongue model MCSc is an AGC controlled single channel amplifier. Since they are AGC controlled, MCSc strips are used extensively both for MATV and CATV.

Gain of these amplifiers is: channels 2-6, 46db, channels 11-13, 35db. A built in gain control can be adjusted to decrease gain by as much as 20 db.

A built in power supply and dual mixing outputs add to the versatility of this unit.

Installation

If MCSc strips are to be used outdoors, enclose them in a weatherproof housing. Up to four MCSc units will fit into a model MRH-A housing. Even indoors it is usually advisable to protect the amplifiers from tampering with a well ventilated housing such as the BH-1.

Since MCSc strips have a low noise figure, they can be used with very small input signals. However, in order to produce a picture with a 28 db signal—to—noise ratio, the MCSc should be supplied with an input voltage of least 135 microvolts on the low band and 200 microvolts on the high band.

With methods 2 thru 6, outputs varying from 0.35 v to 1.0 volt are possible with input values from 50% below, to 40% above the input ranges shown above. The AGC level control can be set to other than the factory calibration mark to provide any output level between 0.35 v and 1.4 v.

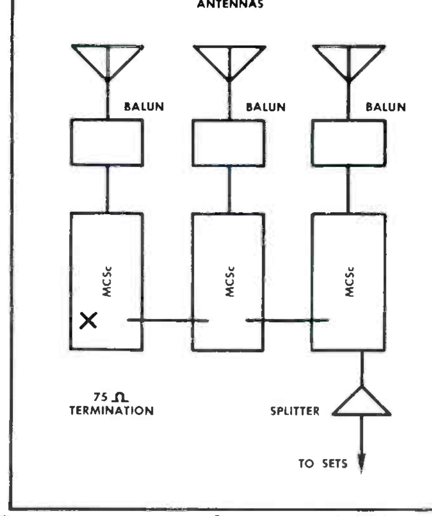
Method 1 (See Figure 1)

Always leave AGC level control at fully clockwise position. For full gain, rotate gain control fully clockwise. At full gain, input levels for undistorted output can be up to 5,000 uV low band and up to 18,000 uV in high band. Gain control may be used to reduce gain by up to 20 db (10X) and permit proportional increases in input. At 20 db gain reduction, permissible low band input is 50,000 uV. Corresponding high band figure is 180,000 uV.

Method 2 (See Figure 1)

Always leave GAIN control set fully clockwise. Set AGC LEVEL control so that hole in shaft is next to metal tag under mounting nut.

FIG. 1
SINGLE CHANNEL
ANTENNAS



Input may vary between 5,000 and 50,000 uV in the low band and between 18,000 and 180,000 uV in the high band. Output will be regulated 0.7v plus/minus 1¼ db (See Note 2).

Method 3 (See Figure 2)

MCSc number 1 acts as a high gain, low noise, non AGC controlled preamp as in Method 1. MCSc number 2 is operated as in Method 2. Adjust gain control of MCSc number 1 so that test point voltage of MCSc number 2 is correct (See Note 2). If the gain control range of MCSc number 1 is insufficient, insert an attenuator, such as a Model SA-3 between the two amplifiers.

Method 4 (See Figure 3)

Always leave GAIN controls of both MCSc's set fully clockwise. Set AGC LEVEL Control of MCSc number 2 at factory mark. Set AGC level control of MCSc number 1 fully clockwise. Connect jumper between the two AGC points as

METHODS OF OPERATION

There are six methods of operation of MCSc Amplifiers. The one selected depends on the input levels available and the AGC stiffness desired. They are:

METHOD	SIGNAL INPUT RANGE (uV) LOW BAND	SIGNAL INPUT RANGE (uV) HIGH BAND	OPERATING SIGNAL VARIATION (uV) LOW BAND	OPERATING SIGNAL VARIATION (uV) HIGH BAND	AGC RANGE for plus/minus 1¼ db change in OUTPUT
1 one MCSc non AGC	10-50,000	20-180,000	10-50,000	20-180,000	none
2 one MCSc AGC	5,000-50,000	18,000-180,000	5,000-50,000	17,500-175,000	20db
3 two MCSc one AGC	25-5,000	300-18,000	Signal variation of 10/1 within input range		20db
4 two MCSc both AGC	25-2,500	300-180,000	25-25,000	300-30,000	40db
5 two MCSc both AGC with external attenuation	25-50,000	300-180,000	Signal variation of 100/1 within input range		40db
6 two MCSc both AGC with preamp		20-30,000	Signal variation of 100/1 within input range		40db

shown. Output will be held plus/minus 1¼ db at about 0.7 v for inputs varying from about 25-2,500 uV in the low band and 300-30,000 uV in the high band.

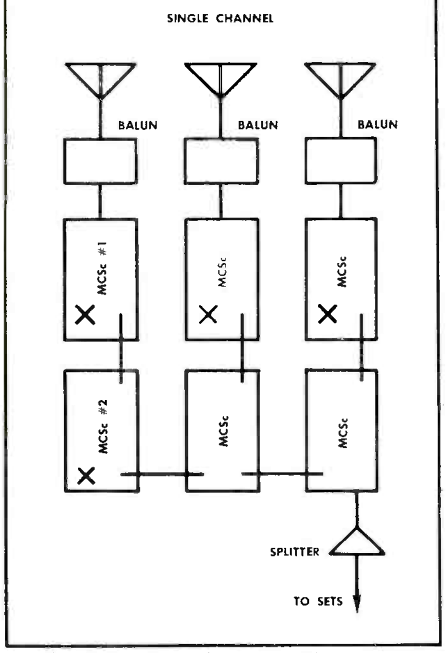


FIG. 2

Method 5 (See Figure 3)

This method is used when the input may rise above the values given in Method 4. (AGC POINT voltage more negative than —3.5v.) Insert an attenuator in between the amplifiers to the ratio of maximum input to 2,500 uV for the low band, or to 30,000 uV in the high band. If the value of the input signal is not known, increase the attenuation until the AGC point voltage

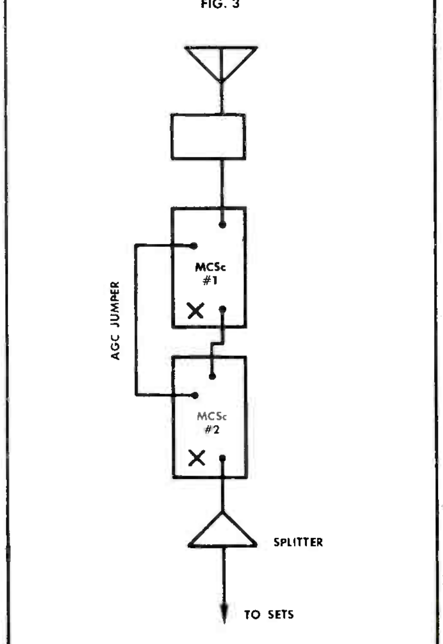


FIG. 3

is less negative than —3.5v. If more than 26 db is needed in the low band, or 15 db in the high band, reduce the input to MCSc number 1 by an additional attenuator (See Note 2).

Method 6

For inputs below 300 uV on the high band, add a low noise preamp (another MCSc or a Model CB) ahead of MCS number 1 in the set up of Method 4 (See Note 2).

Caution:

In Method 1, adjust gain with GAIN control. Always leave AGC LEVEL control rotated fully clockwise.

In methods 2,3,4,5,6, always set AGC level control of MCSc in Figure 1 and MCSc number 2 in Figure 2 and 3, at factory mark or somewhat counter-clockwise. Always leave AGC LEVEL Control of MCSc number 1 in Figure 3 rotated fully clockwise.

level which can be handled. If it should increase, cross-modulation may occur.

(D) The AGC POINT voltage by adjustment of the AGC level Control. Either the AGC level Control is incorrectly set or the input signal level is too high.

Note 3

If input levels of half those given in Methods 2,3,4,5,6 are desired, rotate AGC Level Control somewhat counter-clockwise to reduce output from 0.7 v to 0.35 v. AGC action at somewhat reduced stiffness will result.

Alignment

To align the MCSc, you will need:

1. An RF sweep generate such as RCA-WR-69-A or equivalent. Use a variable attenuator such as the SA-7 between the generator and the amplifier. Use as much attenuation as necessary to prevent overload of the MCS.
2. A marker generator such as the Hitchcock model 680 or equivalent.
3. An oscilloscope, preferably high gain.
4. A detector matched to 75 ohms.

Set up the equipment as shown in Figure 4. Then adjust the coils to get a flat bandpass (plus ½ db, 6 MC wide) on the oscilloscope.

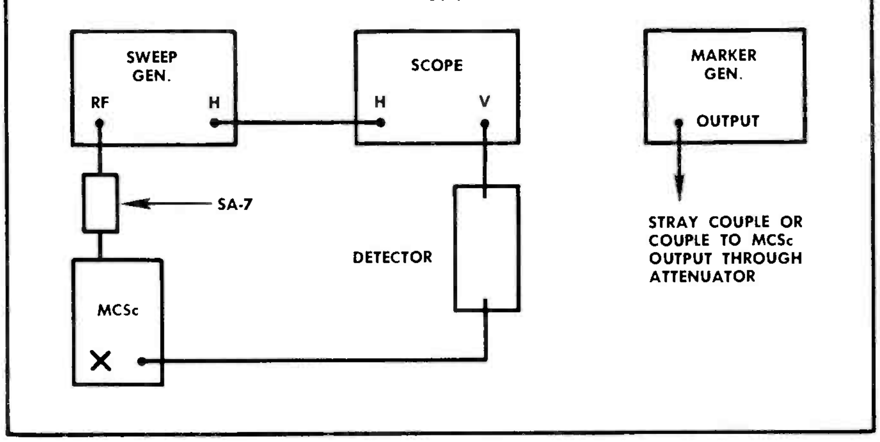


FIG. 4

Note 1

When 300 ohm transmission line is used to the MCSc amplifier input, a B-T Model MB Matching Transformer, should be installed as far as possible from the amplifier input to provide 75 ohm cable (RG-11/U or RG-59/U) to the amplifier.

Note 2

(A) Check "AGC POINT" voltage with a 20,000 ohms per volt meter. The reading should be between plus 0.4 and —3.5 volts.

(B) In Methods 2,3,4,5,6, if AGC Point voltage is about plus 0.4 v, AGC action is not occurring. If this voltage is zero volts, the input signal is so low that the AGC is just starting to operate. If the input signal fades appreciable, the AGC cannot hold on to the signal.

(C) In Methods 2,3,4,5,6, if the AGC Point voltage is about —3.5 v the input is near the maximum

TO CHECK GAIN ON MCSc, PROCEED AS FOLLOWS:

Step 1

Connect input signal cable and detector together. This will produce a reference line above base line on scope. If scope is overloaded or line is above top of scope, insert additional attenuation until distance between base line and top line is approximately two to three inches (for 5" scope).

(Continued — Page 23)

VOLTAGE CHART FOR MCSc

Chart Number 1, Low Band Units (2-6)

Socket	Pin 1	2	3	4	5	6	7	8	9	
V-1	52	−55.3	−57	Fil.	Fil.	90	See Note 3	1.85	Ground	6DJ8
V-2	0.5	1.5	Fil.	Fil.	125	125	0	— —	— —	6EW6
V-3	−140	−138	Fil.	Fil.	0	Ground	−145	— —	— —	6CB6
V-4	54	See Note 3	115	Fil.	Fil.	125	See Note 3	See Note 3	See Note 3	6AM8

Chart Number 2, High Band Units (7-13)

Socket	Pin 1	2	3	4	5	6	7	8	9	
V-1	52	−55	−57	Fil.	Fil.	90	See Note 3	185	Ground	6DT8
V-2	0.5	1.5	Fil.	Fil.	125	125	0	— —	— —	6EW6
V-3	−140	−138	Fil.	Fil.	0	0	−145	— —	— —	6CB6
V-4	54	See Note 3	115	Fil.	Fil.	125	See Note 3	See Note 3	See Note 3	6AM8

NOTE 1—Measurements made with a 20,000 ohms per volt, VTVM to ground, and no signal input.

NOTE 2—All voltages plus/minus 10%

NOTE 3—Voltages vary widely at these points due to lead lengths, stray capacitance, etc.

Step 2
Mark these lines on scope face.

Step 3
Add 36 db of attenuation, in addition to that added in Step 1.

Step 4
Connect input cable to MCSc input.

Step 5
Connect output detector to MCSc output and terminate unused MCSc output with 75 ohm terminating plug. Marker generator can be fed into this output, in which case 75 ohm termination is not necessary.

Step 6
Turn gain control of MCSc fully clockwise.

Step 7
Turn AGC control of MCSc to factory setting or approximately ½ to ¾ of a turn clockwise (Factory setting of AGC control is indicated by a tab and a dot on end of AGC control shaft).Bandpass and gain of unit can now be observed on oscilloscope.

A. Bandpass should be equal to or above marks on scope as set in Step 1 and 2. Bandpass of all units should be flat plus/minus ½ db. The bandpass is considered to be the 6 mc response to the channel being tested as indicated by both band edge markers.

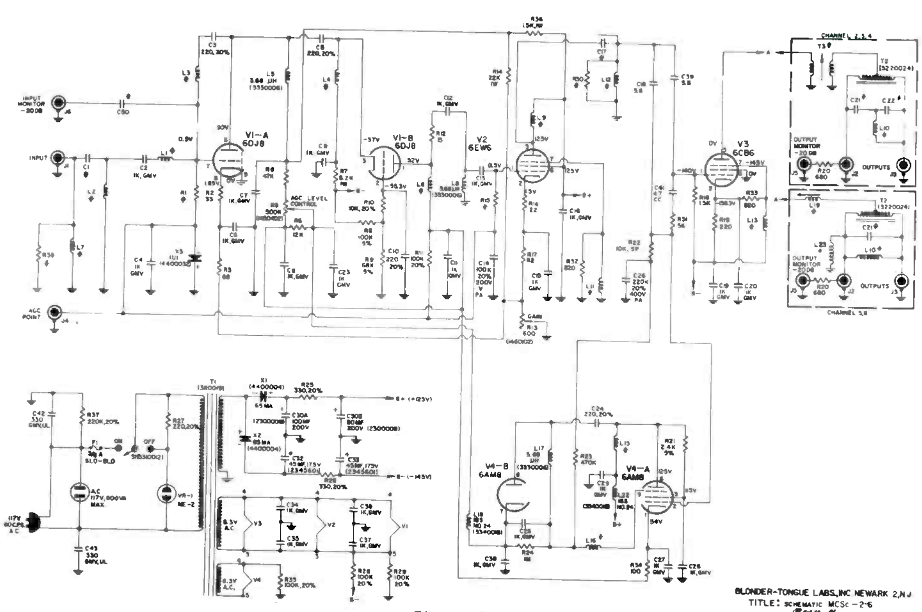


Figure 5

B. If Bandpass is lower than reference lines, unit has less than 36 db gain. In order to decide how much less gain the unit has, take our attenuation until top of bandpass reaches top reference line and base line is on bottom reference line. Subtract the amount of attenuation taken out from 36 db to get the gain of the unit.

Example:

If 12 db were taken out, it means unit has only 24 db of gain instead of 36. Or if 24 db were taken out, it would mean that unit has 12 db of gain instead of 36 db.

C. Two checks on AGC without a complete set up are:

Step 1 (See schematic, Figure 5)

(Please Turn Page)

OUR MAN IN EUROPE . . .

(*Continued from page 17*)

The idea of the subsidiary stations is to ensure that the trunk signals are held in close balance in terms of level and are corrected in terms of response. A.g.c. is also applied; these things being found essential when distributing over large areas.

The trunk cables energise feeder cables and the latter are employed to feed subscribers' downleads. In this way individual control of service areas is facilitated. This pattern of distribution is employed quite extensively in Great Britain, but there are various problems which I shall talk about in subsequent articles in this series.

G.J.K.

G-LINE . . .

(*Continued from page 12*)

Frese does note that in his experience the impedance of the line is close enough to 300 ohms so that a 75 ohm to 300 ohm matching transformer mounted on the back of the ½ inch micalex plate (figure 6) provides a convenient method of getting the coaxial line impedance (75 ohms) to the G-line impedance. He has experienced no ghosting problems using this method.

Conclusion

The G-line device obviously has a number of useful functions in the fringe area television world. It is low in cost, comparatively easy to install and apparently only slightly more difficult to maintain than the more conventional coaxial cable. It will probably never replace cable in most installations, but this evidence of its use and the pioneering work done with it by engineers such as Archer Taylor and George Frese illustrates that our industry is quick to try a new idea, improve upon it and make use of it whenever better television for rural America may result from our efforts.

RBC

ADDENDUM

Patents on the swtl are held by its originator, George Goubou, and commercial applications of the line are handled by Theodore Hafner, Surface Conduction, Inc., 521 Fifth Avenue, New York, New York.

B-T SERVICE BENCH . . .

(*Continued from page 23*)

Connect VTVM from ground to plate of V1-B (junction of L6 and R11). Rotate AGC control from stop to stop.) Voltage should vary from zero to plus 35 volts.

Step 2 Check DC voltage across R7. It should be 10 volts, plus/minus 1 volt.

Trouble Shooting (See Figure 5)

Trouble shooting of the MCSc is quite easy for the experienced technician. Almost all troubles not caused by tubes can be isolated quickly with nothing more than a vacuum tube voltmeter. The small percentage of more difficult troubles can be found using the sweep generator and oscilloscope.

The following chart should be helpful in tracing down trouble areas quickly.

SYMPTOM	CURE
1. Snow	Check tubes by substitution in the following order: V1, V2, V3, V4 check pin voltages.
2. Low Gain	Check tubes by substitution in the following order: V1, V2, V3. Check AGC setting. Check pin voltages. Check by substitution V1, V2, and V3. Adjust L19.
3. Picture ok but no sound or vice versa	Check by substitution V1, V2, V3, and V4. Check for variation in pin voltages.
4. Drift	Check V1 and V4 by substitution.
5. AGC Inoperative	Check input signal and AGC control setting. Check X-3, C-32, C-33, and I-2 bulb.
6. Intermittent	Check tubes. Tap X-3 gently and replace if intermittent.

FIELD ENGINEER . . .

(*Continued from page 20*)

tion proof also. Even indoors, it's usually a good idea to use a well-ventilated housing with a lock on it—to keep the kids away. And by the way, a lot of schools are specifying locking covers for their tapoffs, in order to prevent vandalism."

"Okay," agreed Bob, "I'll mast mount the preamp and lock the converters in a housing indoors. Got any more advice?"

Hank thought for a minute: "Yeah. UHF lead-in wire. You don't use coax for UHF because the loss is too high. Ordinarily, flat twinlead is no good either; its loss increases by 6 times when it is wet and besides it's not durable. We used to recommend tubular twinlead, but when it's hollow it gets filled with water. Foam-filled tubular is pretty good. I'd recommend one of the new UHF polyfoam cables, like Belden Permohm. Another thing: don't use ordinary standoff insulators. They are too lossy. Use the kind where the metal doesn't completely encircle the cable."

"That sounds reasonable," agreed Bob. "Anything else?"

"Well, I could tell you about avoiding converter interference, and how to receive local channels along with the MPATI channels and how to add a closed circuit channel to the system—but go ahead and lay the system out."

"You mean, you think I know enough not to foul it up?" asked Bob.

"Of course," said Hank heartily. "I trust you implicitly. I have complete confidence in your judgment and technical ability. There is absolutely no doubt in my mind that the system you lay out will be a masterpiece of engineering perfection—but be sure to show it to me before you send it out."

On Vacation This Month

BUT BACK IN MARCH. .

★ **PR in CATV**

★ **INTEC Service Bench**

★ **FCC Profile**

IMPROVE SYSTEM SENSITIVITY WITH LOW NOISE
TUNNEL DIODE AMPLIFIERS

CIRCULATOR COUPLED

375-1400 MC WITH 1-10% BANDWIDTH

As self-contained units, NTA amplifiers may be added directly to the front end of existing radar, troposcatter, ground and satellite communication systems. They offer a simple, economical and reliable method of improving systems performance. NTA amplifiers utilize Micro State's special low noise diodes.

TYPICAL SPECIFICATIONS (NTA 615)

Frequency	615 Mc
Bandwidth	30 Mc
Gain	17 db
Noise Figure	4.5 db
Saturation Level	– 37 dbm input for 1 db compression
Power Requirements	Battery operated 5000 hours, replaceable

FROM BASIC MATERIAL . . . TO SEMICONDUCTOR DEVICE . . . TO MICROWAVE COMPONENT

For additional information, write or call,

SEC

micro state electronics corporation

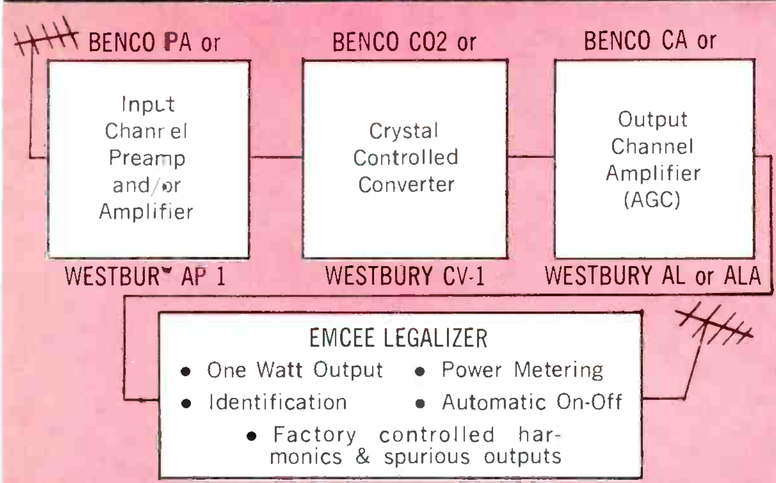
152 FLORAL AVENUE, MURRAY HILL, NEW JERSEY CR 7-6600

BEAT FCC APRIL 31st DEADLINE

Bring your system up to FCC requirements now to insure continuous uninterrupted translator service.

A MESSAGE OF TIMELY IMPORTANCE TO GROUPS WITH CUSTOM ASSEMBLED TRANSLATORS!

Do You Have These Types of Equipment?
ADD A EMCEE LEGALIZER FOR IMMEDIATE TYPE ACCEPTANCE!



Of particular importance to Benco or Westbury component system owners . . . the EMCEE Legalizer added to your equipment produces a type accepted translator*. With the combinations shown above, acceptance is automatic. No engineering conditions to be met . . . no custom type acceptance measurements required.

*CAC-W Type Acceptance Granted
*CAC-B Type Acceptance Pending

EMCEE

LEGALIZER Model CAC

EMCEE offers the perfect, in-time solution to your modification problems through the "LEGALIZER" designed to complement existing translator installations . . . and to provide the easiest and most reliable means of converting existing installations to a system meeting the new FCC requirements for VHF Translators.

The Legalizer connects between the output of your present equipment and the transmitting antenna. It is not necessary to break into or modify the existing units.

NOW! Contact your nearest EMCEE representative for complete details or write to the factory.

Serve several communities from a common site with a full watt to each.
Model 4-MXA multiple amplifier chassis extends EMCEE quality performance — serves up to four communities. Write for detailed specifications, copy of rules amendment. Now type accepted. For use with any VHF Translator.

ELECTRONICS, MISSILES & COMMUNICATIONS, INC.
262 East Third Street • Mount Vernon, N. Y.

F

Gentlemen:

☐ Please send me more particulars immediately on EMCEE Legalizer Model CAC and name of nearest field representative.

☐ Complete translator system planning package.

NAME__________

ADDRESS__________

CITY__________ STATE__________

ELECTRONICS, MISSILES AND COMMUNICATIONS, INC.
262 East Third Street • Mount Vernon 4, New York • MO 8-3012