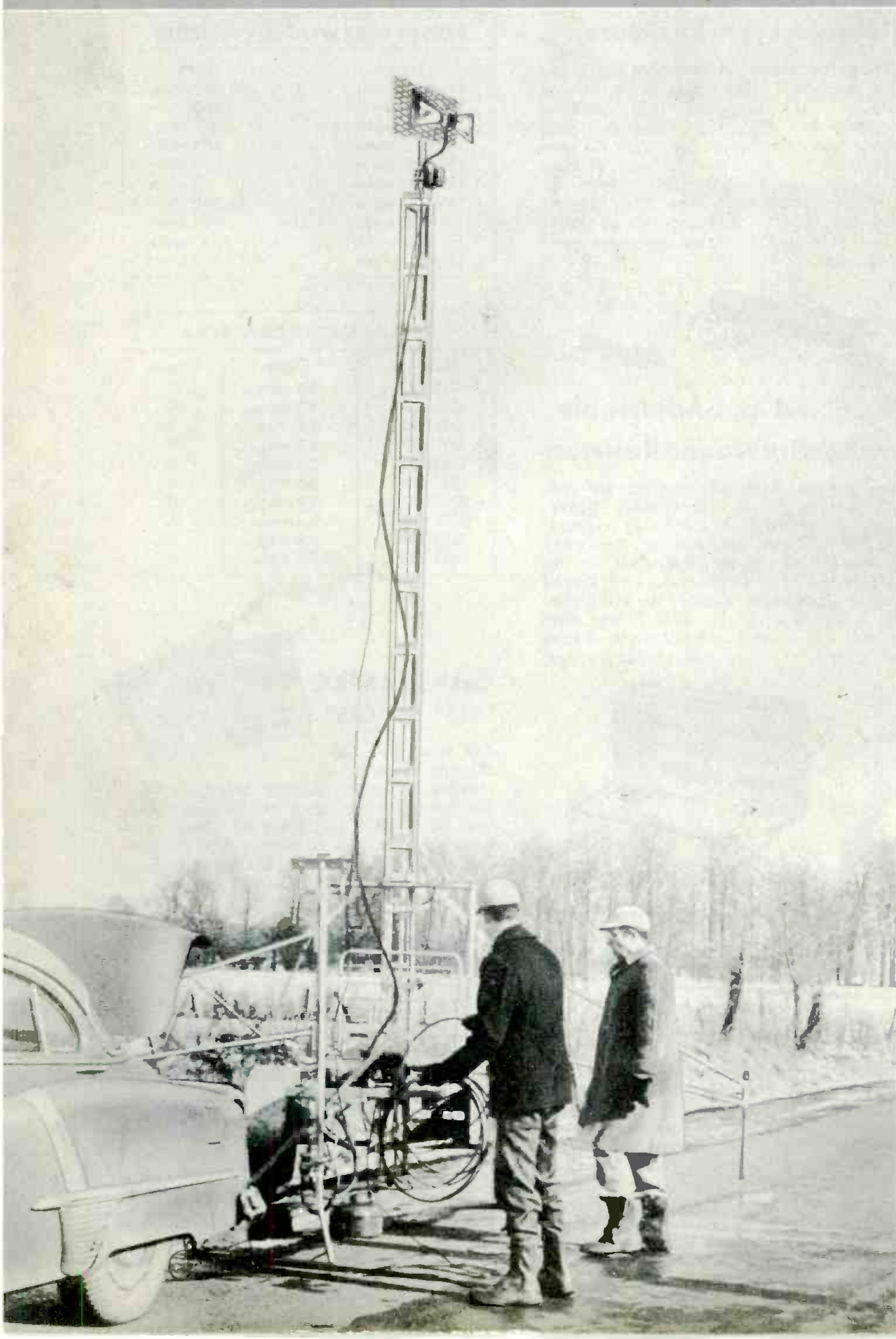
Howard W. Sams

PHOTOFACT

INDEX

AND TECHNICAL DIGEST



March • April • 1953
including
INDEX No. 37
COVERING PHOTOFACT FOLDER SETS 1 THRU 200

CONTENTS

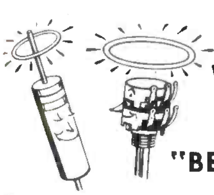
HOW TO PLAN FAST-MOVING INVENTORIES AND REDUCE OBSOLESCENCE WITH IRC "BEST SELLERS"

Why Tie-up Your Money in Stagnant Stocks?

Resistors on your shelves won't bring you a cent—until you put them to use. If they're lazy movers they tie-up your money and your shelf space. And if they're shelf-squatters—gathering dust month after month until they become obsolete—they're actually money wasted. Yet a lot of servicemen continue to stock slow-moving parts because they haven't thought about the advantages of IRC "Best Seller" Resistors and Controls.

For Fast Stock Turnover Invest in IRC "BEST SELLERS"

It's just as easy—easier in fact—to stock fast-moving, money-making parts as it is to load up with shelf-squatters. And it's certainly a lot more profitable. All you have to do is tell your Distributor's salesman that you want a realistic, commonsense inventory based on IRC "Best Sellers". He'll know what you mean, because ten-to-one your Distributor's own invenrory is based on those very fast-moving parts.



What Do We Mean by "BEST SELLERS"?

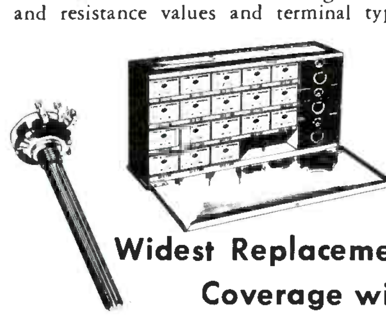
"Best Seller" Resistors and Controls are those you use most often in radio and TV servicing. They're the indispensables—the ones you'll want on hand at all times. Of course there are others you'll need on occasion. But the great majority of parts essential in radio and TV divides into relatively few classifications regardless of brands or models of sets. Although IRC makes resistors and controls for *every* replacement need, careful analysis shows the greatest movement among a limited number of types and ranges. These "Best Sellers", listed here, provide a realistic base for establishing your parts inventory.

IRC Advanced BT Filament Type Resistors

In television sets you'll find more IRC Type BT's than any other types or makes of resistors. Fully insulated, they combine extremely low operating temperature and *superior power dissipation*. Not only do they *easily* meet the stiff requirements of television, they also *beat* Army-Navy Specifications in most characteristics. IRC supplies Advanced Type BT Resistors in a complete variety of ranges and sizes to meet every servicing need.

IRC Fixed and Adjustable Power Wire Wound Resistors

These rugged, long-life resistors are specially engineered for dependable heavy-duty performance. Unlike ordinary resistors, IRC PWW's need no derating; they carry full wattage in any range. Special coating gives faster heat dissipation, and special lead-lug arrangement permits easier installation in crowded chassis. IRC Power Wire Wounds are available in a full range of sizes and resistance values and terminal types.



Widest Replacement Coverage with Minimum Control Stocks

Most adaptable of all radio-TV technicians' volume controls, IRC Type Q Conrrols give you full replacement coverage with only nominal control stocks. IRC's exclusive Knob Master Shaft fits most push-on knobs without alteration except cutting to length. And IRC's Interchangeable Fixed Shaft feature allows fast control conversion to suit almost any radio or TV set. Handy IRC Volume Control Cabinet is the ideal way to buy and stock Q Controls. Cabinet stock of 18 controls handles over 90% of your single carbon control replacements.

Here are Your IRC "BEST SELLER" Resistors and Controls listed in order of popularity

TYPE BT RESISTORS

Type	Value
BTS ½ watt	0.1 meg.
BTS ½ watt	0.47 meg.
BTS ½ watt	22,000 ohms
BTS ½ watt	1.0 meg.
BTS ½ watt	1000 ohms
BTS ½ watt	10,000 ohms
BTS ½ watt	1500 ohms
BTS ½ watt	0.22 meg.
BTS ½ watt	4700 ohms
BTS ½ watt	100 ohms

POWER WIRE WOUND RESISTORS

Type	Value
1¾A 10 watts	10,000 ohms
1¾A 10 watts	5000 ohms
1¾A 10 watts	1000 ohms
1¾A 10 watts	200 ohms
1¾A 10 watts	100 ohms
1¾A 10 watts	75 ohms
1¾A 10 watts	15,000 ohms
1¾A 10 watts	2000 ohms
1¾A 10 watts	1500 ohms
1¾A 10 watts	2500 ohms

REPLACEMENT CONTROLS

Stock No.	Ohms	Taper
Q13-133	0.5 meg.	C
Q13-137	1.0 meg.	C
Q11-133	0.5 meg.	A
Q11-137	1.0 meg.	A
Q13-139	2.0 meg.	C
Q11-123	50 K	A
Q13-137X	1.0 meg.	H
Q11-128	0.1 meg.	A
Q13-139X	2.0 meg.	H
Q13-130	0.25 meg.	C

Cash in on IRC "BEST SELLERS"

Ask your IRC Distributor to set up a sensible inventory for you, based on these fast-moving units. Also, get Catalog Bulletins DC1, DC5 and DC8 on these parts from your IRC Distributor—or send post-card to us for your copies. IRC "Best Sellers" can save you money!

IRC

Wherever the Circuit Says

INTERNATIONAL RESISTANCE CO.

423 N. Broad Street, Philadelphia 8, Pa.

A Pledge to You!

☆

Exactly seven years ago (April 1, 1946) twelve of us started to work for you as Howard W. Sams & Co., Inc. Our objective—to provide Radio Service Technicians with factual, helpful, uniform, time-saving servicing data, at the lowest possible cost. That was my pledge to you.

In seven years we have somehow managed to keep up with things, never being satisfied or content to rest on the day's accomplishment. The fun of licking tomorrow's problem—the keen anticipation of studying something new, something different, has always acted to hold our interest and to spur us on to surmount every obstacle.

PHOTOFACT *Folders, Publications and The* PF INDEX *and Technical Digest are living examples of keeping faith with you.*

For seven years, during an unprecedented era of constant advances in all costs, a Set of PHOTOFACT *Folders at $1.50 has been your most profitable purchase. My pledge to you has been kept.*

It has become economically impossible to continue the $1.50 price established on a Set of PHOTOFACT *Folders seven years ago. As this issue of the* INDEX *goes to press, I do not know what the new price will be.*

I do know that PHOTOFACT *Folders will continue to be your most profitable purchase. We will continue to give you the best we have in us—of which this issue of the* INDEX *is an example. We will continue to give you more than you get from any other dollar you spend. That again is my pledge to you.*

Howard W. Sams

PF (PHOTOFACT) INDEX

AND TECHNICAL DIGEST

VOL. 3 • NO. 2 MARCH-APRIL, 1953

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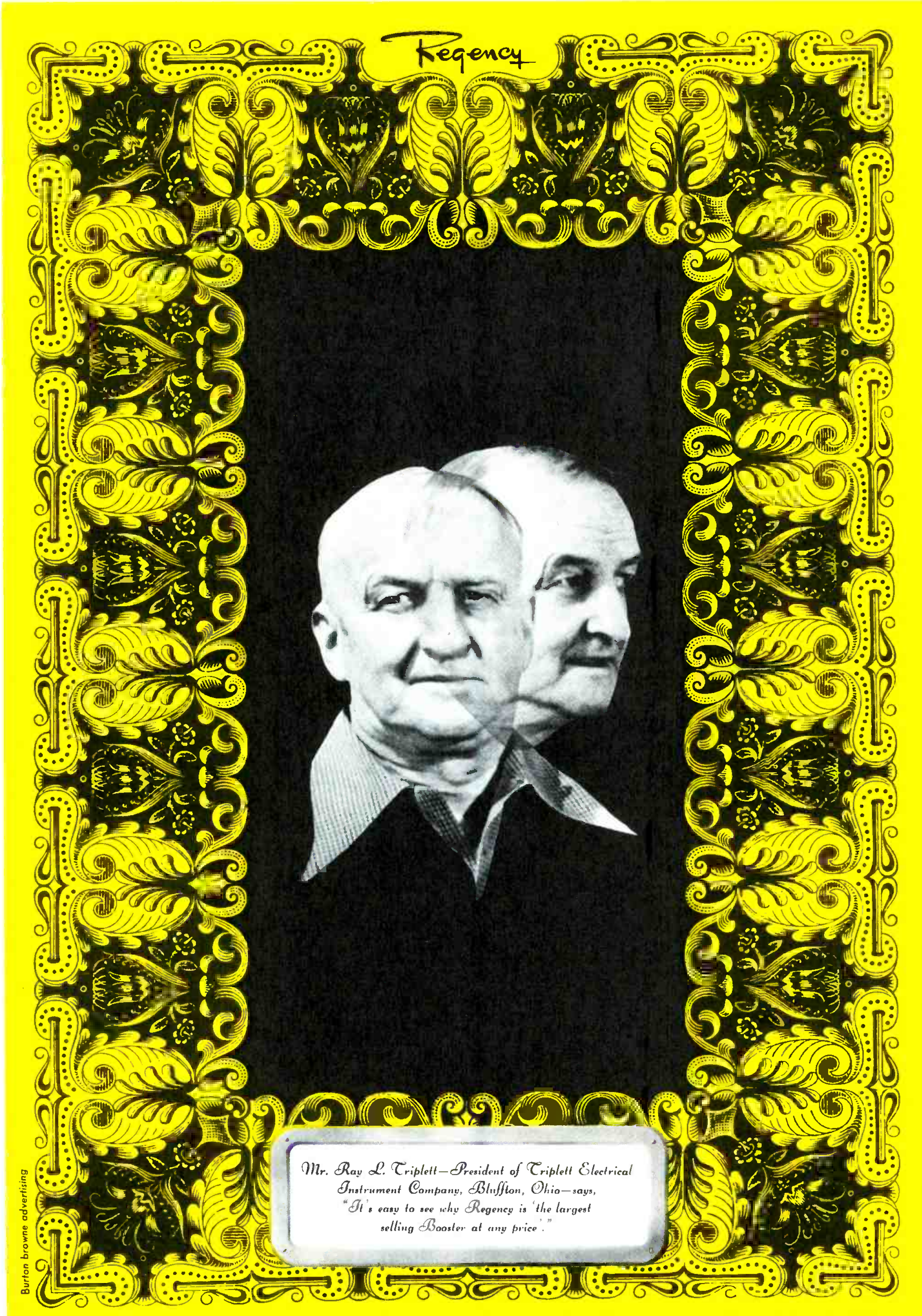
HOWARD W. SAMS, *Publisher*

2201 East 46th Street • Indianapolis 5, Indiana

The PF (PHOTOFACT) INDEX and Technical Digest is published every other month by Howard W. Sams & Co., Inc. at 2201 East 46th Street, Indianapolis 5, Indiana—and is included as a part of PHOTOFACT folders from PHOTOFACT Distributors without additional cost.

SUBSCRIPTION DATA: For those desiring the convenience of delivery to their homes or shops, Howard W. Sams & Co., Inc. will mail each issue of the INDEX direct, promptly upon publication. The subscription charge is $2.00 for eight issues in the United States and U. S. possessions. Acceptance under Section 34.64 P. L. & R. authorized at Indianapolis, Indiana.



Regency
Mr. Ray L. Triplett—President of Triplett Electrical
Instrument Company, Bluffton, Ohio—says,
"It's easy to see why Regency is 'the largest
selling Booster at any price'."
Burton browne advertising

MILTON S. KIVER

President, Television Communications Institute

Shop Talk

One of the difficulties that the beginning serviceman has to surmount, besides the technical knowledge barrier, is the variety of names by which some devices are known. Consider, for example, the lowly capacitor- - probably one of the most widely used components in radio or television. Thumb through any parts catalogue and you will find fixed capacitors listed or described by one or more of the following terms: fixed, by-pass, mica, ceramic, oil-filled, tubular, disc, wax paper, metalized paper, and electrolytic, to mention the more common names. Variable capacitors have their own series of names. To one who lacks experience, the foregoing array can be bewildering indeed.

A somewhat similar situation has arisen for some of the test equipment used in radio and television. In radio, for example, the names AM generator, RF generator, and signal generator are used interchangeably for the same piece of equipment. This is an instrument that generates a single frequency (or a harmonic) for each setting of the front panel dial. The signal may be "pure" or unmodulated or it may be amplitude modulated by a 400-cycle or 1000-cycle audio frequency.

The same instrument, when used for television alignment work, may also be called a marker generator. This is because its purpose is frequently to produce a marker pip on a response curve. However, the mere fact that we have changed the name does not indicate a different instrument. It is still the same AM or RF, or signal generator mentioned above. The word marker refers primarily to its application rather than to its mode of operation.

The alignment of television receivers requires the use of a sweep generator. This instrument produces an output signal in which the frequency varies back and forth across a specified range. The most common name in use is sweep generator. However, the allied names of sweep frequency generator and sweep signal generator are also heard. Sometimes, because of its purpose, this unit will be called an alignment generator. In addition, television generator is another designation while FM generator is also widely used. The name FM, of course, arises from the fact that to produce a sweep signal, we must frequency modulate the generator oscillator.

Frequently, a sweep generator capable of covering the television frequencies (IF and/or RF) can also be used to align FM receivers. However, it does not necessarily follow that an FM generator designed for the sweep alignment of FM receivers can be used to align television receivers. So care must be observed when purchasing such units.

The foregoing are the two test instruments that have the greatest number of alternate names. The other instruments that are used may have one or two names but usually the beginner has little difficulty in determining what they refer to. Thus, a field strength meter and a field intensity meter are alike, a tube tester and a tube analyser refer to the same instrument, and a cross-hatch generator is basically the same as a linearity generator. One instrument in a group may be capable of doing more or less than another instrument in the same group, but this is more a function of price than it is of a difference in designation.

This penchant for using two or more names for the same thing exists quite extensively for test equipment controls, perhaps more so than it does for the equipment itself. As an example, Table 1 contains the alternate names that have been frequently used for various oscilloscope controls. Some of these alternates, like V Gain for Vertical Gain and H Gain for Horizontal Gain are quite obvious and would cause very few servicemen any trouble. But when you encounter such alternate names as X Amplitude for Horizontal Gain, Y Amplitude for Vertical Gain, Steps for Sweep Frequency, and Locking for Sync, you can readily understand why confusion exists. There are not standard designations for instrument controls and even the same manufacturer is not always consistent on different models of his own equipment.

For a long time picture tube nomenclature was standardized and followed a consistent pattern but recently it too has begun to show the ravages of a rapidly growing field. As originally set up, the numbering system on picture tubes followed this general procedure. The first number indicated the screen diameter. The P4 at the end indicated the type of fluorescent screen that the tube contained, and any letters inserted between the front number and the end P4 were meant to take

NAME OF CONTROL	ALTERNATE NAMES
Vertical Gain	V Vernier, V Gain, Vertical Amplifier, Y Amplitude
Horizontal Gain	H Vernier, H Gain, Horizontal Amplifier, X Amplitude
Vertical Centering	V Center, Vertical Position, Y Position
Horizontal Centering	H Center, Horizontal Position, X Position
Fine Frequency	Vernier, Frequency Vernier, Range Frequency, Sweep Vernier
Sweep Frequency	Coarse Frequency, Steps, Sweep, Sweep Range, Sweep Frequency Range
60-Cycle Phasing	Horizontal Phasing, Phase
Horizontal Attenuator	Horizontal Sensitivity, Horizontal Input Control
Vertical Attenuator	Vertical Sensitivity, Vertical Input Control

Table 1. Some of the Alternate Names That Have Been Used for Various Scope Controls.

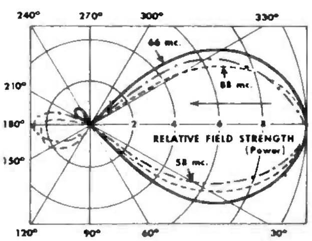
FOR GREATEST TV PICTURE Quality AMPHENOL -INLINE- TV ANTENNAS

OUTSTANDING MECHANICAL SPECIFICATIONS

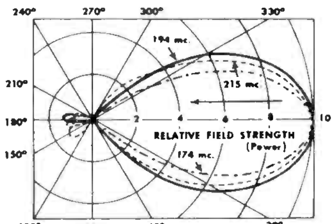
Part	Material	Yield Strength	Size	
		psi	o.d.	Wall
Mast (galv.)	¾" Thinwall Steel Conduit	32,000	0.922"	.049"
Large Folded Dipole	3S ½ H Al.	19,000	.500"	.049"
Small Folded Dipole	3S ½ H Al.	19,000	.375"	.049"
Reflector	3S ½ H Al.	19,000	.500"	.049"
Crossarm	3S H Al.	26,000	.875"	.065"
Center Support & T Casting	Al. Alloy 45,000 psi tensile strength			

EXCELLENT RADIATION PATTERNS

These are the radiation patterns of the AMPHENOL Inline antenna at 58 mc., 66 mc., and 88 mc., in the low band, and 174 mc., 194 mc., and 215 mc. in the high band. Notice the uniformity of these lobes at all frequencies. The lack of lobes off the sides and negligible ones off the back maintains high front-to-back and front-to-side ratios necessary for the rejection of various interferences. The presence of a single forward lobe is usually a very desirable feature, especially when it is wide enough to provide adequate interception area for some differences in transmitter location, changes in the wave front's direction of travel, or physical movement of the antenna in high winds. Furthermore, it is not too critical of orientation. It is necessary only to aim it and forget it.



Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.



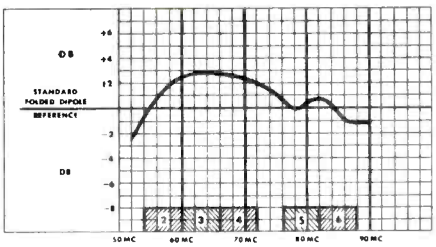
Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005

HIGHER GAIN

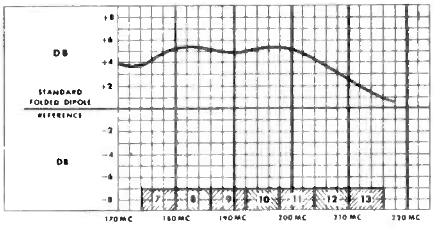
These gain curves of the AMPHENOL Inline antenna represent the intercepted voltage of the AMPHENOL Inline Antenna as plotted against the intercepted voltage of a reference folded dipole cut to the frequency being compared. There is no channel in either the low band or high band where there is more than a three decible change within the channel that can cause picture modulation or "fuzziness." Gain of the AMPHENOL Inline antenna is quite flat over all channels.

You will find more gain designed into the high band because of greater need for it, due to higher losses at these frequencies. Also, notice the drop-off on channel six. This is at the edge of the FM band and is subject to FM interference, so the Inline's gain is purposely held down at that frequency.

The excellent broadband characteristics, impedance match, single forward lobe radiation patterns on all channels, maximum gain, lightning protection, and superior mechanical features of the AMPHENOL Inline Antenna make it the antenna for greatest TV picture quality!



Gain of Amphenol Model No 114-005 Antenna over a reference folded dipole, 54 to 88 mc.



Gain of Amphenol Model No 114-005 Antenna over a reference folded dipole, 174 to 216 mc

for All the factors determining

BETTER TV PICTURE QUALITY

Write for this book containing the characteristics and test performance data of various types of antennas.

AMPHENOL AMERICAN PHENOLIC CORPORATION

1830 SOUTH 54th AVENUE • CHICAGO 50, ILLINOIS care of structural or electrical difference between tubes possessing identical size screens.

This system was adhered to quite closely until the introduction of tubes using specially treated glass for the screen plate. The purpose of this glass (known commercially as gray glass, filterglas, or teleglas) was to improve picture contrast, principally by imposing a greater absorption on light reflections that occurred between the two intersurfaces of the glass screen. To distinguish between tubes using this glass with those using ordinary glass, the letter "A" was appended to the tube number after the P4. Thus, a 16HP4A tube possessed a filterglas screen, whereas the 16HP4 did not. In all other respects, the two tubes were identical.

Next, the letter B appeared and it was employed to indicate that the screen face has been frosted. (Frosting, produced by etching the screen face, tends to diffuse the reflections of bright lights in the room and thereby lessen their annoyance to the viewer.) This frosting, in combination with filterglas, helps to improve picture contrast considerably. The letter B is used for a frosted filterglas.

Occasionally, the letters C and D will be found. In the 19AP4C, for example, gray glass is used and, in addition, the fluorescent side of the screen is coated with a thin layer of aluminum. The aluminum backing serves to increase the light output considerably. In the 19AP4D, a clear frosted glass is used. This is in distinction to the 19AP4B where a gray frosted glass is employed.

The serviceman will find, however, that this system has not been strictly adhered to. Thus, the 20CP4 possesses a filterglas screen while the 20CP4A differs from it, not in having a different type glass face, but by having an external conductive coating over the bulb of the tube while the 20CP4 does not. Or, the 17BP4B does not possess a frosted face, but instead an aluminum backed screen. And, to compound the confusion, the 12UP4B possesses neither a frosted face, nor a metal backed screen, but differs from the 12UP4A by requiring a single magnet ion trap instead of a double magnet trap.

There are a sufficient number of other "discrepancies" to lead one to the conclusion that the additional A, B, C, D, appendages were not carefully established as standards but were improvised when significant differences appeared in tubes having the same size screen. The only consolation the serviceman has in all this, is that tube charts are readily available and that it is usually possible to substitute tubes of equal screen size without much difficulty. Hence, some of these differences lose their significance.

Television is young and robust, expanding in all directions at once. Expansion, of course, brings with it change and what was commonplace yesterday may not be popular today. An excellent example in point is the receiving system used in current television sets. At the start, in 1946, all television receivers employed what is today known as the conventional system. That is, the sound portion of the television signal was separated from the video portion before the signal reached the video second detector. This was the only system in use until the "Intercarrier" principle was discovered by R. B. Dome of General Electric.

Now, the choice of the word conventional for the first system is perhaps unfortunate since it conveys the impression that it is the system most widely employed when, as a matter of fact, it is not. The majority of receivers now being manufactured utilize the intercarrier principle and the percentage is increasing steadily. Probably the origin of the word conventional, as applied to television receivers, arose from the fact that the conventional system came first. Thus, when the intercarrier system appeared, it was compared to the then existing system which was dubbed the conventional system.

Recently a new name has appeared for the so-called conventional system. This is split-sound and while it appears to be preferable to conventional it, too, suffers from ambiguity. The intercarrier set has a separate sound channel, which is in many respects similar in purpose, although not in operating frequency, to the sound system of conventional sets. In both systems, the sound is eventually separated or split from the video signal, the only difference being the point of separation.

So while split-sound appears to be more desirable than conventional it, too, can stand improvement.

REVIEW. Our review article this month concerns trouble shooting in horizontal AFC circuits. This article appeared originally in two installments of the DuMont Service News as follows:

"Trouble Shooting Horizontal AFC Circuits"
by Walter Boiko
DuMont Service News,
February 1952, and
March-April 1952 Issues

Published Monthly by the
Teleset Service Department,
Allen B. DuMont Laboratories Inc.,
257 Sixteenth Avenue,
Paterson, New Jersey

One of the sections in a television receiver which gives the service technician more than its share of trouble is the horizontal sweep system. A good deal of the difficulty stems from the haziness which many servicemen have concerning the exact operation of this system, especially the automatic frequency control tube and its circuit. It is here that the operating frequency of the horizontal sweep oscillator is determined and any shift from normal conditions will immediately make itself visually known by poor horizontal lock-in.

The problem facing the serviceman is how to determine which component in the AFC system is defective. To solve this in a logical manner requires (as it always does) an understanding, first, of the operation of the circuit and second, an idea of what to expect at various points in the system. The circuits to be discussed below include the reactance-tube AFC system (developed by RCA for the 630 receiver) and the now widely used pulse-width AFC system. From the procedure outlined for these two systems, the serviceman should be able to extend it to any of the other methods in use.

A. Reactance-Tube AFC System. A block diagram of this circuit is shown in Figure 1. It consists of a sync discriminator, a reactance tube, and the horizontal sweep oscil-

♦ ♦ Please turn to page 81 ♦ ♦

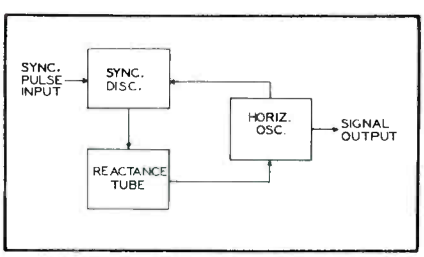


Figure 1. Block Diagram of the Stages in a Reactance Tube AFC System.


FOR YOUR REPLACEMENTS
use Teletrons
from 12" to 30"
12LP4A
16K/RP4
17BP4A
17KP4
19AP4
20CP4A
21FP4A
30BP4
The complete line of Teletrons in the most popular types from 12" to 30", reflects the prominent role Du Mont has played in the advancement of big-picture television. Each time you use a Teletron for replacement, Du Mont's reputation for quality stands behind the reliability of your service.
FREE! Du Mont data chart lists complete specs on all picture tube types. Attach card or letterhead to this ad for your free copy.
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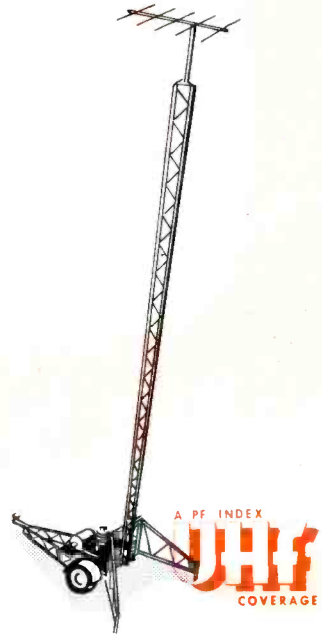
OPERATION UHF

by W. William Hensler



Shortly after the first commercial UHF station came on the air in Portland, Oregon, many varying reports were received from that area. It was stated that at certain points no signal at all could be received. It was also felt that a specific type antenna must be employed in order to get satisfactory reception. The same thing was said of the transmission line. All of these conditions were far different from the normal type of reception which had been encountered in VHF experience.

Knowing that some isolated cases might be misconstrued as the rule rather than the exception, we felt that a more thorough investigation of UHF reception would be very helpful, not only from the standpoint of our own knowledge of this type of reception, but also to be of assistance to our readers and those people who will be called upon to make UHF installations. We immediately started plans to make field tests to gain the necessary facts and data from which we could make reports.

The first step was to decide what type of field equipment would be best suited for this purpose. After making some investigation, it was decided that an antenna trailer-tower would be the most satisfactory means of duplicating installations in the field. We immediately placed an order for such a trailer-tower through the Philco Corporation. This trailer-tower is equipped with a telescoping tower which extends to 40', upon which up to 20' of mast can be inserted, giving a total height of 60'.

We then contacted antenna manufacturers who had already announced that they were planning to supply UHF antennas. It was our desire to obtain as many basic types of UHF antennas as possible. We told them of our plans, and asked if they could supply us with UHF antennas which they were going to offer commercially. The response we received from the various manufacturers was extremely gratifying. Most all of them were very anxious to send us samples which we could test first hand in the field.

In order that we could get a full picture on the operation of these antennas with various transmission lines, the transmission line manufacturers were also contacted so that we could get samples of their products. Again, the response of these manufacturers was very satisfying. We were able to obtain samples of all the basic types of transmission lines which the reports out of the Portland area indicated that we would need.

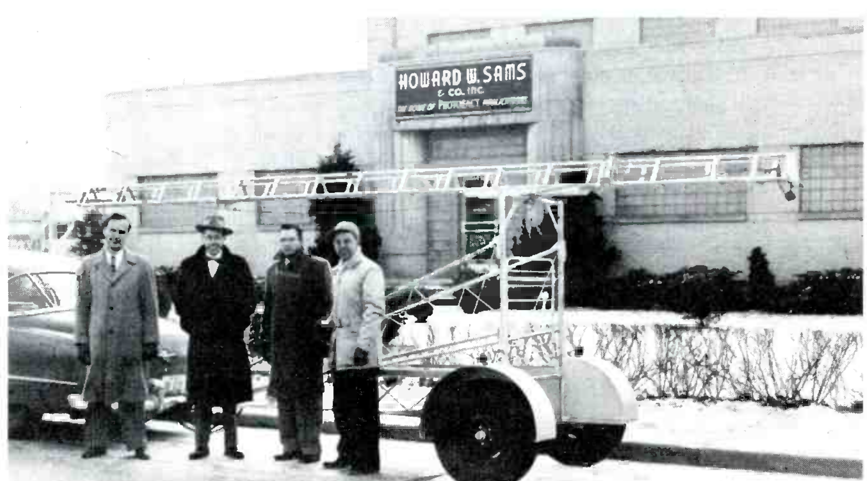
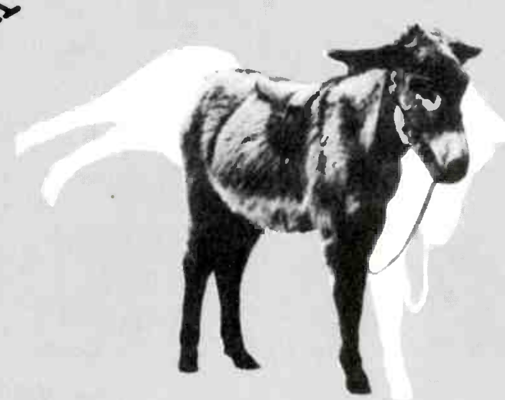
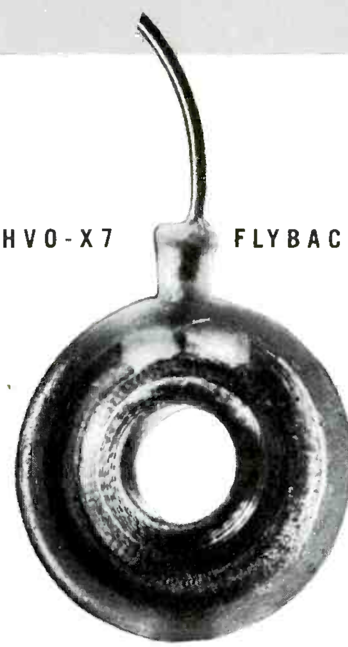


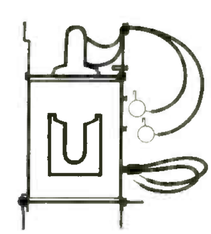
Figure 1. Field Crew and Equipment Just Before Departure.

take the kick out of TV



CORONA **FREE** HVO-X7 FLYBACK TRANSFORMER





Servicemen are in for a *pleasant* shock as Merit designs a corona-free transformer! Merit's famous HV07—the world's most popular transformer—is now treated to a miracle-tough, new non-hygroscopic insulation. Liquid-molded, this insulation encloses the high voltage winding, is impervious to moisture and high humidity and forms a watertight seal for the high voltage lead. This, the latest development in insulating material, is unaffected physically or electrically by high humidity or cycles of heat and cold. It will withstand operating temperatures 50% above normal without change—and its high dielectric constant affords maximum protection with minimum distributive capacity. And this miracle new material resists oil, acid, corrosion and is non-flammable as well.

MERIT

MERIT COIL AND TRANSFORMER CORP.
4425 North Clark St., Chicago 40

Burton browne advertising

Our next step was to obtain as many converters and UHF receivers as possible. Our aim here was to be able to test these various converters in actual field operations, so that we could familiarize ourselves with their operation and to particularly acquaint ourselves with any operational difficulties which might be experienced by the consumer. In obtaining the UHF receivers it would be possible to check these receivers using the various antennas, and also to check their operation as compared to the use of external converters.

As soon as our trailer was received, we set about modifying it so that it would be most satisfactory for the particular type of survey. The first step in converting the trailer-tower was the consideration of the tires to be used on the unit. Since the trailer has no springs, it was decided that larger size, lower pressure tires, than those which could be used on the particular wheels supplied with the unit, would be more satisfactory. We obtained wheels which would accommodate 8.00-15 tires, allowing us to carry lower air pressure, and providing a smoother ride.

Next was the consideration of the storage or carrying space on the trailer. The unit comes supplied with a grid-like base which is entirely satisfactory for carrying most television receiver cartons. However, since this space was to be used as a work table, we built a platform upon which we could set our test equipment and receivers when so desired. The grid work, which was originally intended to be used as a base, was then installed in an upright position to act as a guard to prevent cartons or equipment from falling off the rear of the trailer. The platform and the upright grid structure can be seen in Figure 2. This particular type construction also lends itself to easy strapping, or tieing down of equipment.

It was decided that fenders should be installed on the trailer. These were installed at a local welding shop and were made of sheet steel, reinforced with angle iron so that there would be no vibration which might cause damage to the trailer. Figure 3 shows the mounting brackets used to hold the fenders.

The next step was that of wiring the trailer for night operation. We first installed a tail and stop light combination, and license plate holder. We then installed a red clearance lamp at the rear end of the tower and also two yellow clearance lamps pointing one to each side on the top of the two fenders. Since the trailer itself is merely a skeleton, it was felt that the extra clearance lights pointing outward on the side were required. One of the side clearance lamps can be seen in Figure 3.

Since the trailer had no springs it was necessary to install an extra-heavy trailer hitch on the car which was to pull the unit. Although there was a comparatively small amount of weight impressed on the car, the unsprung axle exerted considerable forward and backward motion as the trailer would hit bumps or chuck holes. A light hitch on this type of trailer might easily weaken and snap due to the sudden jerking action. Loops were installed on the trailer hitch and also on the trailer to allow for connection of safety chains. This is necessary by law in some states and if such an arrangement is to be used, the local regulations should be consulted.

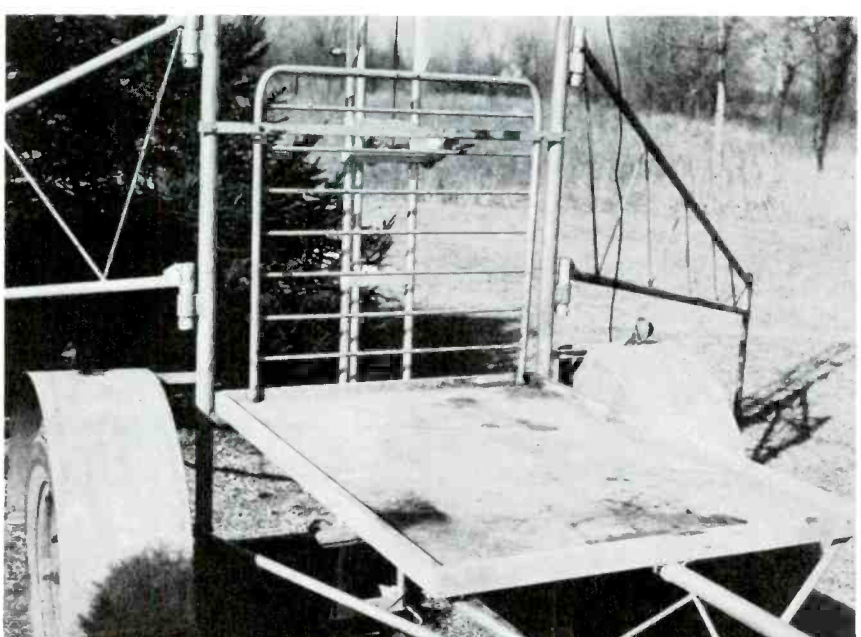


Figure 2. Trailer-Tower Showing Modified Platform.

Figure 3. Fender Mounting Detail.

Another modification on the trailer, was the addition of mast holders. These holders were installed at the same time that the fenders were mounted on the trailer. They consisted of two short lengths of 2-1/2" pipe which were welded to the main member of the trailer. Set screws were installed in these sections of pipe allowing us to tighten them down on the mast and hold it securely. The front section of the mast holder can be seen in Figure 4 just to the left of the safety chain loops. The length of the trailer was such that a 10' length of mast could be carried and would extend only a few inches behind the fenders of the trailer. Since the tower itself extended five feet beyond the trailer and clearance lights were provided for this tower, the carrying of the mast proved very satisfactory. For a regular installation where a telescoping type mast might be employed, such an arrangement would be very useful in carrying the mast to the installation point. Figure 5 shows a 10' length of mast in place in the holder. This particular feature proved extremely satisfactory

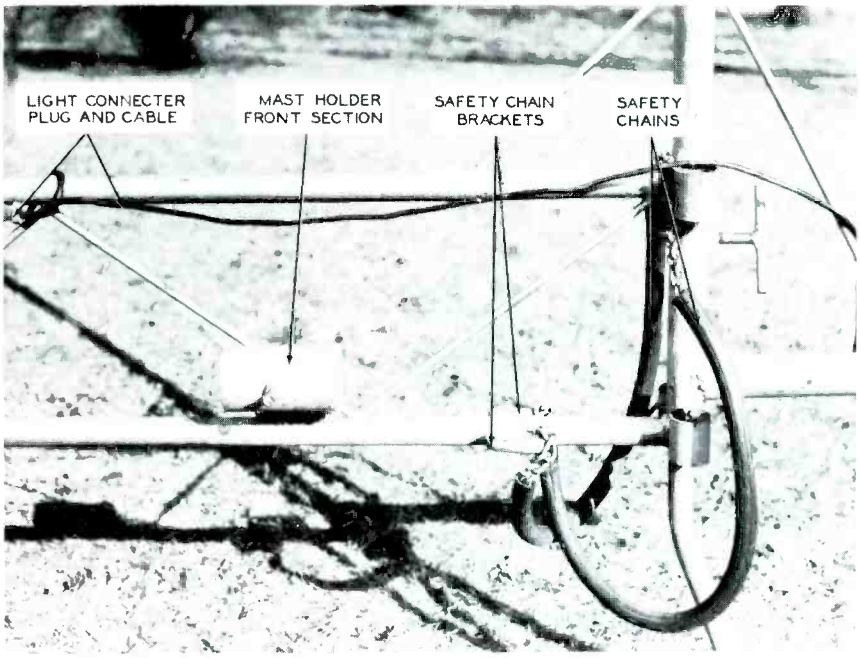


Figure 4. Mast Holder and Safety Chains.

and it is recommended that it be added to any of the trailer-towers.

In order to make possible easy and rapid change of various antennas, we used a mast which has a key and is tapered at one end. A section of this type mast was permanently installed at the top of the tower. Since a rotator was required to facilitate our operation, a short section of mast was installed in the clamps on the stationary portion of the rotator. This could be slipped on to the tapered end of the mast with a minimum of effort. The rotating section of mast in the rotator was another short section which also had a tapered end at the top. This arrangement is shown in Figure 6. Thus, it was possible to install antennas with or without the use of the rotator. During our field tests, the rotating unit was used at all times. We also cut several short sections of mast which could be installed in the antenna clamps, at the beginning of each day, on all those antennas which we planned to check. This made it possible to very quickly slip the antenna on the end of the mast. Time was at a great premium since a comparatively few hours of test pattern were available.

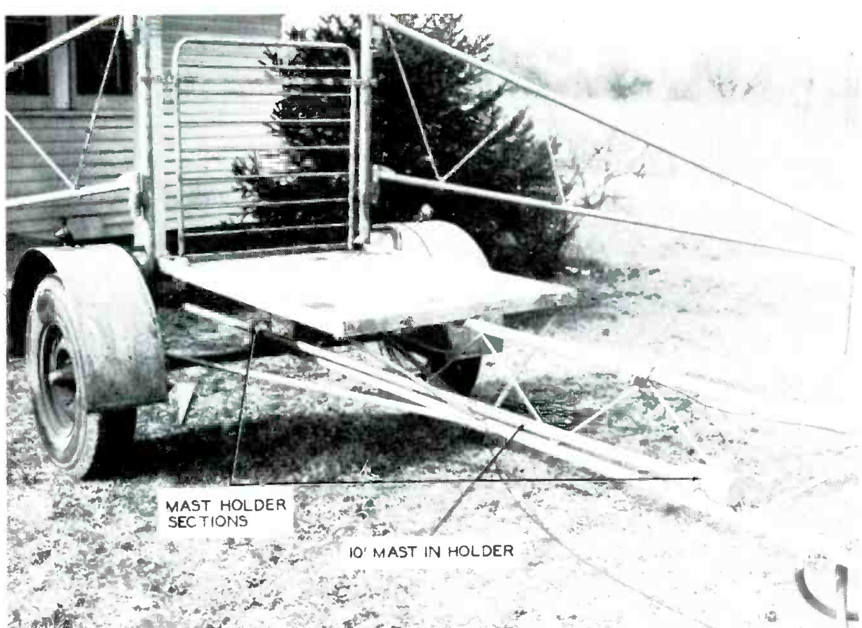


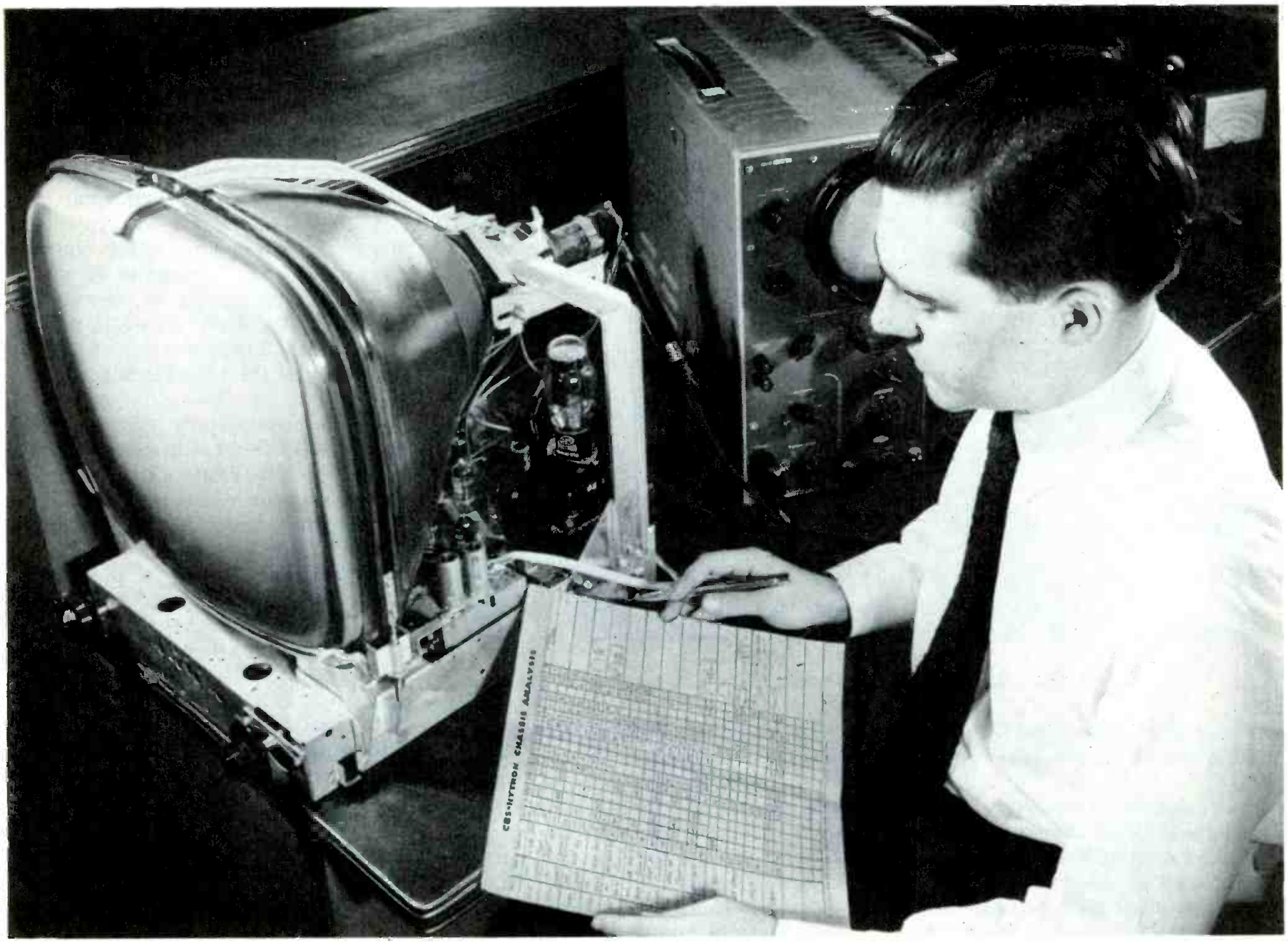
Figure 5. 10-Foot Length of Mast in Holders.

The next obstacle which we had to overcome was that of obtaining power for test equipment and receivers which we planned to use in the field. We contacted the Carter Motor Company and obtained a converter which operates from the electrical system of the car and generates 117 volts 60 cycle AC. The particular unit which was obtained has an output of 40 watts, which was sufficient to operate the rotator or the field strength meter. It did not, however, provide for operation of the television receiver.

As an auxiliary unit we also constructed a vibrator power supply, employing a 60 cycle vibrator, which was satisfactory to drive the rotator. This supply made possible the operation of the rotator at the same time that the field strength meter was being used. Since considerable arcing was noted across the points of the vibrator, when the rotator was not on, an additional set of contact points was installed in the control box. These points were closed only when the rotator was put into operation. The contacts on these points were placed in the primary circuit and thus the vibrator did not operate unless the control box switch was actuated either to the right or to the left.

We originally planned to operate the television receivers either from farm houses, service stations, or any other source of 117 volts which we could use. Since this would place considerable limits on our field of operation, it was decided that such an arrangement would not be satisfactory. We, therefore contacted the various manufacturers who supply gasoline-driven power plants in an effort to obtain a unit which would provide the power that we needed. Ultimately we obtained a Homelite unit, which has an output of 1,000 watts at 115 volts - 60 cycle AC. This unit is a single cylinder two-cycle gasoline-driven alternator which has a total weight of only 68 lbs. It is quite small and proved to be extremely satisfactory for our tests. Figure 7 shows the power unit mounted on the trailer platform. With this unit it was possible to supply not only the television receivers, but any converter which we might choose to use as well as our field strength meter, antenna rotator, and the lights for our night operations.

We then had obtained the trailer and the power plant necessary to carry on the operation. We had equipped the trailer for night driving.



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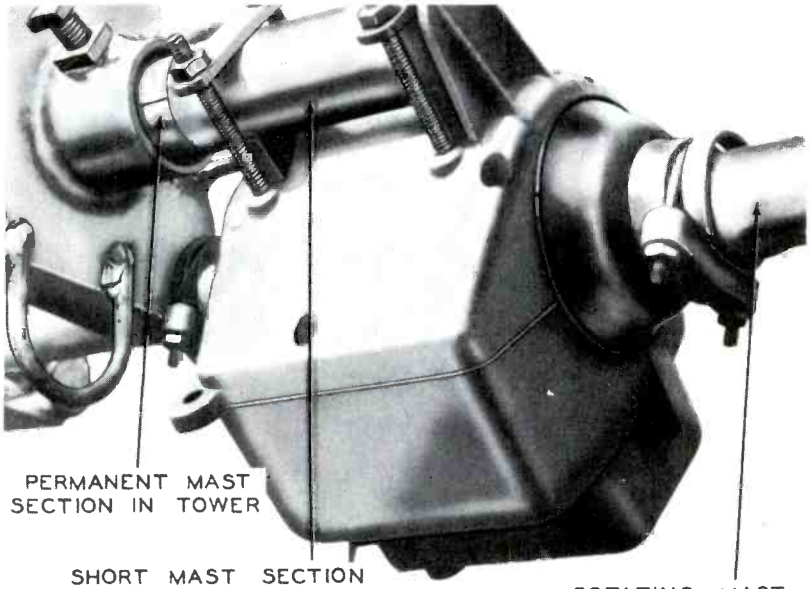


Figure 6. Rotator with Mast Sections in Place.

The car had been equipped with the necessary hitch. We had obtained antennas, transmission lines, converters and UHF receivers. It was decided to ship this equipment, except for the trailer and power plant, to the selected area so that we could leave on a moments notice and start our tests as soon as possible.

In addition to the aforementioned equipment, however, it was decided that we should send all tools and accessory equipment which we might find necessary to use during our tests. From the reports which were heard about the Portland area, they were more or less caught flat-footed and it was almost impossible to obtain replacement crystals, tubes, tools, or for that matter any equipment associated with television installation. Thus, a list of tubes used in all of our equipment was made and a spare tube kit was drawn up. The fuse problem was also taken into consideration. Operating at a remote point in the field, a tube or fuse failure might result in the loss of considerable time, so a spare fuse kit was drawn up and shipped with the equipment. All of the tools, drills, and alignment equipment were also included. We shipped standoff insulators, turnbuckles, guy wire, roof mounts, chimney mounts, and associated equipment so that we would not be held up in our operation due to the lack of any accessories.

Shortly after the completion of this preliminary work it became more and more evident that the originally selected area adjacent to Reading, Pennsylvania would not start operation on or near the date originally planned. We maintained frequent contact to keep abreast of developments there and held up the second shipment of material until we were more assured of an early UHF start in Pennsylvania.

To be assured of not missing other UHF starts, we contacted Jackson, Mississippi and Baton Rouge, Louisiana who had announced that they planned to come on the air in the near future. Contacts there were not positive of the time when the UHF transmitters would be shipped which, of course, was the big holdup in most all areas.

The break we had been waiting for came on December 18th when RCA shipped two transmitters - one to Atlantic City, New Jersey and the other to South Bend, Indiana. The next day two transmitters were shipped to York and Wilkes-Barre, Pennsylvania. Obviously, with the South Bend area being much closer to our home office, it was to our advantage to carry on our field survey at that area. We immediately called Mr. Al Kester of Commercial Sound & Radio Company in South Bend and made arrangements for the use of his place of business as a base for our operations. He was very happy to cooperate with us and told us that he would make space available for our equipment when it arrived. In the meantime we contacted Carl Barbey at the George Barbey Company in Reading and asked them to reship our equipment from there to South Bend, Indiana. We also made another shipment from our home office of the equipment we had accumulated after our first shipment to the Reading area.

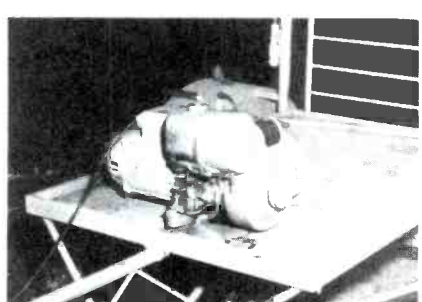


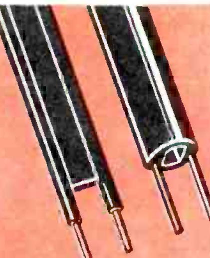
Figure 7. Power Plant Used for Field Operations.

The South Bend UHF station, which operates on Channel 34, came on the air the week-end before Christmas. It was decided that we would commence our actual field survey on January 5th. Prior to this time, however, we made a trip to South Bend and became acquainted with the personnel at Commercial Sound & Radio Company and WSBT-TV. We also made reservations at a motel north of South Bend to accommodate our field crew during our stay in South Bend. This completed our preparations for the trip.

By the time January 5th rolled around, I for one had become quite eager, and I think the same feeling existed in the rest of the field crew, to get under way. We loaded up the remainder of our equipment, coupled the trailer to our car, and left our home office at approximately 10:00 A.M. on the morning of January 5th. Figure 1 is a photo of our equipment and the field crew. As could be expected, during the month of January in this particular latitude, cold weather usually sets in and such was the case during the first week of our operation.

We arrived in South Bend at about 2:00 P.M. and went immediately to the motel. We then went to Commercial Sound & Radio Company to pick up some equipment so that we could get on the air that evening. The motel in which we stayed was very well suited for our operations. We had two units and it was possible to park our trailer-tower directly in front of these cabins during the night without obstructing traffic. The trailer-tower is shown at this location in Figure 8. This enabled

why install 2 when 1 will do?



THE VEE-D-X Mighty Match*

IS MIGHTY IMPORTANT FOR EVERY VHF-UHF INSTALLATION

* Lic. A. A. K. Pats. 2,422,458; 2,282,292; 2,611,086; others pending.

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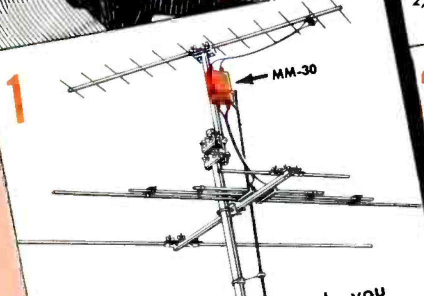
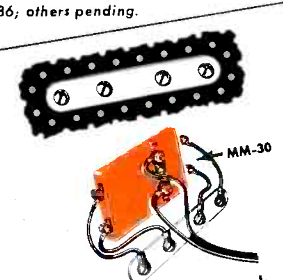


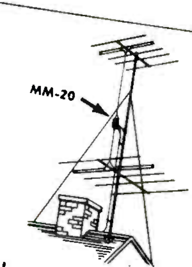
With the Mighty Match you can connect separate UHF and VHF antennas to a single transmission line.

2



With the Mighty Match you can quickly and easily terminate a single transmission line at the converter or TV set equipped with two sets of terminals – one for VHF and one for UHF.

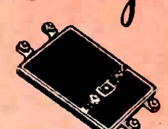
3



With the Mighty Match you can use a single transmission line between separate high and low channel VHF antennas.

Available 6 ways

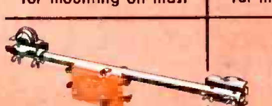
Plain MM-30 (red) for UHF-VHF



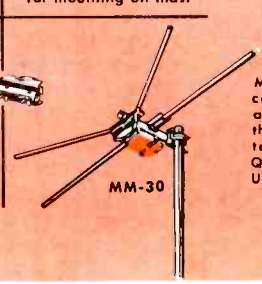
Plain MM-20 (green) for VHF only

SO-MM-30 (red) for VHF-UHF with standoff for mounting on mast

SO-MM-20 (green) for VHF only with standoff for mounting on mast



AB-MM-30 supplied with Universal Mounting Bracket for attaching UHF antenna to present VHF mast



MM-30 built into certain VEE-D-X antennas, such as the UHF "V" antenna, the Ultra Q-Tee and the Ultra Q-Tee S.

No television set owner wants two transmission lines when one will do. No installation man wants to waste time installing two when one will do. Mighty Match takes care of both situations the fastest, easiest, most profitable way for you. The patented* VEE-D-X Mighty Match is the only practical device yet perfected to make single transmission line VHF-UHF possible. Mighty Match has a double-barreled application – at the antenna – at the terminals on TV set or converter. The Mighty Match is extremely compact (only 3¼" x 2¼" x ¼"), thanks to its newly developed printed circuits that separate all channels (2-83) automatically. Is it any wonder that Mighty Match is the magic name for all UHF-VHF installations? **WARNING** — *Accept no substitute for Mighty Match. It is completely protected under A.A.K. Pats. 2,422,458; 2,282,292; 2,611,086.*

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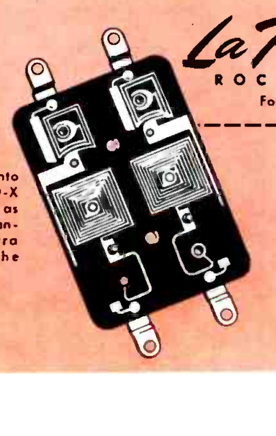

The Mighty Match printed circuits, shown at left, consist of six separate sections which are independently resonant at critical frequencies in the UHF spectrums. Electrical action of the filter is entirely automatic.

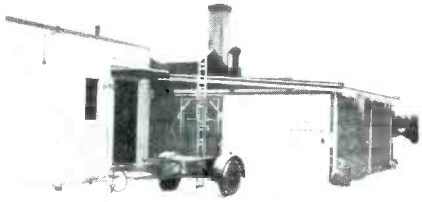

Figure 8. Trailer in Position in Front of Motel.

us to monitor the Channel 34 signal, as well as making any tests which would prove beneficial at that particular location. At this point we were approximately seven miles from the transmitter. We were north of South Bend, and the transmitter was southeast of the city, which meant that the signal actually came across South Bend proper.

At Commercial Sound & Radio, we found out that our equipment had not arrived from the Reading, Pennsylvania area, however, the equipment which we shipped from Indianapolis had been received. We picked out converters, receivers and sufficient antennas to start our operations. The first evening most of our tests consisted of visual checking to familiarize ourselves with the operation of the converters and UHF receivers. The first thing that we noted was the ease with which the equipment could be tuned. This was true of the UHF converters as well as the UHF receivers. It was no more difficult to tune the Channel 34 signal than it is a VHF channel. We were also favorably impressed by the apparent lack of drift in the UHF tuning systems. We, more or less, had envisioned the necessity of retuning during the first few minutes of operation, but such was not the case.

In order to clarify the procedures which were employed in making these tests, it might be well to point out some of the methods used in making our measurements. The test pattern time from WSBT-TV was from one to five in the afternoon. This gave us four hours of working time in the field. Since this is a comparatively short time, we tried to get set up at our particular location so that we could commence operation exactly at 1:00 o'clock. Prior to this time we would decide what type of testing was to be performed during that day. There were several basic tests made.

One was the testing of a given antenna, under as nearly identical conditions as possible, at various distances from the transmitter. This gave us a picture of the signal strength that could be expected at these various distances. By using the same antenna, lead-in and field strength equipment, it was possible to get a very good overall picture of the signal that could be expected at any given point.

Another plan of operation was to check a variety of antenna types at any given location. This enabled us to check the merits of a specific type of antenna as far as gain is concerned.

Still another plan was to determine what locations were exceptionally bad as far as ghost problems were concerned. In order to obtain this information, some personnel who had some experience in making installations were contacted to find out which areas were particularly bad in this respect.

Our plan of operation also included a check of several lead-ins under as nearly identical conditions as possible. In this way it was hoped that the merits or demerits of specific types of transmission line could be determined.

Each morning we determined which type of operation would be carried out during the day. This, of course, governed the type of antennas which we would take with us. After the antennas were selected, the short sections of mast, which were previously mentioned, were installed in the U clamps on the antennas so that a minimum of time would be required in changing the units in the field.

The following equipment was carried in the trunk of the car at all times for the purposes of monitoring the signal and making field strength measurements. A Motorola 17" receiver, in which we had installed a UHF converter kit, was used to check the quality of picture and also as a monitoring device. An RCA U2 converter was used in conjunction with a Simpson Model 488 Field Strength Meter to make relative field strength readings. We also incorporated a variable voltage transformer so that the voltage supplied by our portable power plant could be adjusted to the proper voltage. As a constant check on this voltage, a Hickok Model 900B Watt-Amp.-Meter was permanently connected into the circuit.

At any of the test locations, all that it was necessary to do, as far as our electrical circuits were concerned, was to start the power plant and plug in the extension lead. All of the equipment was left on, eliminating the necessity of turning off and on the individual pieces of equipment. A view of this equipment

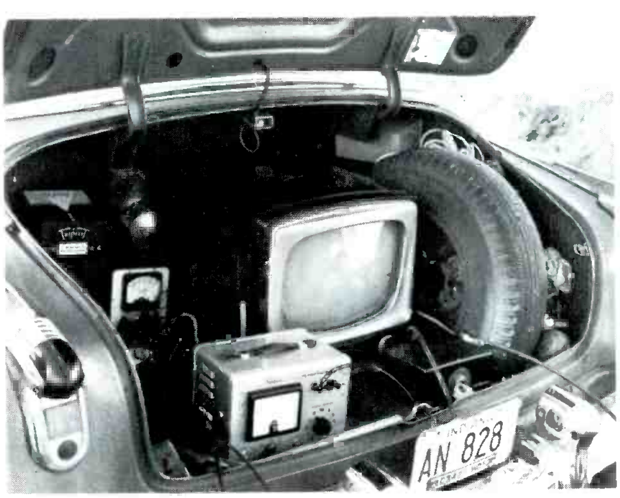

Figure 9. Testing and Monitoring Equipment Setup.

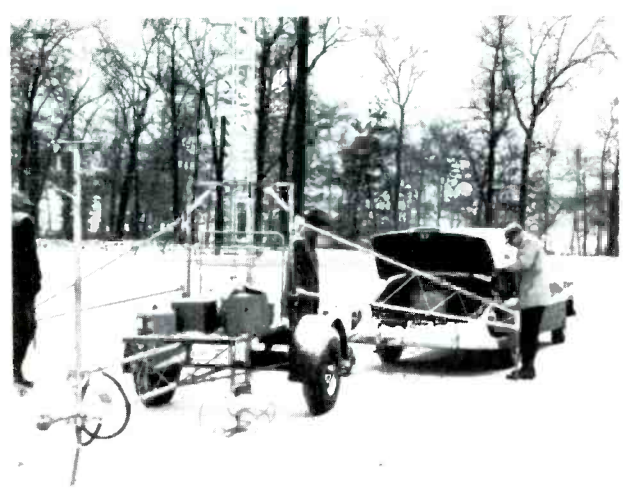

Figure 10. Testing Under Adverse Conditions.

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setup is shown in Figure 9. Incidentally, the item at the rear of the trunk which looks like a coffee pot is not a UHF antenna. It actually is a coffee pot, which we carried along for "thawing out" purposes. The weather during the first week of operation was extremely cold.

On the first full day of field operations we were plagued by a snowfall which practically covered our instruments at times. This test site is shown in Figure 10. All of us on numerous occasions have heard of snowy pictures, but frankly this is the first time that we had experienced a situation where this was literally true. Although our operations on this particular day were hampered to a great extent, we did gain sufficient experience to show us what equipment was necessary for field operation, and many short cuts were discovered that enabled us to do a quicker, more efficient job.

It was decided that readings should be taken at several antenna heights, at each position. Readings were taken at each positioning of the cross-members on the tower. This resulted in the taking of 14 measurements for each particular test. By doing this it was hoped that we could get a pattern of signal strength versus antenna height. In order that the proximity of the lead-in to any object did not affect our readings, we had one man hold the lead-in with an insulating strip. All of the lead-ins which we used were approximately 60' in length. This allowed plenty of length, even with the tower at full height.

On Wednesday night of the first week we experienced exceptionally bad weather. There was a great amount of freezing rain and upon arising in the morning we found that our tower was completely iced up. Each evening before retiring we cranked the antenna down, although we left it in a vertical position. On this particular night, had the antenna been at full height, the runners would have been iced up so badly that it would have been impossible to let the antenna down. The iced condition can be seen in Figure 11. Since the antenna was at the lower level there was sufficient clearance to hinge the antenna tower. We then set about breaking off the ice, as is shown in Figure 12.

In order that the editorial staff could start compiling our data as quickly as possible, a report was sent back to our home office each evening on a wire recording. Special test data forms had previously been designed and the data for these reports were included on the wire. In addition to speeding up the transfer of information, the wire recordings also served another purpose. Since the recordings were made each day, any impressions that we might have had as a result of a day's tests were permanently recorded. Thus, after we returned, by playing back these particular recordings, it was possible to relive our experiences for that particular day and we were less apt to forget, or lose any opinions or impressions gained from that day's operations.

The portable power plant proved to be a very valuable piece of equipment. This allowed us to be completely self-sufficient, since we did not depend upon power from any other source. We could make tests at any particular position that we desired. During the first week of operation the power plant was not permanently mounted on the trailer. Thus, it was necessary at each stop to untie it and remove it from the platform. We usually set it several feet away from our operation to reduce the noise level. However, the second week, in order to cut down on the time required in mounting the power plant on the trailer and taking it off at each stop, the unit was permanently mounted on the platform of the trailer. Thus, all that was necessary to do at each stop, was to start the engine and plug in the extension cord. Except for a little hard starting on a couple of occasions, we experienced no difficulty whatsoever with the power plant. Of course, this hard starting was to be expected since the temperature was around 3 degrees, at times.

One of the things that concerned us, in connection with the portable power plant, was the possibility of a variation in line frequency affecting our measurements. In checking the frequency under a constant load, it was found that it was within one cycle, and since this condition exists sometimes on local operation when viewing a network program, no more difficulty was experienced than would be encountered when viewing this type of signal. Since the frequency of operation was slightly different from that of the line frequency at the transmitter, slight hum bars were noticed on some occasions. These, however, did not affect our readings in any way.

Since some of our readings were made on very narrow roads, it might be interesting to point out the methods which we employed to prevent blocking traffic. After selecting the test sight, the trailer was unhitched from the car and turned at a slight angle which placed the front end of the tower at the side of

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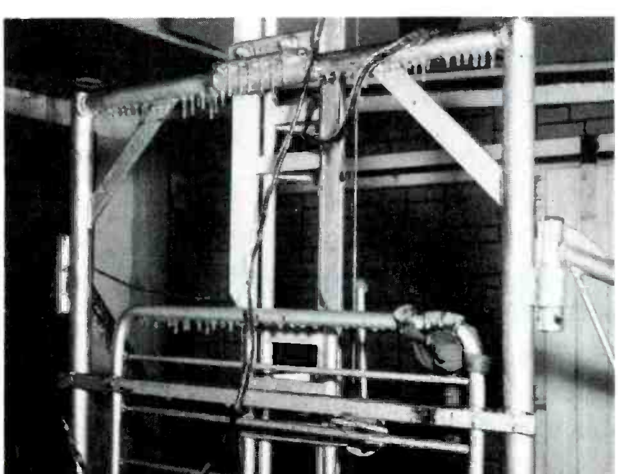

Figure 11. Ice Formation on Trailer.

Figure 12. Chipping Ice.

Which Antenna? for UHF

A PF INDEX ... COVERAGE

by Glen E. Slutz
and C. P. Oliphant

Interest is growing rapidly in the new UHF band of television broadcasting. Many questions are being asked, particularly by service technicians who work in areas which now have, or soon will have, one or more UHF television stations on the air. Facts pertaining to the installation of antennas are frequently desired. Here is a list of some of the questions along this line:

What type of antenna is best for UHF?

What are the difficulties encountered in making an installation for UHF?

How does the terrain, or structures in the area surrounding the receiving antenna, affect the reception?

Does the height of the antenna make much difference in the strength of the received signal?

What conditions govern the choice of using a strictly UHF antenna or an all-channel VHF-UHF antenna?

At what distance from the transmitter is best reception obtained?

What is considered the fringe area of UHF?

Is there much ghost trouble?

The answers to these questions and many others will be fully arrived at as working experience in this new field is gained. In this report an endeavor has been made to use the experience gained during our field trip to South Bend, Indiana, as the basis for answering as many of these questions as possible. A two week trip, of course, is not a real substitute for months of installation experience, and it is expected that the ideas presented here will receive their share of amendments as time goes by.

The different makes of antennas which were field tested on the trip are listed in Chart A. Many tests were made on the comparative performance of these antennas at several locations, and the data has been condensed into graphs and written evaluations. The antennas were of many makes and models as can be noted from the chart. They were selected principally for difference in design. Samples of each of the following general styles were chosen: V-dipole, rhombic, Yagi, conical, fan dipole, and colinear. (For a further description of each of these types, reference may be made to "UHF Antennas" in Photofact Index and Technical Digest #36 for January-February, 1953.) In addition there were one or two antennas which cannot be readily classified in these categories.

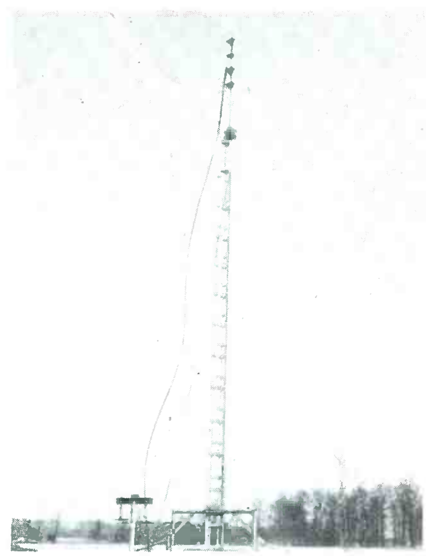

Figure 1. Portable Antenna Tower Showing Rotator Used for Orientation of Antenna.

Figure 2. Lead-in Being Held Above the Ground During a Typical Test.

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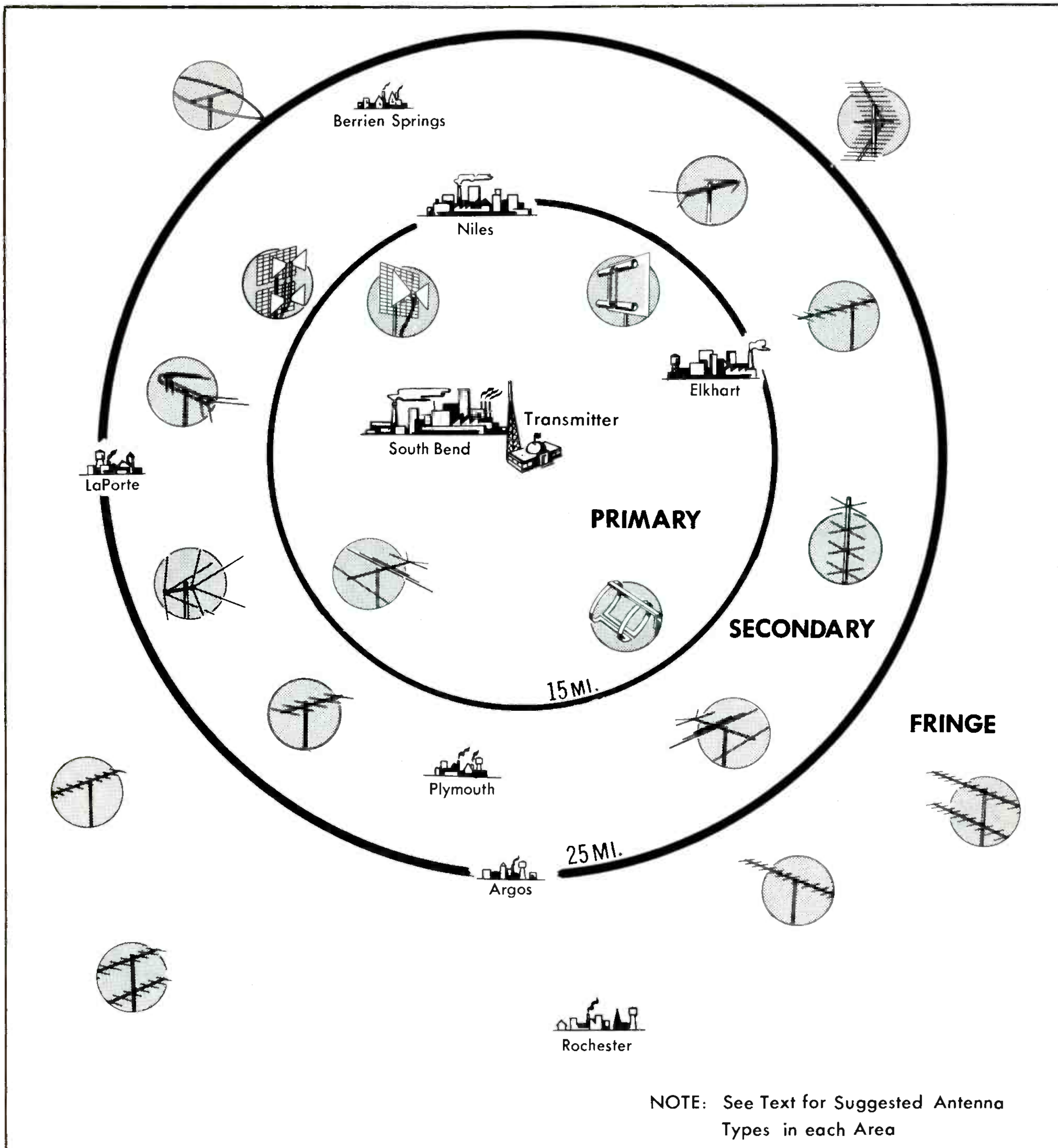

Figure 3. Drawing of the Three UHF Service Areas in the South Bend Territory.

Nearly all the antennas in Chart A were tested at various heights above the ground. Furthermore, the directivity characteristics of several were investigated through the use of a rotator, visible in the photograph of Figure 1. The rotator also facilitated the tracking of strong ghost signals when they were encountered.

Lead-in losses were kept nearly constant by using the same lead-in in all of the antenna comparison checks and also by keeping the line away from both the tower and the ground. Figure 2 shows the lead-in being held above the ground during a typical test.

The measurements of signal strength were obtained through the combined use of an RCA UHF converter, Model U-2, and a Simpson field-strength meter, Model 488. Field-strength figures given in this report should not be construed as absolute signal levels in microvolts per meter; rather they are figures of comparison only.

A television receiver equipped for UHF reception was used to check the quality of the signal being received on each antenna tested. The receiver was especially valuable for ghost tracing.

Tests were made at various locations in and around South Bend, Indiana. For the purpose of grouping these locations, the South Bend

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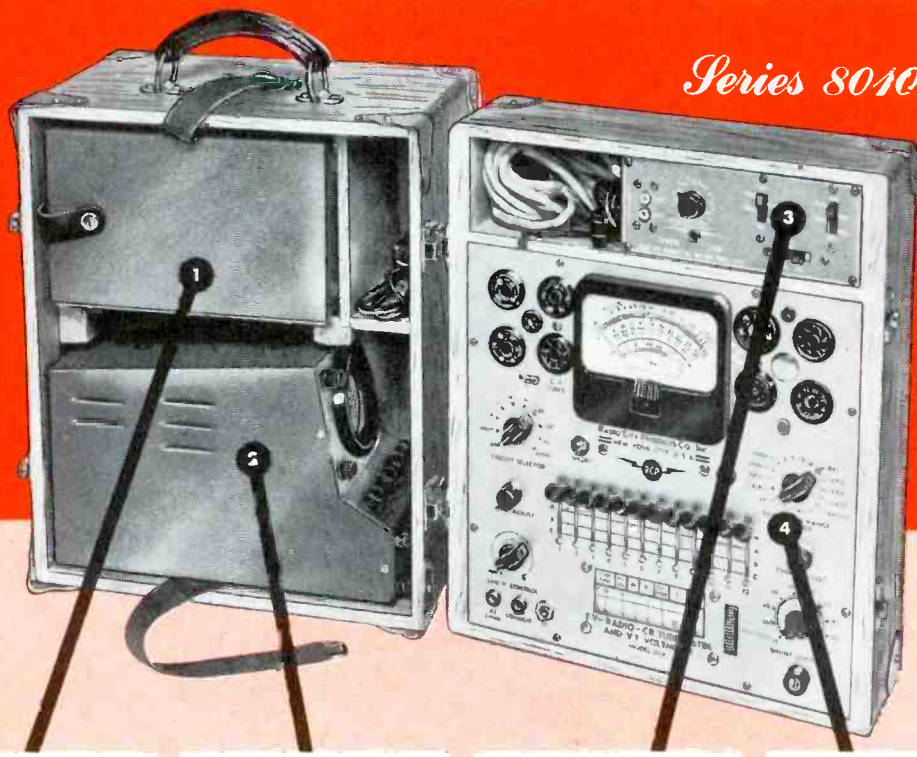

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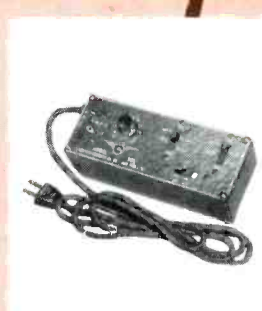
MODEL 533M



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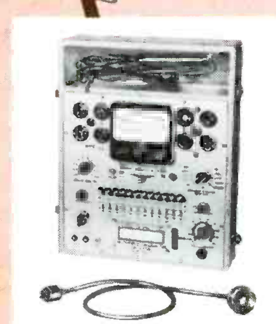

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V-beam (JFD, Model UHF 500),
V-dipole with VHF antenna (Vee-DX Ultra Q-Tee).

Rhombic

Rhombic (Tricraft, Model U-1).

Yagi

Yagi, 8 element (Vee-DX, Model LJU).
Yagi, 12 element (Vee-DX, Model LLJU 28-39).
Yagi, 5 element (RMS, Style 5-34).
Yagi, 8 element (RMS, Style 8-34).
Yagi, duplex (Telrex, Model 300).

Conical

Conical, 4 bay stacked (Taco, Catalogue #3005).
Conical V-beam, double (Telrex, Model 400).
Conical V, single (Telrex, Model 1X-500).

Fan-Type

Corner reflector (Walsco, Model 4450).
Bow-ties with screen reflectors, stacked (Walsco, Model 4402).
Bow-tie with screen reflector (Channel Master, Model 403).

Other

Colinear (Vee-DX, Model CAU).
Clover V-beam (Telrex, Model 100).
Bat wing (Telrex, Model BW-1).
Dipoles with screen reflector, stacked (Radiart, Model U-4).
Circular folded dipole (Rytel, Model RDO-1).

Chart A. List of Antennas Checked at South Bend.

territory has been divided into three major areas (See Figure 3). These will be referred to as the primary service area, the secondary service area, and the fringe area. The primary service area is that which is within a 15 mile radius of the transmitter. The secondary service area is designated as the area between 15 and 25 miles from the transmitter. The fringe area is beyond the 25 mile limit. The division of this territory in the above manner may not necessarily correspond to the division made by the management of station WSBT-TV or the manufacturer of the transmitter. It was arrived at, however, after extensive testing, which

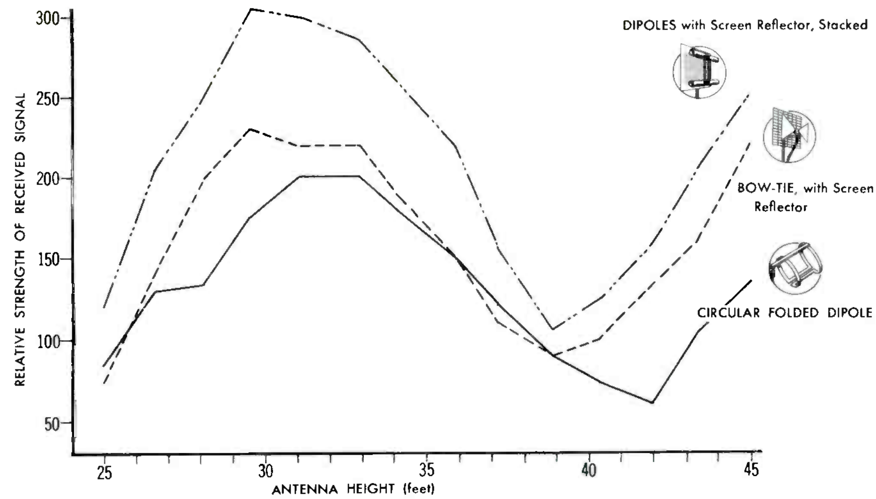


Figure 4. Relative Strength of Received Signal Versus Antenna Height at Position P-1 (1 Mile).

indicated what strength signal could be expected at various distances.

Primary Service Area -

A total of five test locations were established within the 15 mile circle in Figure 3. The first of these, which we shall call Position P-1, was about a mile from, and within sight of the transmitting tower. The country was quite open and rural in nature; there were no large buildings or reflecting objects nearby. As was expected, the signal at this point was very strong. We checked, three antennas at Position P-1 (1 mile). These antennas were the stacked dipoles with screen reflector (Radiart, Model U-4): the bow tie with screen reflector (Channel Master, Model 403); and a circular folded dipole (Rytel, Model RDO-1). The results are graphically pictured in Figure 4.

Notice especially the variation in signal strength at different antenna heights above the ground. This phenomenon was the significant feature of the test at Position P-1, (1 mile). There are at least two possible reasons for the variation. One might be the effect of the minor lobes in the radiation pattern of the transmitting antenna; these minor lobes are very often responsible for "dead spots" in the immediate vicinity of a transmitter tower. Another reason could be a cancelling effect between the direct signal and the signal reflected from the surface of the ground.

The picture showed some evidence of smear at Position P-1, (1 mile). This condition may have been due to high AGC voltage altering the frequency response characteristics of the IF strip in the receiver. The difference in the signal pick-up of each of the antennas is not particularly important since the field-strength of the signal was so high. It may be said, however, that all three antennas operated very satisfactorily.

A further check was made on the radiation pattern of the signal by moving the antenna tower several feet at right angles to the transmitter. A sequence of readings was taken at different heights here, and when compared with the previous readings no appreciable difference was noticed. It would seem, therefore, that the vertical field strength pattern remained fairly constant at a given distance from the transmitter.

Positions P-2 and P-3 were chosen with the problem of reflections in mind. Both locations were near a large gas storage tank in the city of South Bend. A sketch of the area has been drawn in Figure 5 and the approximate distances involved have been indicated.

Position P-2 was in the midst of a residential district about three miles from the transmitting tower. The gas tank was situated nine city blocks away in nearly the opposite direction from the transmitter. There had been complaints from residents of this neighborhood concerning trouble with reflected signals from the tank. In conducting the check at position P-2, therefore, we were less interested in comparing the gains of the various antennas and more interested in determining ways

♦ ♦ Please turn to page 97 ♦ ♦

A PF INDEX UHF COVERAGE

Lead-ins

by W. WILLIAM HENSLER

The transmission line can be considered as a necessary evil. It is necessary in that it must couple the signal, which is picked up by the antenna, to the receiver. It is an evil since it provides attenuation of the signal. The problem which must be overcome in any installation is to provide this coupling with the least amount of signal loss that is possible.

The frequencies employed in UHF transmission result in greater losses in transmission lines than are experienced in VHF. With this in mind, several tests were performed during our field survey to determine what types of line could be recommended for UHF use. These tests fell into three main categories which are as follows: (1) Comparison of losses with several types of lines, each having the same length and tested under as nearly identical conditions as possible. (2) The effect of adverse weather conditions on each of the various types of lines. (3) The effect of mismatch between the antenna and transmission line and/or between transmission line and receivers.

Three basic type lines were employed in these tests. These were the punched 300 ohm flat twin-lead, the tubular twin-lead and the open wire transmission line. Figure 1 shows samples of these types. Type A in Figure 1 is the punched 300 ohm flat twin-lead, B, C and D represent the tubular twin-lead types and E is the open wire transmission line.

As would be expected, the test performed under category 1 followed very closely the readings which would be obtained by calculating the losses using the published attenuation figures for each type of line. Most open wire lines are stated to have an attenuation of around 1 db per 100 feet at the center of the UHF band. Our tests verified this low attenuation figure.

There are several disadvantages to the use of this line which will be brought out later. However, it should be said at this time that in those cases where it is necessary to run an exceptionally long lead, this type line should be employed. Such a condition would be where a residence may be directly behind a cliff or hill, making it necessary to mount the antenna at considerable distance from the home. By using the open wire line for this application, a minimum of attenuation would be experienced.

The twin-lead providing the least attenuation of the remaining types is the punched 300 ohm flat twin-lead. This lead proved to be the easiest to handle due to its small size and flexibility. It is easy to mount and since insulators are readily available for this type of line, no difficulty is experienced in this respect. Several disadvantages, however, are evident in the use of this type of lead-in. These will be discussed later under adverse weather condition tests.

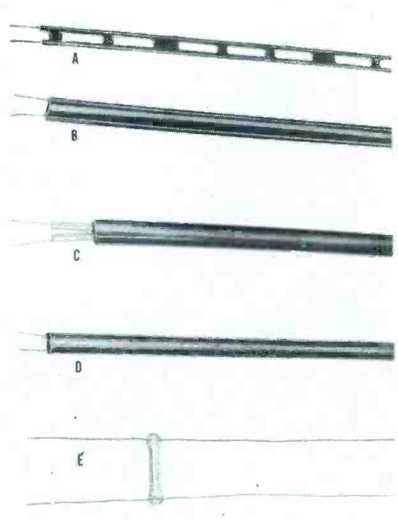


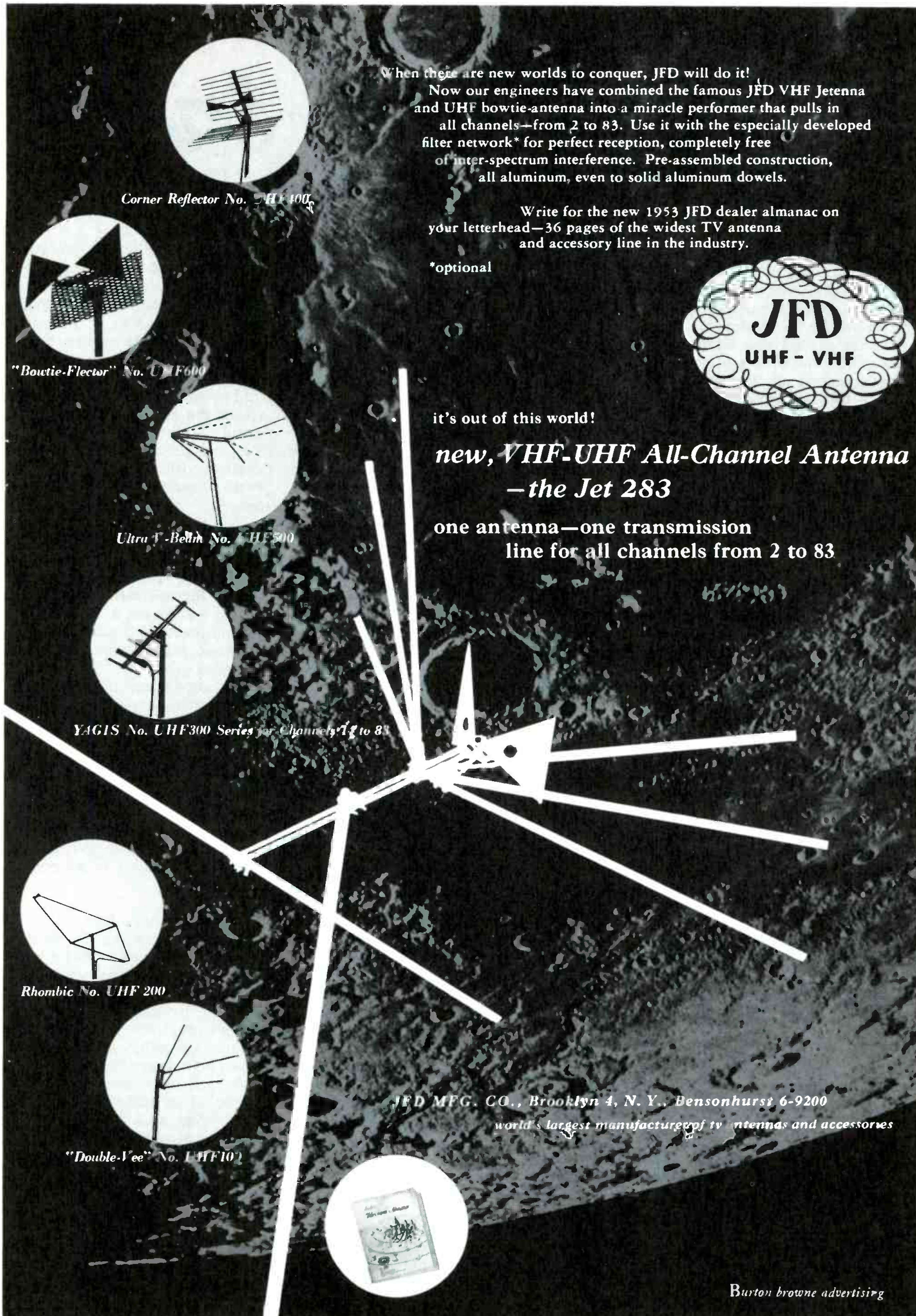
Figure 1. Five Transmission Lines: (A) Punched 300 ohm Flat Twin-Lead (Don Good, Inc.); (B) 300 Ohm Tubular Twin-Lead (Amphenol); (C) ATV-270 Line (Anaconda Wire and Cable Co.); (D) 300 Ohm Tubular Twin-Lead (Atlantic Wire and Cable Co.); (E) Open Wire Line (T.V. Wire Products Co.).

The tubular twin-lead types, being represented by B, C and D in Figure 1, have a slightly greater attenuation than that of the previously mentioned type. Again this was substantiated by tests made during our field survey. This type of line is very rugged and is much less affected by aging and weather conditions than the punched 300 ohm flat twin-lead. It is more difficult to handle, however, at the time of installation. This will be discussed at greater length under Installation Procedure.

Much data has been published concerning the effects that wet lead-in has on UHF reception. In order to present factual data on this subject, we performed tests as was previously mentioned under category 2. Since we did not have a means of artifically aging the line, most of our tests were made using a clean, dry line versus a wet line, keeping all other factors constant. Knowing that reception during a rain would differ from that during normal conditions, it was decided to set up an artificial wet line test. In this manner, the effect of wetting the line would introduce the only variable in our readings. The following procedure was employed to perform these tests.

A clean, dry line was connected to the antenna, the antenna was properly orientated and a relative field strength reading was taken. The lead-in was then disconnected at the field strength meter end and water was poured over the line for 25 feet of its length. Another reading was then taken which indicated the additional loss caused by the wet line. The line was then wiped dry and a reading was again taken in order to compare the attenuation with that of the clean, dry line.

This test was first performed on the open wire line but produced so little difference between the wet and dry conditions that generally speaking it can be said that the attenuation provided by open wire line is the same under both wet and dry conditions. Just recently sev-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eral companies have announced an open wire line with fairly close spacing. This type line was not available to us at the time our field survey was conducted. It would appear, however, that the attenuation caused by a wet line would increase as the spacing of the wires decreased. Even so, the attenuation would be far less than a line having a solid spacer.

Our next test was made on the punched 300 ohm flat twin-lead. A clean, dry lead-in was installed and a reading of 350 was obtained. We then wet 25 feet of the line and a reading of 165 was obtained. We then wiped the line dry and found that the reading increased to 240. As can be seen, there is a considerable reduction in signal when the line is wet. The loss, which is experienced with this type of line when wet, is brought about by the fact that the water can actually be deposited between the two lines. This places the moisture in the concentrated field existing between the two lines, resulting in a greater loss. In an actual installation dust, dirt and soot can deposit on the line in such a manner as to increase the attenuation. It is probable, however, that the attenuation is less than that experienced in the unpunched, flat twin-lead, since there is much less area for the deposits to occur. The deficiencies just sighted are the only disadvantages to the use of this particular line, with the exception of what might happen as far as attenuation is concerned with normal aging of the line.

It would seem, then, that this line would be suitable for UHF use where it is possible to keep the line clean and dry. Such a condition might exist where a comparatively long length of line is required inside a building or structure of some sort. Of course, it would not be practical to use a different type line for the external portion of the lead-in and then use only a few feet of the flat line to complete the installation. The stiffness, however, of some of the other types of line, particularly the tubular twin-lead, makes it rather difficult to handle inside the home. This brings up a point whereby the use of the punched 300 ohm line could be used to an advantage. In those cases where a plug-in arrangement is employed for connecting to the antenna service, this punched line could be used between the socket and the TV receiver since, for the most part, it will be kept clean and dry. It would be much easier to conceal and is less apt to be broken when the TV set is moved for housecleaning purposes or to achieve a better angle for viewing.

The next wet line test was performed on the tubular type twin-lead. The same procedure as previously outlined was used. A length of clean, dry tubular twin-lead was installed and a reading of 300 was obtained. Twenty-five feet of the line was then wetted down. This resulted in a reading of 260. We then wiped the line dry and the reading returned to 300. No special care was taken in drying the line. The fact is, it was a single wiping process. We merely held a towel tightly around the line and pulled the line through only once.

It is interesting to note that in the case of the tubular twin lead the reading returned to the original reading after the line was wiped dry. Such was not the case with the punched flat line. The reason for this is fairly obvious. It was impossible to completely get the line dry on the edges of the punched holes. Another point was noted, in that the water had a greater tendency to run off the tubular line. In the case of the flat line, the water would collect in the punched out sections, which, of course, further decreased its efficiency. In summarizing the tests just outlined, it is apparent that the open wire and tubular twin-lead transmission lines are less affected by foul weather conditions. Thus, any installation which will be subjected to such conditions should employ a tubular or open wire type lead-in.

On those installations where fringe area UHF reception is the prime objective, it is recommended that the lead-in be wiped clean at regular intervals, and particularly if a decrease in signal pickup is noted. Such a cleaning process is especially recommended in the Spring in those areas where cold weather is experienced in the winter. Such installations would be subjected to soot deposits from winter heating plants which might be detrimental to optimum reception conditions. A more regular cleaning procedure might be required on installations that are subjected to more abnormal conditions, this being where excessive dust or dirt might be deposited on the lead-in itself. The effect of these dirt deposits can only be definitely determined with experience. Any increased attenuation might, in fringe area locations, mean the difference between the satisfactory or unsatisfactory reception of the UHF signal. The cleaning of the transmission line is a point to keep in mind, particularly if it is necessary to repair any portion of the antenna installation, such as the antenna itself, or the rotator. If such work need be done, the line can very easily be wiped clean at that time.

The tests performed under category 3, that of checking the effects of mismatch, were rather limited. We did make a few tests, however, to determine if there was a noticeable effect in using a transmission line that is not matched to the antenna and/or the receiver. Practically all of the antennas which we used were designed for 300 ohm balanced operation. Since most of the lines we employed were of this type, no comparative tests could be made using the 300 ohm lines. We did, however, employ a 450 ohm open line and found there was considerable losses due to mismatching between the transmission line and the antenna. To sight an example, at one test position the open wire was connected to an antenna designed for 300 ohm operation. No attempt was made to provide for matching of the line to the antenna. The reading obtained with this setup was just one-half of that obtained when using a 300 ohms tubular line which, of course, was properly matched. Considering the greater attenuation afforded by the tubular line over that of the open wire line, the signal obtained under this mismatch condition could have been more than doubled by properly matching the line to the antenna and receiver. The amount of loss, of course, is dependent upon the degree of mismatch, the greater the mismatch, the greater the loss.

It should be pointed out that all of the previous tests were made without regard to losses caused by the proximity of the lead-in to the building or mounting accessories. These are covered in the next section under Installation Procedure.

INSTALLATION PROCEDURE -

For the most part, the installation of the previously de-

♦ ♦ Please turn to page 111 ♦ ♦

Figure 2. Insulator Standoffs Mounted on the Tower.

the USE of UHF Converters

by MERLE E. CHANEY

How well do UHF receiving units operate in practical applications? Is the picture and sound comparable to that provided by VHF transmission? How about drift and ease of tuning? Will UHF TV assume a position comparable to that held by VHF? These and innumerable other queries continually arise as the result of the accelerated pace of UHF in the television field. It was hoped that our experience in using the equipment during our South Bend field survey would give substance to any answers pertaining to these questions.

Our experiments involving the use and operation of UHF receiving devices essentially took two forms. The first was concerned with operating the equipment under conditions similar to those experienced in the homes. Figure 1 illustrates this type of operation. The second phase of the tests were made under less favorable conditions. These were conducted entirely out-of-doors, employing the required portable equipment. Figure 2 shows one of the test setups employed in the field.

The first phase of the tests was made at a location seven miles from the transmitter. In order to make the tests complete, we had on hand a variety of receivers and UHF converter units. Figure 3 shows some of the converters and receivers which were used.

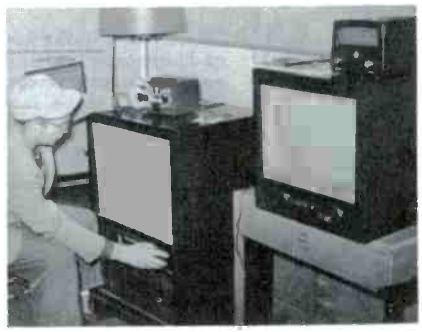


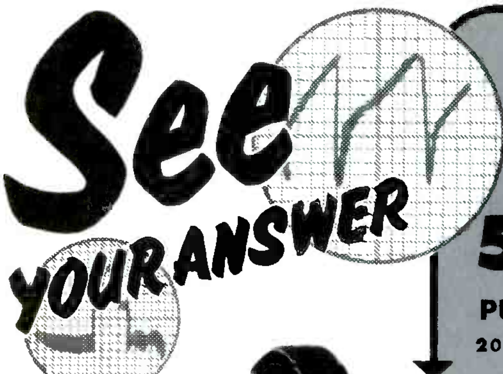
Figure 1. Operating UHF Receiving Equipment.

For our tests, we also installed UHF tuner kits in applicable receivers and compared their operation with factory installed units. Comparison was further noted between receivers using built-in UHF tuning units and those requiring the use of an external converter. UHF strips were added to those sets that incorporated tuners which would accommodate them. The sets were then checked under actual operating conditions. In this manner we were able to employ several types of UHF receiving devices, set them up for operation, familiarize ourselves with their operation and individual characteristics, and note their effectiveness in providing UHF reception. Without qualification, we found that every combination provided highly satisfactory results.

This now brings up a point as to what system should be employed to receive UHF signals. Receivers using turret-type tuners for which UHF strips are available, obviously can utilize this system for UHF reception. It exhibits certain advantages from the standpoint of economy and simplicity of operation. A strip can be placed in the tuner, its oscillator tuning slug adjusted as required, and thus provide operation having the same ease of tuning as exhibited in VHF. Additional UHF strips can be substituted as signals from other UHF stations are made available. The limitation to this system, however, results from the fact that there is a maximum number of strips which can be added to a given tuner. However, it is not expected in the near future that the number of stations providing service in only one given area will exceed

Figure 2. Field Testing UHF Receiver Using Portable Equipment.

Figure 3. Some of the Converters and Receivers Employed During Tests.



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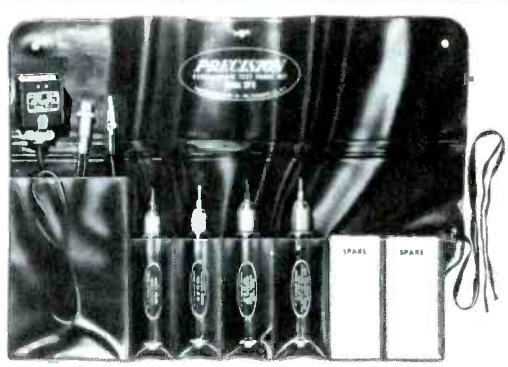

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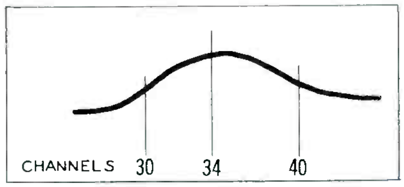
the maximum number of strips and therefore this limitation is not a major factor at present.

Receivers capable of accommodating UHF kits were found to function very well. Extra switching is frequently employed with the kit-type units to provide switching from VHF to UHF reception. The switch may be on the front of the cabinet in the form of a separate control or concentric with a front panel control shaft. In some cases the switch may be placed on the back cover of the receiver, close to the top or side for convenient access to control its operation.

In most of the applications of UHF tuner kits, the design is such that the UHF output is applied to the VHF tuner input by means of a switching device, with the VHF input tuned to receive a channel 5 or 6 signal. The VHF tuner is switched to either of these channels upon which no signal is available in that given location. To facilitate this operation, and to insure that either channel may be employed, the converter output usually is designed with a 12 megacycle passband characteristic. Thus comparable reception should be obtained at either channel 5 or 6 position of the VHF tuner.

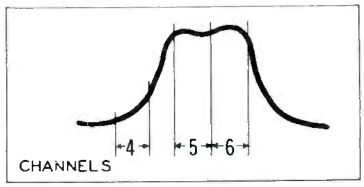
For the purpose of experimentation, we attempted to receive the converter output at channels 4 and 3 position of the VHF tuner. It was found that, in strong signal areas, picture and sound were received, but of inferior quality and the gain was down over that provided in channel 5 or 6 position. Since such a circumstance may be encountered in practice, particularly when the user is unfamiliar with the operation of the units, it is advisable to insure that the customer be provided with proper operating instructions.

In order to see clearly why reduced efficiency results from operation of the converter into an improperly tuned VHF tuner, observe the illustrations in Figures 4A and 4B. Note the broad response characteristic of the preselector as compared to the narrow passband of the output stage. Thus, the preselector circuits, in most instances, have sufficient band pass to allow for a moderate amount of mis-tracking with but little attenuation of the incoming signal. Thus, by means of the converter tuning control, it is possible to shift the resultant beat or IF frequency over a wide range. However, the fixed tuned output stage of the converter can accept, without



A RESPONSE OF PRESELECTOR.

NOTE BROAD PASSBAND CHARACTERISTIC



B RESPONSE OF CONVERTER OUTPUT STAGE

NOTE THE NARROW PASSBAND CHARACTERISTIC

Figure 4. Typical Passband Characteristics of Preselector and Converter Output Circuits.

attenuation, only frequencies falling within the frequency spectrum of channels 5 and 6.

In line with the experiments on converters and receivers, we arrived at several conclusions. One of these concerned stability. Under actual operating conditions, we observed the stability of the units under test to be apparently equal to that of VHF tuning systems. The time necessary for a UHF unit to stabilize itself was only very slightly longer than the warmup time of the receiver. We felt, therefore, that stability did not present a problem to the degree as to noticeably effect satisfactory UHF TV reception. All receivers used for these test, however, were of the intercarrier type which are not as critical to oscillator drift as a receiver employing a separate sound channel.

Another item of concern which we encountered during our tests is one of greater importance than indicated at first glance. It has to do with the connecting of antenna lead-ins to the converter and receiver. First of all, most of the receiving systems now employed for VHF-UHF reception utilize separate terminal connections for VHF and UHF input leads. This presents no problem when two lead-ins are used. However, as is frequently the case, it may be desirable to use a single lead-in from the antennas to the receiving equipment. This is a feature of most of the all-channel antennas, and from the standpoint of simplicity, economy and appearance is very desirable. In order to connect this single transmission line to the VHF and UHF inputs, it is usually necessary to employ a matching arrangement. One such unit currently available is the VEE-DX "Mighty Match*". If a unit of this nature is not employed, it would be necessary to manually switch the common antenna lead to VHF or UHF terminals depending upon the service desired. These matching units automatically perform the switching electrically. Drawings of this antenna matching unit are shown in Figure 5. When employed at the antenna itself VHF and UHF antennas may be matched to a single transmission line. At the receiving equipment another matching unit is inserted to electrically differentiate between the UHF and VHF signals. Observe that there are 6 terminal points on the matching unit. Their function is illustrated by comparing their purpose to that of a double-pole double-throw switch. The common lead-in is connected to the center terminals while VHF leads are connected to one end and UHF leads to the other.

Figure 6 shows two ways in which transmission lines may be connected to a VHF-UHF television receiver. Figure 6A is the usual hookup employed when two lines are used to feed from separate UHF and VHF antennas. Figure 6B shows the connections needed when a common transmission line is employed. The matching unit electrically connects the desired input to the appropriate terminals of the receiver.

Figures 7A and 7B illustrate similar methods of connecting a common or separate lead-in to the receiving equipment when a converter unit is employed in conjunction with a VHF receiver.

In many areas, it is desirable to employ a booster for VHF reception and a converter unit for UHF reception. The drawings in Figure 8 show the connections required be-

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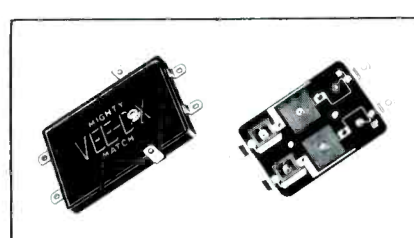
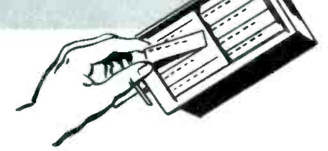


Figure 5. VEE-DX Antenna Lead Matching Unit.

A PF INDEX

UHF COVERAGE STRIP installation



by W. WILLIAM HENSLER

THE OPERATION AND INSTALLATION OF STANDARD COIL UHF STRIPS

For several years many television manufacturers have been advertising that their sets are adaptable to UHF reception. Most of these employ a turret type tuner which allows for the removal of VHF strips and the insertion of UHF strips. The Standard Coil tuners, all of which are of the turret type, is such a tuner.

Those who have not had actual experience, whether it be a consumer or the service technician, might have a tendency to adopt a "show me" policy concerning these claims. Since so much must be accomplished by these "little magic" strips, such thoughts can be considered as normal. Frankly, our field crew felt somewhat the same way and we were quite anxious to install some UHF strips so that we could check the procedure as well as the final operation. In order to do this we acquired some Standard Coil UHF strips and made installation in receivers as well as in our Simpson 488 Field Strength Meter.

Before describing the actual installation procedure, it might be well to analyze the circuits employed in the strips themselves and associate them with the circuits in the tuner itself. First of all the strips provide for a double conversion process to obtain the desired IF output. Since only one section of the 6J6 oscillator-mixer tube can be used as an oscillator, this double conversion process must be accomplished through the use of one oscillator. This is done by selecting the desired harmonic of the oscillator to perform the first conversion while the fundamental of the oscillator facilitates the second conversion. A schematic of the antenna and oscillator-converter strips is shown in Figure 1. Note that the only connection, other than those accomplished through the turret connector contacts, is the coupling link between the harmonic generator (R6, C9 and 1N64) and the first mixer crystal. This connection is accomplished by means of a prong on the oscillator converter strip which engages a small clip on the antenna strip. Care must be taken to see that this connection is made when installing the strips. This will be covered in greater detail later under the installation procedure. The connecting prong can be seen in Figure 2 which is a photograph of a set of 34R UHF strips.

This brings up a point of great concern on any installation. What strips need be obtained for a given Standard Coil tuner? First of all, as would be expected from our experience with VHF strips, the number (such as 34 in the above mentioned strips) indicates the channel number for which the strip is designed to operate. The letter indicates into which tuner that the strip is designed to be installed. For example: The 34R is designed to operate on channel 34 in a tuner which incorporates "R" strips. Thus, the strip that is installed in a tuner should bear the same letter as those originally used. There is one exception to this, and that is the case of those tuners which employ "F" strips. These tuners require the use of UHF strips lettered "G." Chart "A" may be used as a guide to determine the proper UHF strip required for the various Standard Coil Tuner models.

Some of the early model Standard Coil tuners did not have a letter designation on the coil strips. In the event that such a tuner is encountered, check to see if the tuner series number is stamped on the ends or sides of the tuner. If not, check the manufacturer's tuner part number, and order strips from the

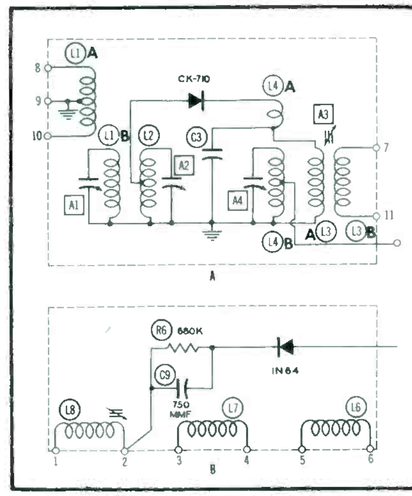


Figure 1. Schematic of Standard Coil UHF Strips. (a) Antenna Strip. (b) Oscillator Converter Strip.

manufacturer's distributor for that specific tuner.

Another thing which will be of great importance to the service technician is the merchandising set-up of the various receiver manufacturers for distributing these UHF strips. Many manufacturers assign a part number to their tuners which may or may not correspond with the Standard Coil tuner model number. If this is the case, UHF strips should be ordered from the manufacturer's distributor, using the receiver manufacturer's tuner part number. In some cases the receiver manufacturer may assign an actual part number for these UHF strips. Obviously in this case they can be ordered under this assigned part number. Regardless of the buying

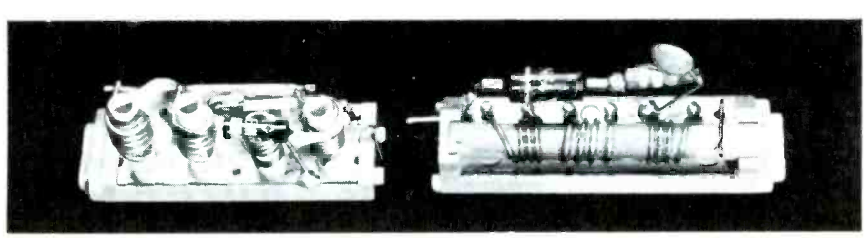


Figure 2. Standard Coil "34R" UHF Strips.

SERIES NUMBER	STRIP DESIG.	UHF DESIG.	VIDEO IF	RF TYPE
TV-100, C	Uncoded	xxB	21mc	Pentode
TV-200	F (Green)	xxF/G	21mc	Pentode
TV-300	F (Green)	xxF/G	21mc	Pentode
TV-1000	F & G (Green)*	xxF/G	21mc	Pentode
TV-1500	H (Black)	xxH	21mc	Pentode
TV-2000	K (Glack)	xxK	21mc	Cascode
TV-2200	Q(Red)	xxQ	21mc	Cascode
TV-3000	M (Black)	xxM	41mc	Cascode
TV-3100	R (Red)	xxR	41mc	Cascode
TV-4000	Q & R (Green)#	xxQR	41mc	Cascode
TV-4400	Q & R (Green)#	xxQR	41mc	Cascode

CHART A - - - Identification of Standard Coil Tuners.

*," G" in Green on channel 2 thru 9 oscillator sections. All others are " F" in Green. (TV-1000 only).
Antenna sections, " Q" in Green. RF-Osc. sections " R" in Green (TV-4000, 4400 only).
xx - UHF channel number precedes the letter.

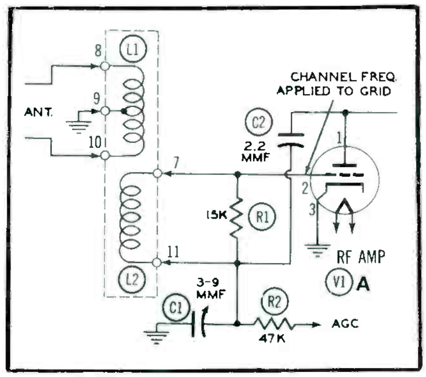


Figure 4. VHF Input Circuit.

procedure, the final check is to see that a UHF strip is used that bears the same letter as that of the original VHF strip. No attempt should be made to use other than the correct strip as improper results will be obtained, plus the possibility of causing damage to the tuner itself.

Figure 3 shows a set of 34Q strips alongside the installation instruction sheet which is packed in the carton with the strips. Note the "34Q" designation on the end of the carton.

Returning to the electrical circuitry of the UHF strips, let us see how the electrical connections differ from those used during VHF reception. Figure 4 shows the input circuit of a 2200 series Standard Coil Tuner. L1 and L2 are the coils included in the VHF tuner strips. The 300 ohm input connects to contacts 8 and 10 which engage with coil L1. The center tap of this coil is returned to ground through contact 9. The signal is magnetically coupled to L2 which is the RF amplifier grid coil. The electrical connection of this coil is completed through contacts 7 and 11. The inductance of L2 is of a value that will properly tune the RF grid circuit to the desired channel. C1 is a trimmer which adjusts the RF grid circuit so that the various channel strips will be properly tuned. Obviously C1 cannot be adjusted for each channel, so, the inductance of L2 in the various channel strips must be held within a close tolerance. Keep this fact in mind during our discussion of the circuits employed in the UHF strips.

The signal which is applied to the grid of the RF amplifier is that of the received signal. This is not true when UHF channel strips are employed.

Figure 5 shows the input circuit of the same Standard Coil Tuner, except a UHF strip has been engaged with the contacts. Note that the circuitry outside of the dotted-line box is identical to that shown in Figure 4.

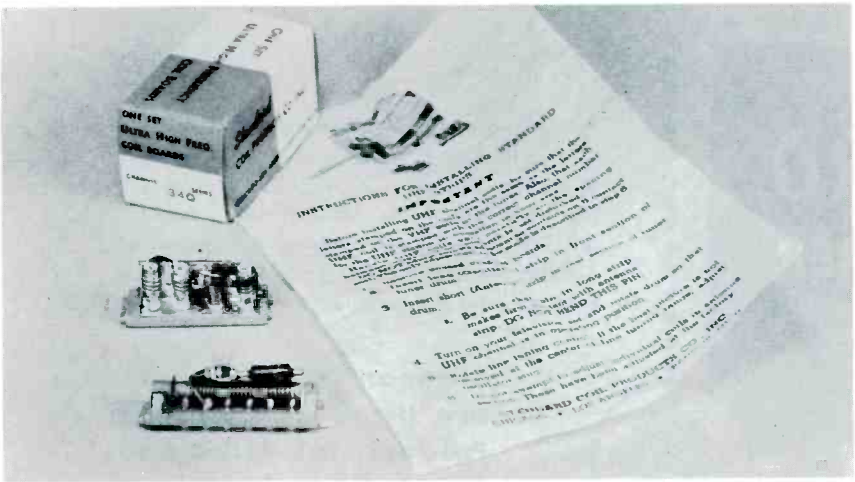


Figure 3. "34Q" UHF Strips and Instruction Sheet.

As was previously stated, a double conversion process is employed to provide UHF reception. Since one of the conversions take place in the input circuit, it might be well to point out the two incoming signals which effect this conversion. The first signal is that of the received television signal which is connected to L1A through contacts 8 and 10. As in the case of the VHF strip, the center tap of L1A is returned to ground through contact 9. Another important connection in the UHF strip is the internal ground which, physically, is the metal bracket upon which the coil forms are mounted.

The signal is magnetically coupled to L1B which is wound on the same coil from. This can be seen in Figure 6, which shows a set of 34Q strips. Note the proximity of L2 and L1B. Such an arrangement provides coupling between the two coils. The crystal mixer is connected to a tap on L2. While the other terminal of the crystal connects to L4A, which is a half-turn loop very closely coupled to L4B. L4A is returned to ground through C3, a ceramic capacitor, which is mechanically constructed on the grounded bracket. L4B which is the harmonic tank coil is trimmed by A3. Since L4A and B are closely coupled, harmonic frequency coupling is provided to the crystal. With the two frequencies (the TV signal and harmonic signal) applied to the crystal, a beat frequency results. This signal is fed to the transformer, L3, which constitutes the output circuit of the UHF strip. The output signal is picked off by contacts 7 and 11 and applied to the RF amplifier grid. Thus, it can be seen that the frequency of the

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A PF INDEX UHF COVERAGE

UHF tuner kit Field Installation

by MERLE E. CHANEY

The rapidity with which UHF television is assuming stature in the commercial broadcasting field has resulted in a great number of television set manufacturers designing methods for current, or future, incorporation of UHF tuning systems in their receivers. Since successful UHF transmission is now on a commercial basis, little doubt remains in the minds of those producing present receivers that current designs must meet the demands of the consumers. With this in mind, many TV sets are now available which are capable of receiving any station within the receiving area, whether VHF or UHF. At the same time, it is obvious that various localities will be without UHF broadcasting facilities and the addition of UHF tuning systems in the receivers will represent an immediate unnecessary added cost to the consumer. It is noted, therefore, that a compromise is adhered to in the production of many of the current receivers. That is, new receivers may be purchased with built-in UHF tuning systems or with only VHF tuning provisions. The selection of either set may be made at the option of the buyer. Therefore it is anticipated that UHF converter kit installation in the field will be performed on many receivers.

One word of caution should be injected in reference to the use of UHF kits in order to avoid unnecessary complications in the installation procedure. First of all, it should be determined that the kit is specifically designed to fit and operate in the receiver to which it is to be added. Some kits can be used in only the current productions, while others are also adaptable to a number of the older models. If the manufacturer of the converter kit specifically states which models can be adapted to UHF with built-in type units, needless time and expense can be saved in trying to install it in other models. For those receivers not adaptable to kit installation, the best solution is through the use of an external UHF converter.

Another point that should be checked prior to the kit installation, is to insure that the TV set is in satisfactory operating condition before any conversion work is attempted. Difficulties that might arise after the kit is installed could then be more easily diagnosed.

In many areas where UHF is expected, there may be some concern as to feasibility and profitable nature of kit installation. As to the time and facilities necessary to effect a conversion, few problems should exist. Obviously the first installation of a kit requires a little more time than that required for subsequent operations of this nature. Close attention to instructions supplied with the unit is important in achieving the desired standard of performance.

Two of the receivers which were used during out tests in the South Bend area were equipped with UHF field kits which we installed ourselves. These sets were specifically selected in order for us to gain experience in making the installation and to gain first hand information on the operation and dependability of these units. These receivers were subjected to considerable abuse due to the necessity of transporting the sets during out tests. In spite of this, no failure of operation was noted, nor was it possible to detect any difference in the operation of these sets in which the kits had been installed, from those receivers which were factory equipped for UHF reception.

Contributing to the time factor is the fact that in most instances UHF converter kits may be installed in the customer's home. Only a few tools are required (these are usually carried in the tool kit). At the time the kit is installed, the antenna requirements can be determined and the necessary measures can then be employed to pick up the UHF signal.

A typical example of a UHF converter kit installation may be ob-

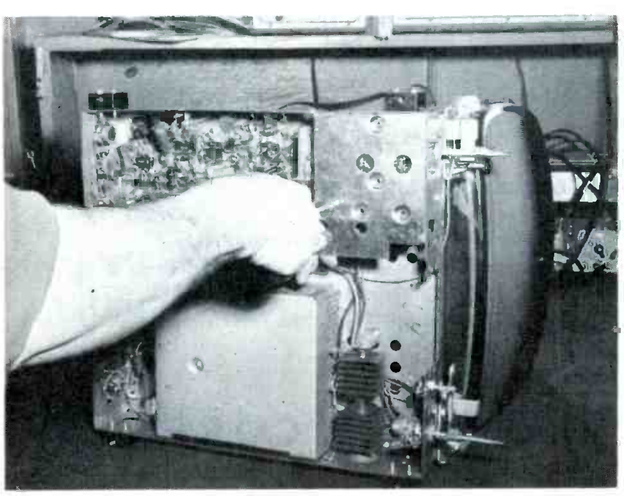


Figure 1. Preparing a Motorola Receiver for Kit Installation.

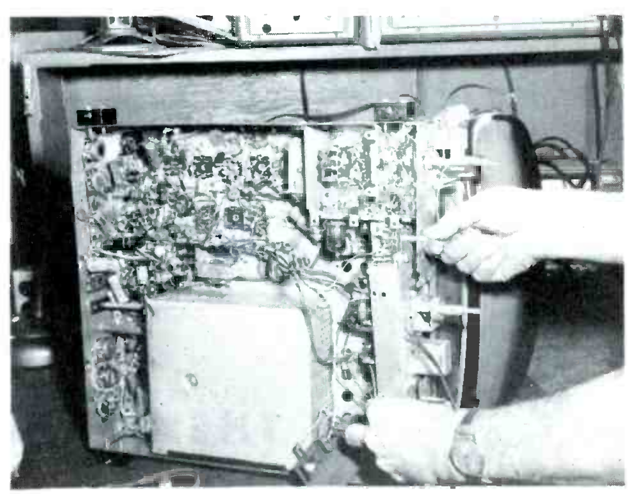
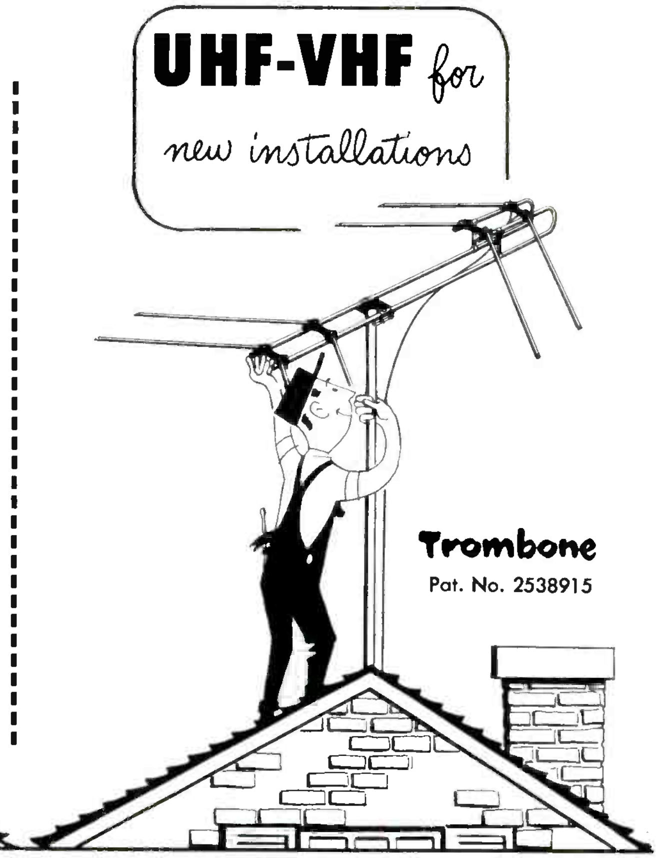


Figure 2. Placing the Motorola UHF Converter in the TV Chassis.



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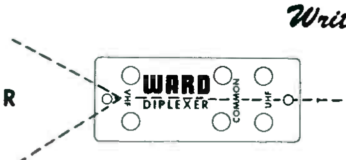

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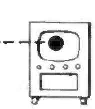

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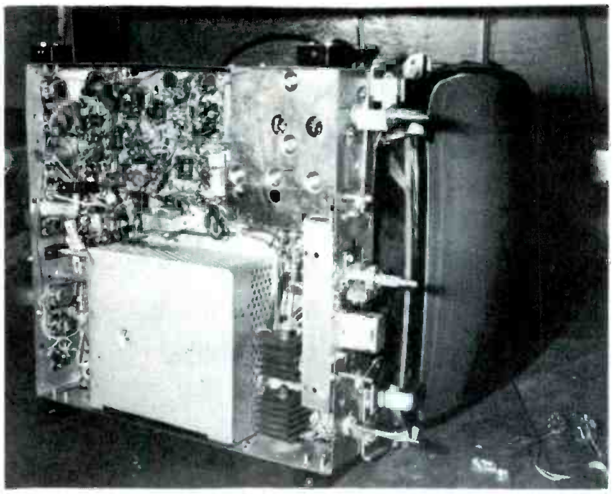

Figure 3. Bottom Chassis View of Motorola Receiver With UHF Converter Installed.

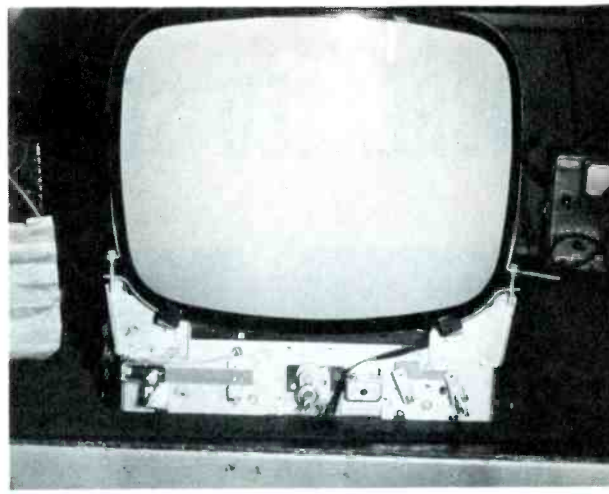

Figure 4. Front Chassis View of Motorola Receiver Showing Completed UHF Converter Kit Installation.

served in Figure 1. In this case, the receiver illustrated is a Motorola Model 17T11EC (Chassis TS-408A) and the kit is designated as TK19M.

Figure 1 shows the receiver chassis being prepared to receive the UHF unit. A cover plate on the front apron has been removed and the shield plate under the VHF tuner is being removed. The next step is the temporary removal of the RF amplifier tube in the VHF tuner to permit the UHF tuner to slide into position at the center of the front apron. The tone control was then removed and discarded. Also the linkage to the tone control shaft was temporarily removed. Since the leads to the control are connected to a multi-pin plug, no soldering is required at any time during the installation. Next, the screws holding the selenium rectifier nearest the center of the chassis were removed. This allowed the UHF unit to be inserted into position, as shown in Figure 2. Three transmission-type leads and one cable extend from the UHF unit. Two of these leads are for the VHF and UHF antenna inputs, while the third lead plugs into the VHF tuner input circuit. The cable lead is terminated in a multiple-pin plug which is inserted in the socket from which the plug connected to the tone control was removed. The cable provides the tone control circuit continuity and, in addition, applies 117VAC to the filament transformer and rectifier circuit.

Figures 3 and 4 show the UHF tuner completely installed in the Motorola chassis. The tone control linkage is again attached and another linkage is placed between the converter switch shaft and the VHF tuner shaft. The selenium rectifier is remounted, the RF tube is reinserted and the bottom cover is replaced on the VHF tuner. When the chassis is reinstalled in the cabinet, the VHF and UHF terminal boards are fastened to the back panel on the cabinet and the control knobs placed on the shafts.

This installation requires several operations, yet, the work entailed in the process may be less than that required to replace a defective component. After a few kits have been installed, the time required to do the job will be reduced to a minimum.

Figures 5 and 6 show two other UHF tuners which are designed to be added to existing receivers in the field. Figure 5 shows the Crosley Converter kit (part #154927) which is designed to be added to Crosley Chassis 385, 386, or 387.

Figure 6 shows the Raytheon UHF-100P tuner which is designed to be added to Raytheon Models 17T1, 17T1A, 17T1B, 21T1, 21T1A, 21T1B or 21T3. For the addition of this tuner to other Raytheon sets employing a continuously tuned UHF tuner, an accessory kit is available, and must be obtained to make the installation.

In all instances of UHF converter kit installation, it is observed that the manufacturer of the unit has stressed in the design, a unit requiring a minimum of detailed operations to install it in a receiver in the field. Most of the kits do not require soldering operations during installation, since plugs, sockets and connectors are employed as much as possible. The exception to this is when a kit is designed to function in some of the early production receivers, where UHF sockets and wiring facilities have not been incorporated on the set at the time of manufacture. In these cases, it may be necessary to solder in the connecting leads directly, or to mount sockets provided in the kit.

UHF kits may be considered to fall into two general categories: units employing separate controls from the VHF tuner and those using the same controls as the VHF tuner. Where common controls are employed, the VHF and UHF tuning mechanisms are linked by either gear or pulley devices, or a combination of the two. Many of the current production receivers are supplied with the UHF tuning mechanisms in position and require only the addition of the UHF tuner to the receiver. It is also noted that a number of sets have a UHF escutcheon mounted on the cabinet which is removed when a converter is installed. Thus, the cabinet design is maintained, while at the same time, the addition of a UHF tuner does not alter the general appearance of the set. Probably the chief point to remember when called upon to install a UHF converter in a television receiver, is to follow the

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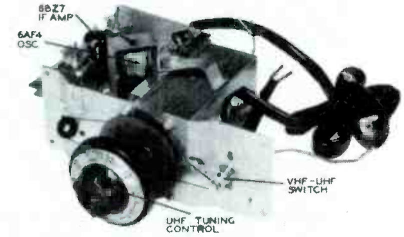
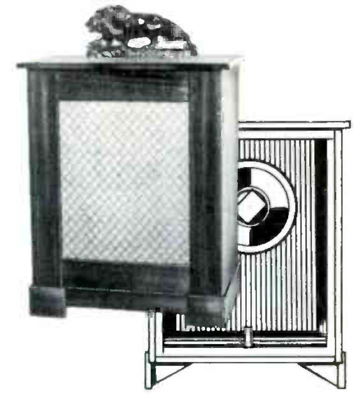


Figure 5. Crosley UHF Converter Kit.

Audio-Facts

by ROBERT B. DUNHAM



Amplifiers, pre-amplifiers and phonograph pickups have been mentioned in previous Audio Facts articles, and their relation to distortion in high quality audio reproduction has been discussed to some extent. One thing is certain, loud speakers and their influence in sound systems cannot be ignored. If the speaker system, due to its own short-comings, cannot convert the electronic signal into sound satisfactorily, it is logical that no matter how well the amplifier and allied equipment operate, the sound output will not be satisfactory.

Since speakers and their enclosures are so important, much has been written concerning them. Also, constant research is being conducted, and countless experiments are being made by both professionals and amateurs, in an effort to produce the ideal speaker system.

The number of people who strive for and appreciate high quality sound reproduction is growing rapidly. Many manufacturers are becoming increasingly aware of the importance of high quality audio in their products. Others are specializing in the manufacturing of high fidelity equipment.

Speakers, of course, are an important part in any equipment, but the growing use of high fidelity systems has created a lot of interest and activity concerning loud speakers and their enclosures. The speaker system can be simple or complex, large or small, depending upon many things that must be considered if the best results are to be achieved. The whys and wherefores of these variations make up the important things we should know and understand when we select, install, or work with such equipment.

The most commonly used loud speaker is the familiar dynamic cone speaker. Dynamic units, with small plastic or metal diaphrams, designed for coupling to horns, are also employed but usually are found in PA installations and High frequency "tweeters."

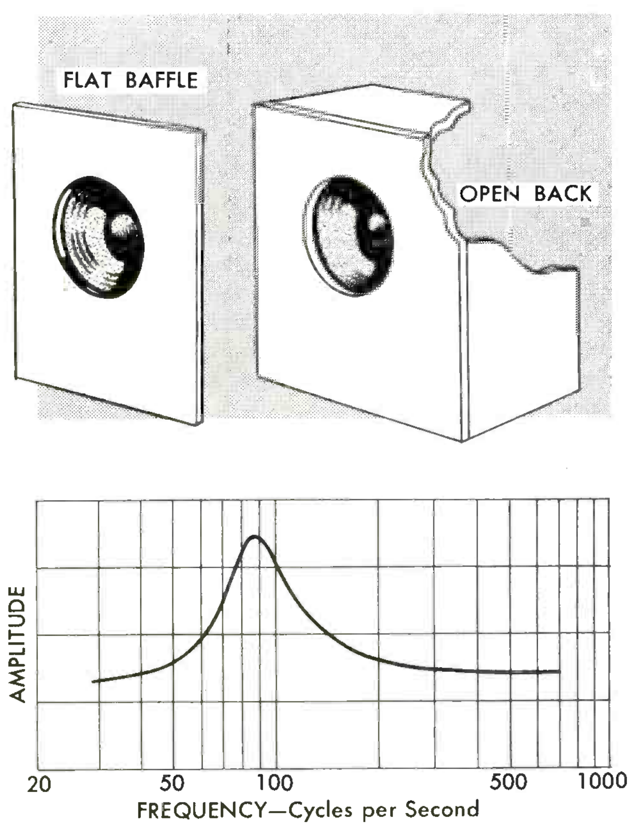


Figure 1. Open Back Enclosure and Flat Baffle with Typical Impedance Curve.

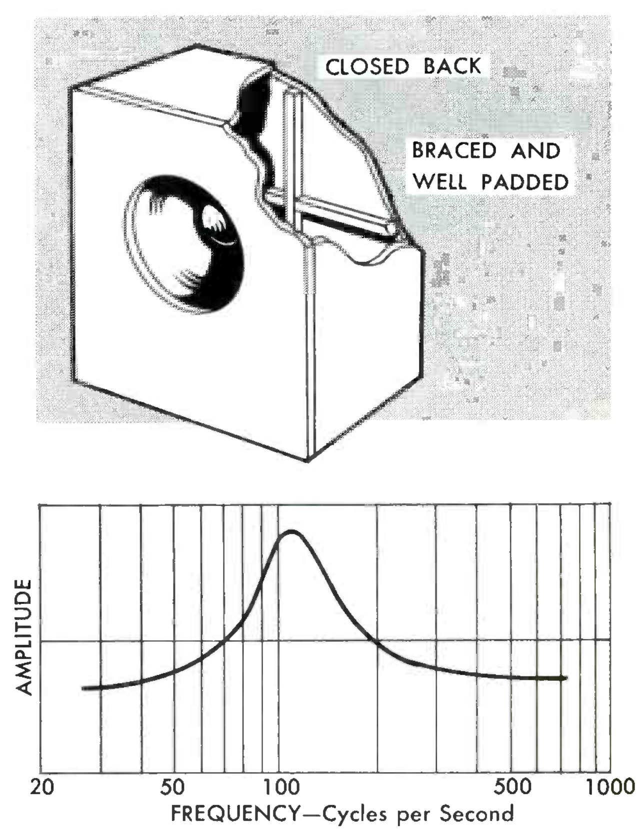


Figure 2. Totally Enclosed Enclosure With Impedance Curve.

Several basic characteristics of cone type speakers must be considered when discussing loudspeaker systems. For instance, power handling ability is usually greater in larger speakers, although it also depends on such things as magnet size and general construction. Incidentally, size refers to the diameter of the cone, which is somewhat smaller.

The size of the cone usually has a bearing on the low-frequency response, since it takes power and the movement of a comparatively large volume of air to reproduce a low tone. The larger cone with its greater surface, contacts more air, making possible the movement of a greater volume of air with a given movement of the cone. Also, every speaker has a resonant frequency, which results in a hump in the response curve, and audibly as an accented "boom" in the low frequencies. The resonant frequency of the speaker has a great influence on how low the speaker can be made to respond. That is, the lower the resonant frequency the lower the response. Since it is easier to attain a low resonant frequency with the larger speakers it would seem that in general they are better in this respect.

On the other hand, smaller speakers can produce their maximum low-frequency response with a smaller enclosure. This is an advantage, since the smaller systems used in smaller rooms usually do not require the higher power output obtainable with the larger speakers.

Speakers are manufactured that have some, or nearly all, of the desired qualities, regardless of size. Therefore, physical size cannot be the only deciding factor. Some are designed to have a uniform full range response, which is sometimes practically achieved. Some are designed particularly to reproduce the low frequencies, as "woofers." Others to reproduce the highs, as "tweeters." As can be understood, these things are attained in varying degrees, by the various manufacturers of speakers, in a wide range of sizes and a wider range in price.

Some discussions and experiments would give one the impression that the limitations of the speakers are so great that we cannot expect to reproduce sound in a satisfactory manner. But we know that a high quality audio system can be made, using the correct speaker system, which will afford the utmost listening enjoyment of the excellent program material available.

Speaker Enclosures -

Loudspeaker enclosures can be classified as:

1. Open back baffle.

2. Totally enclosed or infinite baffle.

3. Reflex or vented enclosure.

4. Horn.

5. Labyrinth.

These can be subdivided into various applications of the principles involved, but these are the chassis classifications. All have some advantages and disadvantages, due to their individual characteristics, which we will discuss to some extent here, and in more detail in later issues.

The most used loudspeaker enclosure is the cabinet of the usual radio, record player or tel-

♦ ♦ Please turn to page 94 ♦ ♦

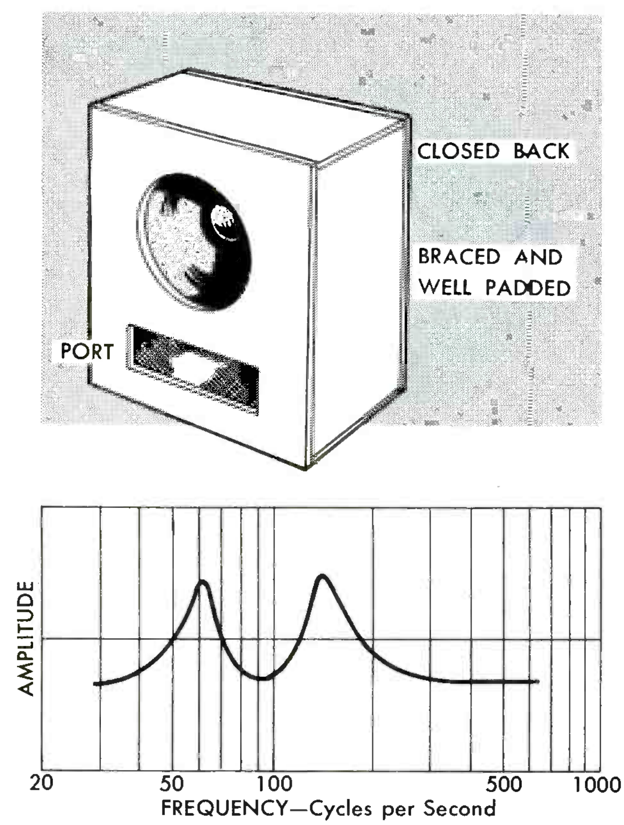


Figure 3. Reflex Enclosure With Impedance Curve.

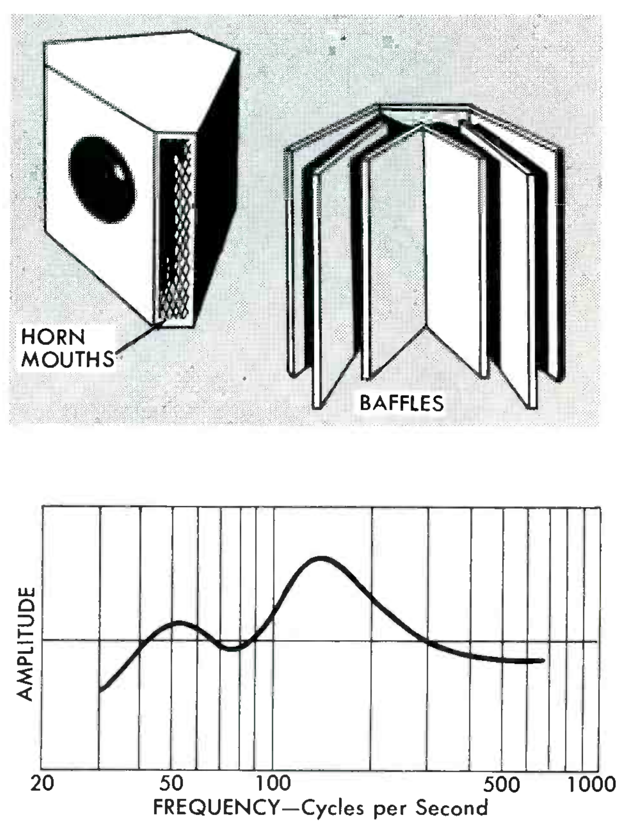
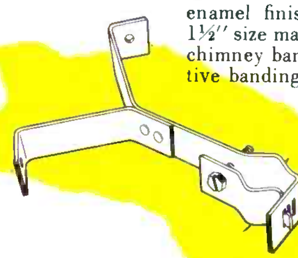


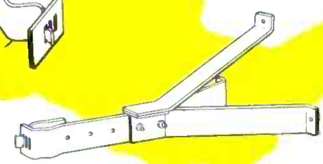
Figure 4. Folded Horn Enclosure With Impedance Curve.

ORDER A BALANCED STOCK FROM YOUR JOBBER TODAY

CHIMNEY MOUNTS

Made of ⅛″ x 1¾″ steel, zinc-coated plus baked-enamel finish. One-screw mast clamp adapts to 1½″ size masting. Complete with 30′ stainless steel chimney band, eyebolts and NEPCO'S quick, positive banding clamps.





TV set owners want a better picture, longer

Here is the answer

Today, TV set owners are demanding better reception. Often the *trouble is in the antenna installation, not the set.* A corroded antenna (and most antennas are corroded if they have been up a while) or cracked and crazed down-leads (and most polyethylene leads *are* faulty after 10-12 months) can cause a deteriorated picture. *Nothing* you do to the set can correct this condition. A *new* and *better* antenna installation is the answer.

The NEPCO Line of antennas and TV installation materials eliminates this condition.

It was designed to meet the pressing demand for *better* electronic equipment—with more built-in ruggedness and corrosion-resistance than any line now known.

The NEPCO line was designed with YOU in mind:

- Provides *maximum* number of installations with a *minimum* number of parts from jobbers. Your stocks are kept at a minimum.
- Its high quality eliminates costly call backs . . . saves you time, trouble and tempers . . . improves customer goodwill.
- Eliminates rust streaks—a common customer complaint.
- Provides *quicker* installations . . . goes up fast . . . easy to handle . . . easy to carry.

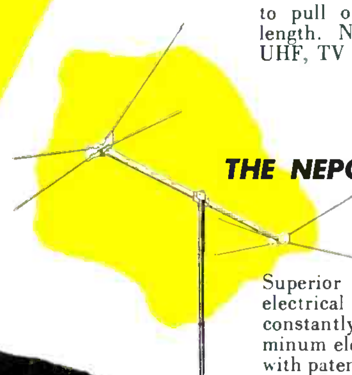
Remember, a better installation using better materials will insure more satisfied customers.

WALL BRACKETS

Fabricated of ⅛″ x 1¾″ steel, heavily zinc-coated with baked-enamel finish. One-screw mast clamp adjustable to 1½″ masting. Hex head slotted bolts to speed erection time.

SPACE SAVER— BIG, FLAT BOXES FOR TV WIRE

NEPCO "Zee" Line comes in strong, flat cartons. Easy to stack, easy to handle, easy to pull out for cutting to any desired length. NEPCO "Zee" Line is low-loss UHF, TV receiving wire.



THE NEPCO CONICAL ANTENNA IMMEDIATE DELIVERY

Superior mechanical features maintain electrical effectiveness and performance—constantly—regardless of conditions. Aluminum elements are permanently secured with patented "vibration-proof" imbedding screws.

These other features will "spark" your TV sales:

- All parts heavily zinc-coated plus baked-enamel finish.
- All mounts made of rigid, heavy gauge steel.
- Unique adjustable mast clamp with one-bolt mounting.
- Two 15′ stainless steel chimney bands with each chimney mount.
- Over 100 installation combinations possible with minimum inventory.
- Slotted, hex-head bolts standard equipment . . . all zinc-coated plus baked-enamel finish.
- Exclusive antenna mast clamp with positive alignment in all planes.
- Patented imbedding type screw for positive electrical and mechanical locking.

John Markus Editor-in-Chief, McGraw-Hill Radio Servicing Library

Dollar and Sense Servicing

SNORING. Instead of rise-and-shine chatter, listeners who tuned in on a San Mateo, California, radio program one morning got an earful of snoring. Someone called the sheriff, and he in turn sent a deputy over to the station to investigate. Finding the disc jockey sound asleep beside the open microphone, the deputy completed his assignment by shaking the young fellow and telling him to rise and shine.

MIXING. What seems to be an ideal combination of two non-interfering businesses is operation of a gas station in a country-crossroads community and operation of a television and radio servicing business in between pumpings. The only requirement is having a wife to run the pumps while out on calls. A working example of this logical mixing of jobs exists in the town of Saddle River, New Jersey.

MILLIONS. It is estimated that for every $100 million worth of electronic equipment purchased by the military, $1 billion must be spent on maintanance before it wears out. Contrast this with the servicing picture for radio sets, where servicing rarely reaches a dollar-for-dollar basis even though the sets last four to five times longer than in military service. As an extreme example, one well-known make of auto radio is reported to have run for 16 years, without even having its cover pried off. Our own experience with this same make of auto set has given ten years, and it's still running.

TUBENAPPING. In broad daylight on one of the most heavily travelled streets in New York City, a truck driver was extracted from his truck and hauled away in one direction, while his truck with a half-million dollar (retail value) cargo of radio and television tubes was driven off in another direction. The loot in the carefully planned and executed crime had been trucked from a factory in Emporium, Pa., to the Sylvania warehouse in New York City. The incident occurred while the driver was waiting for a loading platform to become free. The driver was dumped into an abandoned Long Island railroad shack four hours later, bound and gagged, but managed to untie himself and call police. This being kidnapping, the FBI in turn were called. The empty truck turned up in Brooklyn a few days later, stripped of clues, and as yet no trace has been found of the tubes or test equipment in the truck. Distributors and dealers in the entire eastern area have been alerted, so somebody is stuck with a pretty hot half-million in bulky loot that can't be kept hidden for long from the insurance inspectors, local police and G-men.

At first thought, it might seem impossible to have a truckload worth so much. Yet, consider that you can get a thousand miniature tubes into the space of a picture-tube carton, then look at one of the big new trailer-trucks, and you then begin to wonder if maybe that truck might have been half-empty.

FOR THE BIRDS. While in search of food, hungry birds are often attracted by the bright metal brackets that support insulators on television towers and high-tension lines. As long as the bird stays on the crossarm bracket or on the energized part while picking out insects from between the crevices of the insulators and brackets, he continues to breathe. When he reaches across the insulator to grab a bug on the other side of the line, however, fireworks break loose. This makes trouble for station operators and power line men, to say nothing of the bird's own feelings.

In the search for something to discourage the birds, color experts were called in. They announced that brown has little attraction for birds. Brown Formica strips formed to fit around the metal brackets were tried, and proved to be the answer. They insulate the brackets, cover the crevices and preserve our birds.

OBIT. The gift of its experimental stratovision equipment by Westinghouse to Texas A & M College marks the demise of a noble experiment by Westinghouse engineer C. E. Nobles. Technically feasible and satisfactory, but politically unwise, is the final story. Vast coverage was obtained by putting the television transmitter in a plane flying in a small circle four to five miles up, but this coverage contributed to its downfall.

Because of interference between adjacent stratovision planes, the FCC conclusion was that more channels would be needed than could be allocated. Stratovision, they said, would deprive too many cities of their own local television stations. All results of the tests were turned over to the Defense Department of Westinghouse.

PROGRESS. The week ending October 31, 1952, marked another milestone in TV history. More television sets were made that week than radio sets, though admittedly the difference was slight--only 26 more TV sets.

Not too far off in the future is another milestone--the day when dollar sales volume of picture tubes will exceed that of all other receiving tubes put together. Projected sales figures by one large tube manufacture indicate that this historical date will occur some time in 1955. Contrast this with the tube business of even five years ago and you get a pretty dramatic picture of how television has affected the tube business and, in turn, servicing.

DICTIONARY. One station-break commercial on television is called a spot, just as in radio. Two commercials together are known as twin availabilities. If there are three, the third is called a proximity. A fourth snuggled in at the end of a network show is a hitchhiker. A fifth, at the start of the next show, is a cowcatcher. Unlucky indeed is the viewer who gets five in a row.

♦ ♦ Please turn to page 94 ♦ ♦

INDEX TO PHOTOFACT

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 37

Covering Folder Sets Nos. 1 thru 200

HOW TO USE THIS INDEX

To find the PHOTOFACT Folder you need, first look for the name of the receiver (listed alphabetically below), and then find the required model number. Opposite the model, you will find the number of the PHOTOFACT Set in which the required Folder appears, and the number of that Folder. The PHOTOFACT Set number is shown in bold-face type; the Folder number is in the regular light-face type.

IMPORTANT—1. The letter "A" following a Set number in the Index listing, indicates a "Preliminary Data Folder." These Folders are designed to provide you *immediately* with preliminary basic data on TV receivers pending their complete coverage in the standard, uniform PHOTOFACT Folder Set presentation.

2. Models marked by an asterisk (*) have not yet been covered in a standard Folder. However, regular PHOTOFACT Subscribers may obtain Schematic, Alignment Data or other required information on these models without charge by supplying make, model or chassis number and serial number. (When requesting such data, mention the name of the Parts Distributor who supplies you with your PHOTOFACT Folder Sets.)

3. Production Change Bulletins contain data supplementary to certain models covered in previously issued PHOTOFACT Folders, and are listed in this Index immediately following the listing of the original coverage of the model or chassis. These Bulletins should be filed with the Folders covering the models to which the changes apply.

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IMPORTANT PHOTOFACT INFORMATION

We want you to receive maximum benefits through your use of this Index and of PHOTOFACT Folders. To keep you fully informed about PHOTOFACT, we have prepared the table of informative subjects listed below. Be sure to read each item carefully.

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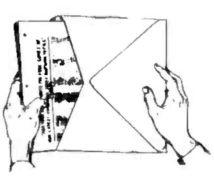
IMPORTANT

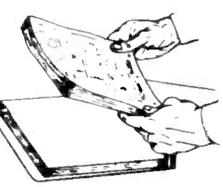
Quick, Easy PHOTOFACT Filing Method

The preferred 30-Second method for filing PHOTOFACT Folders

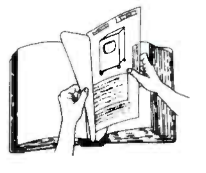
Your PHOTOFACT Folder Sets come to you in convenient envelopes. When you remove a Set from its envelope, you will find the Folders already arranged in proper filing order, and preceded by an Index Separator. This Separator lists each receiver covered in the Set, and has an index tab showing the Set number. To file, here's all you do:



1. Remove the Index Separator and the Folders from the envelope. The Folders and manila TV Jackets are already arranged in proper numerical filing order except the TV folders, which are placed last in the Set.



2. Open your binder and place the entire contents, taken from the envelope, behind the preceding Set of folders, laying aside the TV folders.



3. Now, insert the TV folders in their respective manila jackets and your filing is complete.

To locate the folder you want, refer to instructions on the first page of this index listing.

ALWAYS REFER TO THE PHOTOFACT INDEX

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SHOP TALK (cont'd from page 7)

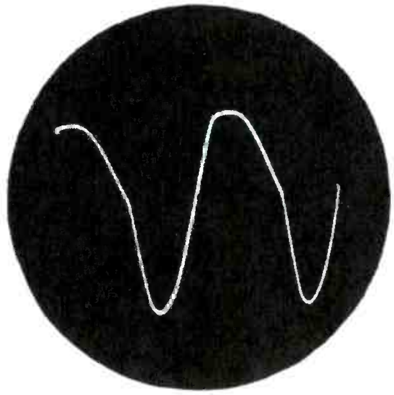

Figure 3. Waveform Which Is Present at Points A and B of Figure 2. Antenna Disconnected from Receiver.

lator. Now, the purpose of the discriminator and the reactance tube is simply to control or regulate the frequency of the horizontal oscillator so that the latter keeps in step with the incoming horizontal sync pulses. The discriminator and reactance tube do not eause the oscillator to oscillate, nor do they have any control over the type of oscillations. All they do is to attempt to keep the oscillator on frequency. (They cannot even do this if the oscillator drifts too far off frequency.)

This being the case, let us look somewhat more closely at the sync discriminator and its companion reactance tube. The sync discriminator compares the operating frequency of the horizontal oscillator with the frequency of the incoming horizontal sync pulses. If a difference exists, then a DC voltage is developed. The voltage is positive when the oscillator frequency is too low, and it is negative when the oscillator frequency is too high.

These facts point to a fairly simple test to determine whether or not the discriminator circuit is operating as it should. Place a VTVM between the output of the discriminator and ground, as shown in Figure 2. Now tune in a television signal and rotate the horizontal hold control back and forth. This will cause the horizontal oscillator frequency to change and the output of the discriminator should vary in step. In the particular circuit shown, the DC output voltage should vary between +1 and -4 volts. The voltage goes more negative than positive because of the negative biasing voltage required by the following reactance tube.

In the absence of this DC voltage variation, it is necessary to determine two facts before assuming that the sync discriminator is at fault. First, are the incoming sync pulses reaching the discriminator and, if so, is the oscillator signal reaching the sync discriminator, too? To check the latter, connect the vertical input of an oscilloscope between ground and each end of the oscillator-tranformer discriminator winding in turn. (That is, between point A and ground and then point B and ground, Figure 2.) While performing this test, disconnect the receiver antenna to prevent the incoming sync pulses from interfering with the waveform observation.

The normal pattern to be obtained at the transformer ends is shown in Figure 3.

The next step, upon obtaining this pattern, is to reconnect the antenna and then remove the horizontal oscillator tube. (Remove only momentarily, since in some sets horizontal output tube or circuits may be damaged.) The horizontal sync pulse, as shown in Figure 4, should then appear at each end of the discriminator transformer winding.

Note that in the foregoing tests, each of the waveforms applied to the discriminator were checked individually. In this way, if any difficulty is encountered, we know where to look for it.

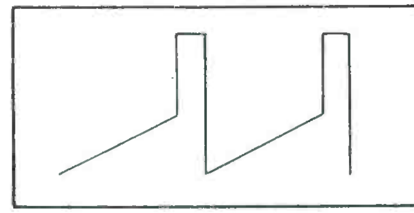

Figure 4. Waveform Which Is Present at the Ends of the Oscillator-Transformer Discriminator Winding When a TV Signal Is Being Received.

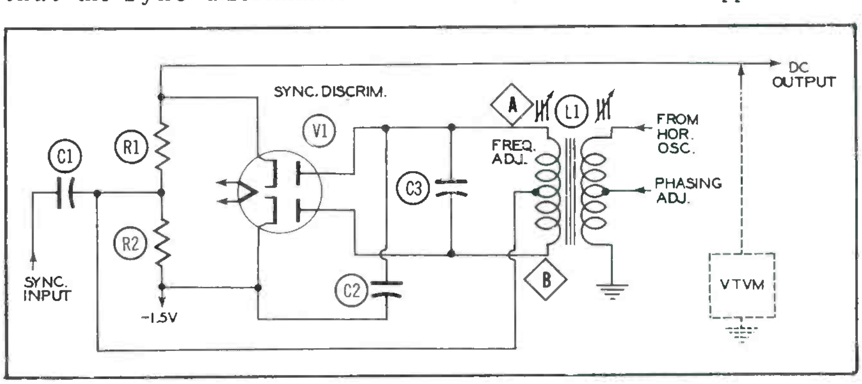

Figure 2. Simplified Circuit Diagram of the Sync Discriminator. A VTVM Should Be Connected as Shown to Check the Operation of the Circuit.

Returning to the DC correction voltage which is obtained from the sync discriminator, this is passed through a noise-immunity (or long time constant) network before being applied to the reactance tube. See Figure 5. The function of this network is to eliminate the effects of any noise impulses that may be present, and to permit only relatively slow changes in frequency of the sync pulses to affect the sweep oscillator. To determine whether the correction voltage is passing through this network, place the VTVM at the control grid of the reactance tube and again vary the horizontal hold control. The VTVM needle should swing back and forth, indicating that the DC correction voltage is present at the reactance tube. Failure of the meter to respond will point to an open R3 and R4 or to a shorted C5.

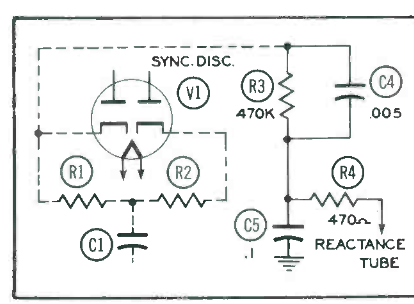

Figure 5. Between the Sync Discriminator and the Reactance Tube, There Is a Noise Immunity Circuit.

The noise-immunity network should also be checked to determine whether or not it is performing its filtering job properly. This is best done with an oscilloscope. Connect the vertical input terminals of the scope between the grid of the reactance tube and ground. If the network is performing correctly the waveform shown in Figure 6A will be observed. On the other hand, if the network is somehow defective, noise pulses will not be filtered out and

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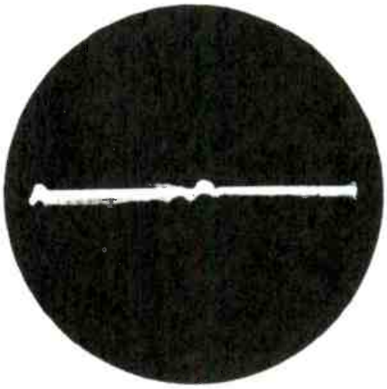
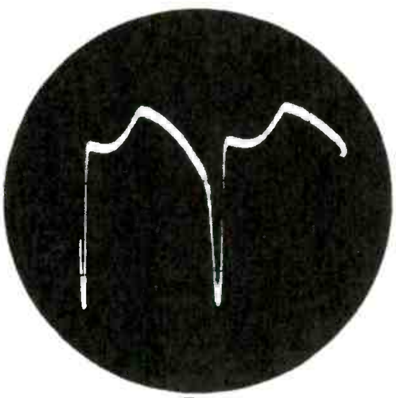


A



B

Figure 6. (A) Waveform at Grid of Reactance Tube When Noise Immunity Circuit Is Performing Properly. (B) Waveform Indication When Noise Immunity Circuit is Defective.

will appear on the oscillogram, as shown in Figure 6B. Here is a very conclusive test of the effectiveness of a filter network.

Remaining in this AFC system is the reactance tube and this can usually be checked by voltage and/or resistance measurements. A screen by-pass capacitor, if open, will not be revealed in this manner but it can be tested by bridging another unit across it.

B. Pulse-Width AFC System. This AFC system, shown in Figure 7, consists of a control tube, a noise filter, and a blocking oscillator. The control tube compares the frequency of the horizontal oscillator with that of the incoming sync pulses. If the two differ, a correction voltage is produced in the cathode circuit of the control tube. This same cathode circuit is also common to the grid of the blocking oscillator and so whatever changes in voltage occur here are felt at the grid of V1B.

The noise filter is formed by the combination of resistances and capacitors in the cathode leg of the control tube.

The pulse width AFC network leads itself very well to voltage and resistance analysis and also to a waveform check by means of an oscilloscope. In examining this circuit, Figure 7, it will be seen that the control tube receives two sets of voltages. One voltage comes from the sync separator stage and is the horizontal sync pulses. The other wave is parabolic-shaped (Figure 8) and it is obtained from the output of the horizontal blocking oscillator.

The first step in checking this circuit is to test the 6SN7 tube. If this is not the seat of the trouble, the next step is to determine if the control tube is receiving the voltages it should. To perform individual tests on these voltages, first remove the 6SN7 and check for the presence of the sync pulses at the

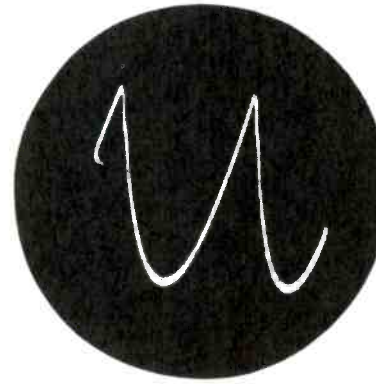


Figure 8.

grid of the control tube. When these have been seen, reinsert the 6SN7 and disconnect the antenna. This will remove the sync pulses and enable you to observe the feedback waveform (Figure 8) from the horizontal oscillator. Other waveforms of importance in this system are at the grid and plate of the horizontal oscillator. See Figure 9. Also check to see whether the proper saw-tooth deflection voltage is being produced at point "D".

The voltages on the control tube and on the horizontal oscillator are fairly critical. Hence, their values should be carefully checked against those specified in the service literature.

In the circuit of Figure 7, the positive voltages which are applied

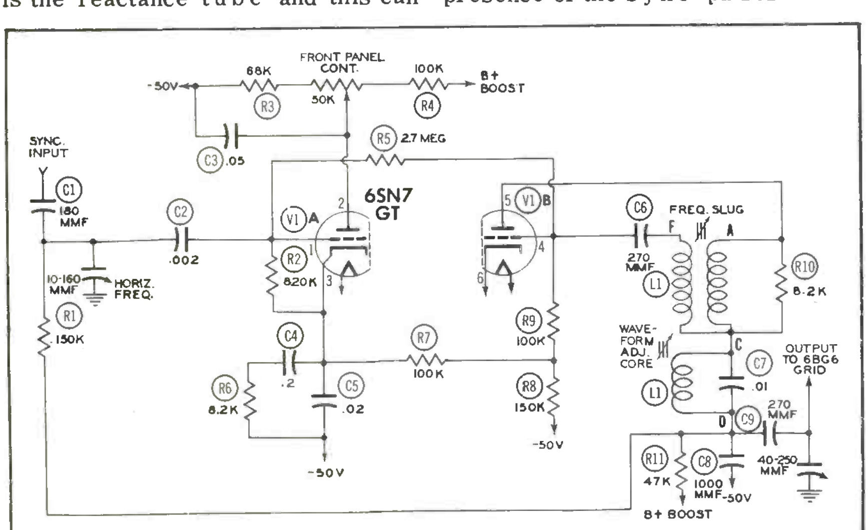
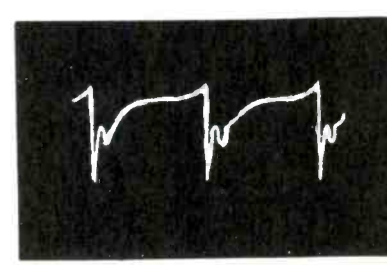


Figure 7. Schematic Diagram of a Pulse-Width AFC Circuit.



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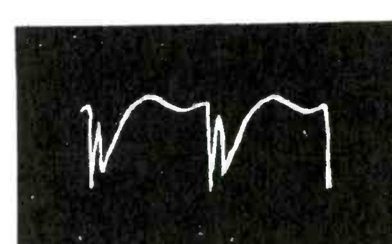

B

Figure 9. Other Waveforms of Importance in the Pulse Width System. (A) Grid of V1B, Figure 7. (B) Plate of V1B, Figure 7.

to the control tube and the oscillator come from the "boost B+" point in the damper tube circuit. The development of the proper amount of "boost B+", in turn, depends upon the oscillator providing the horizontal output amplifier with the correct saw-tooth wave. Thus, the two are dependent upon each other.

To determine where the trouble lies, examine the saw-tooth wave produced by the oscillator. If its shape is correct, the chances are good that a low "boost B+" voltage is being caused by a defect in the deflection circuits. On the other hand, if the wave shape is distorted, concentrate on the oscillator and its control tube.

The pulse width AFC system is particularly sensitive to leaky capacitors. Should C2, C5, C4, C3, C6 or C1 become leaky, it will be found that the circuit will tend to drift out of synchronization. Changes in resistance values will also affect operation, although the tendency here is to make the operation more critical rather than to cause immediate drift. The stability of this system is also dependent upon the proper adjustment of the stabilizing circuit (this is the coil and capacitor between points C and D, Figure 7.)

DuMont suggests the following procedure for locating a leaky capacitor:

1. Bring the picture into sync by making the proper oscillator transformer adjustments.

2. Allow the set to warm up. At the first sign of drift, set the front panel hold control at its most critical point (that point where the picture just stays in horizontal sync).

3. Apply the heat of a soldering iron to the body of each suspected component for approximately 10 seconds.

4. When the leaky capacitor is heated, the picture will lose horizontal sync.

While only two AFC systems have been discussed, the same method of approach can be applied to any of the other AFC systems in use. It is a logical procedure, starting with tube testing, then working down to waveform checking, and finally to voltage and/or resistance measurements.

MILTON S. KIVER

OPERATION UHF
(cont'd.from page 19)

the car. This gave access to the end of the tower for changing antennas and it also allowed the rear gate, which needed to be swung around for trailer support, to be positioned at the center of the road. Figure 13 illustrates the positioning of the trailer. Most of our tests were made on side roads or in out-of-the-way places so that the traffic problem was not serious.

A very important step that was performed before each test was that of leveling the trailer. To do this, a carpenter's level was employed. When necessary one of the wheels was blocked up so that the tower could be raised in a true vertical position. The bar at the front of the trailer allowed for adjustment at that end. We were particularly careful about leveling the trailer when there was a strong wind. Since the tower itself affords considerable wind resistance when it is in the full "up" position, we took no chances in tipping over the whole unit. Figure 14 shows the tower in the full up position. When there was considerable wind it was found that care must be taken when letting the antenna down or the inside tower would stick to the slides. To alleviate this condition, it was necessary to crank it down slowly and if necessary vibrate the tower slightly. On one of the days there was an extremely strong wind, probably as strong as would be encountered when any normal operation of this type would be conducted, and there was no fear of the unit tipping over. However, the precaution of leveling the trailer and making sure the side braces were tight was a necessity.

It should be pointed out that throughout our complete operation, which involved over 100 tests at several locations, there was no failure of any part of the trailer. The use of the large tires proved extremely satisfactory since it allowed us to carry only 15 pounds of pressure and even under full load, that is with two television receivers on the platform, plus the power plant and several antennas, the tires hardly flexed. The lower pressure allowed the tires to absorb a great amount of the road shock which would otherwise have been transmitted to the trailer.

During one of our test operations we wanted to check the effect of using different length standoff insulators. We decided to use the strap-on type units, and the triangular tower enabled us to mount sets of three, five, and seven inch insulators, a set on each corner. As a suggestion it might be wise to install a permanent set of insulators on a tower that is intended to be used for installation work. This will more closely approximate the actual conditions under which the antenna, transmission line and receiver will be called upon to operate. If no insulators are used at all during the initial tests, it may be found that the signal level is considerably lower after the lead-in is fed through the standoff insulators. The strap-on type should not be used for a permanent installation, particularly on a tower of the type which we employed. The straps, since they wrap around the outer supports, come in contact with the slide. On a permanent basis it would be much better to use the bolt or self-tapping type insulators.

Figure 13. Trailer-Tower Positioning on Narrow Roads.

Figure 14. Tower Fully Extended.

We were particularly pleased with the operation of the trailer-tower throughout our field survey. After using it only a few times, we began to realize the potentialities of such a unit for not only the installer, but the salesman as well. The use of a unit of this type can aid the installing crew immeasureably in making sure that a satisfactory installation can be made at a given location. This is particularly true in fringe areas, or at points where ghost problems predominate.

Most of these trailer units are equipped with some sort of a platform, upon which receivers can be carried. Figure 16 shows our trailer unit with two table model TV receivers on the platform. Even the large consolette type receivers can be carried. The addition of a mast holder, as previously described, will also be helpful in carrying the necessary equipment to the point of installation.

From the sales viewpoint, a trailer-tower has infinite possibilities. It makes possible the demonstration of receivers, particularly in fringe areas, under actual operating conditions without having to put up a costly antenna installation. These demonstrations should prove extremely effective on UHF and dispel skepticism on the part of the potential customer as to the success of UHF reception.

From an operational standpoint, we experienced no difficulties of any kind throughout our two week survey period even though the

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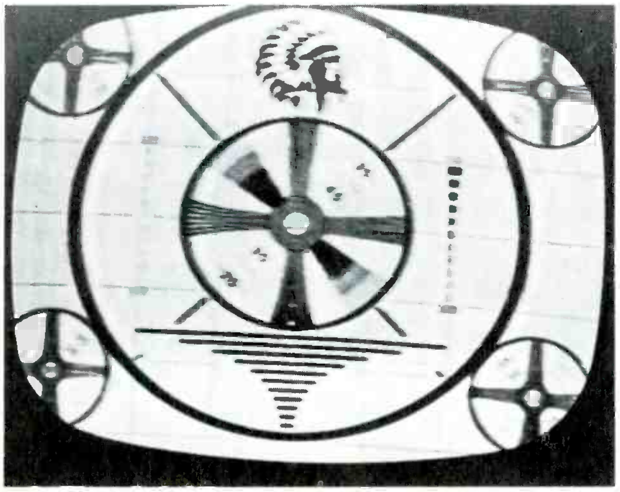

Figure 15. WSBT-TV Test Pattern.

Figure 16. Trailer-Tower Loaded with two TV Receivers.

trailer was pulled approximately 1200 miles. The tower itself was raised and lowered over 200 times. Considering the success that we had with this unit, we recommend that any sales or installing organization consider the possibilities of a mobile antenna tower as a piece of necessary equipment.

In summarizing our two week operation it was a general feeling among all those who helped in conducting the tests that UHF is a success. At times we were amazed at the quality of picture which could be received, sometimes under adverse conditions. This is especially true in areas where we expected to encounter extreme ghost difficulties. It was also true in outlying districts where it was felt that an extremely poor and weak signal would be received. In most instances the signal was strong and clear, and most noticeable of all was the fact that there was no man-made interference problem. The gasoline-driven power plant, for instance, played havoc with any attempts to check VHF reception. However, at UHF frequencies there was no trace of interference of any kind from the ignition system of the power plant.

After making these tests at various distances from the transmitters, we arrived at a boundary between the primary and secondary area at 15 miles. The secondary area then extended to 25 miles. Beyond this we have chosen to classify as the fringe area. Elsewhere in this issue, particularly under the antenna discussion, complete details are given as to the problems involved in selecting the proper antenna at the various locations.

Figure 15 is a photograph of the test pattern received at the motel. No special attempt was made to get an exceptionally good picture for photographing purposes. At one of our test positions, which was located 20 miles from the transmitter, a good, acceptable picture was received with a variety of antenna types. We found that at any position within 25 miles of the transmitter we could receive a good, acceptable picture through proper selection of the antenna and lead-in combination. There were points even at 37 miles where a steady picture with only a moderate amount of snow present was obtained. Since no attempt was made at this particular position in stacking antennas to try to obtain a stronger picture, it was generally felt among the test crew that a careful installation could produce

Figure 17. Trailer-Tower in Front of Commercial Sound & Radio Co., South Bend, Indiana.

Figure 18. Transmitter of WSBT-TV, South Bend, Indiana.

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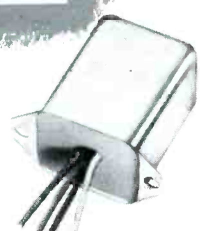

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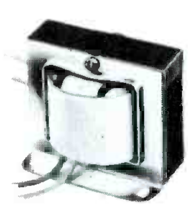

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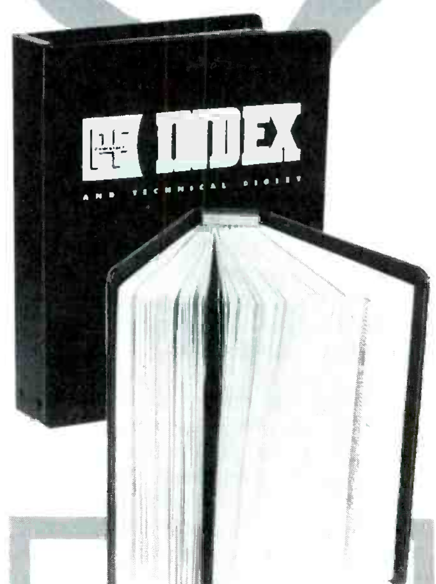

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100% satisfactory reception at points up to approximately 40 miles. This is assuming, of course, that no unusual obstructions that might affect reception were present in that area.

Another important point was the fact that at none of our test positions, at any antenna height, did we find any of the dreaded dead spots which plagued installers in the Portland area. This is probably due to the essentially flat terrain which is present in the South Bend area. Of course, we were very happy that this condition did not exist. As you may know, many of the reports out of Portland indicated that at certain points the movement of the antenna a few inches sideways, or up or down, toward or away from the transmitter might result in complete loss of the signal. We deliberately searched for such points by tilting the tower, which meant that the antenna itself was moving either sideways, or toward or away from the transmitter. We also noted the readings when raising or lowering the antenna and no dead spots were in evidence. There was, however, a variation in signal strength as the antenna was raised or lowered. A report on this condition is included in the UHF antenna section in this publication.

The field survey was conducted to provide the necessary data upon which we could make a factual report on those problems which we felt were uppermost in the UHF field. We sincerely hope that the results of our tests, which are included in the various articles in this issue, will in some way be instrumental in answering many of your questions.

This article would not be complete without expressing our sincere thanks for the splendid cooperation which was given us by the following people and concerns:

Figure 17 shows our Trailer-Tower in front of the Commercial Sound & Radio Company, in South Bend, Indiana, which was used as a base for our operation. The personnel of this company were extremely cooperative. They not only gave us storage space for our equipment, but made equipment available to us which we were not able to ship from our plant. Mr. Al Kester, Sr., instructed his employees to do anything within their power to help us with our project. Messrs. Al Kester, Jr., Steve Casper, Mel Ebersole, and Art Bush carried out these instructions faithfully. We wish to sincerely thank each of these people for their help.

A vote of thanks to Mr. Carl Barbey of the George Barbey Company in Reading, Pennsylvania, for handling the equipment which was shipped there.

Our thanks also to Mr. Otto V. Wise at the Cabell Electric Company in Jackson, Mississippi, and Mr. L. T. Hepler at the Electronic Supply Company in Baton Rouge, Louisiana, whom we contacted for UHF time-table information in their respective areas.

We also received a lot of help from Mr. Bill Rodgers of the Colfax Distributors in South Bend, Indiana. He supplied us with antennas and equipment which made possible a greater number of tests during our field survey. Our sincere thanks to Mr. Rodgers.

All of the personnel at WSBT-TV, particularly Mr. Art O'Neil, who is chief engineer, were most cooperative in supplying us with information concerning the station and their schedule. It is with their permission that pictures of their pattern (Figure 15) and transmitter (Figure 18) are included in this issue.

We also want to convey our thanks to all manufacturers of antennas, transmission lines, test equipment, receivers and converters, who made their equipment available to us in order to carry out this project. Needless to say, without their help we could not have accomplished our goal. We sincerely appreciated their help.

W.W. HENSLER

UHF STRIP INSTALLATION
(cont'd from page 37)

signal applied to the RF amplifier grid differs from that of the received signal.

The output of the UHF antenna strip is in effect a variable IF frequency. Although the output of any given UHF strip is fixed, (except for the effect of the fine tuning control) the frequencies will differ from one UHF strip to another. Hence the term variable IF.

The factors determining the selection of the exact variable IF frequency that need be employed for a specific UHF channel strip is dependent upon many things. First of all, the harmonics of the selected frequency must not interfere with the incoming signal. Similarly, the oscillator must operate at a frequency so that its harmonics will not interfere with the incoming signal. The choice of these frequencies are a design problem and are not of direct concern to the service technician. However, the technician should be fully aware of the factors involved in the selection of these frequencies.

The UHF strips are supplied with the various coils and trimmers in the antenna strips (A, A2, A3 and A4) properly adjusted to provide resonance at the proper frequencies. Under NO CIRCUMSTANCES Must The Adjustments on The Antenna Strip Be Tampered With.

Let us consider the function of the RF amplifier when the tuner is operating on UHF. By referring to Figure 7, the circuitry employed in the plate circuit of the RF amplifier can be seen, plus the mixer grid and oscillator circuits. Schematically the circuit is the same for UHF reception as it is for VHF reception, except for the addition of the harmonic generator on the UHF strip.

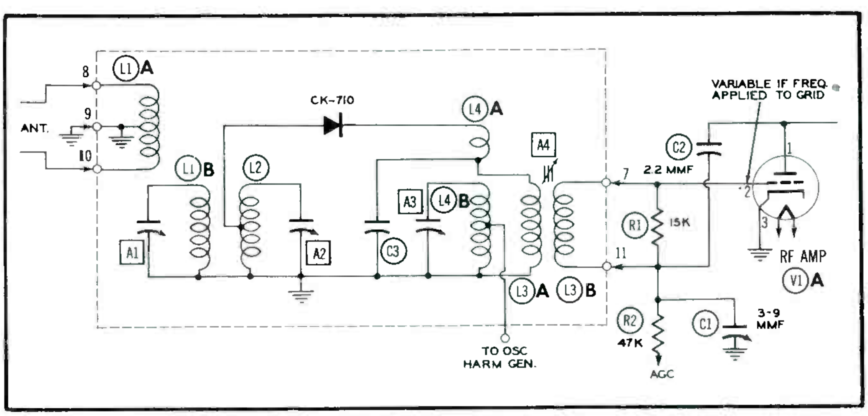


Figure 5. UHF Input Circuit.

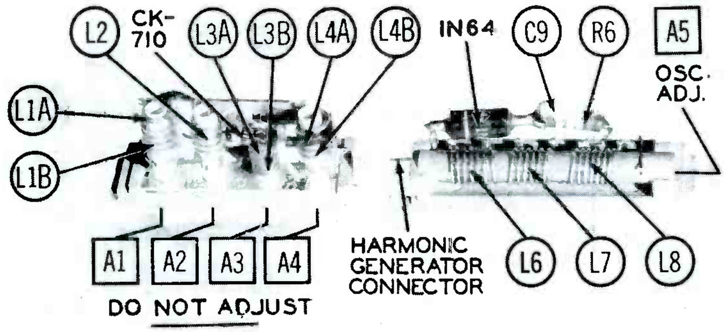


Figure 6. "34Q" UHF Strips Showing Component Placement.

These additional components, which consist of a resistor, capacitor, and crystal, can be seen in Figure 6, and are shown dotted-in on the schematic of Figure 7.

The second conversion takes place in the mixer tube (V2A) in a manner similar to that employed during VHF reception. Again let us consider the two frequencies involved with the input of the mixer stage. First of all, the inductance of L6 is such that it resonates at the variable IF frequency which was applied to the input of the RF amplifier. L7 is also tuned to this same frequency. The inductance associated with the oscillator circuit is L8. This coil is equipped with a variable brass core which is accessible through the adjustment hole in the front of the tuner. This is The ONLY ADJUSTMENT That Need be Made On The UHF Strips. As can be seen in Figure 6, L6 and L8 are placed on either side of L7 providing coupling of the oscillator signal and the variable IF signal to the mixer grid. The output of the second converter is the video IF frequency of the receiver.

In reviewing the double conversion process one very unique feature comes to mind. This is the fact that double conversion is accomplished with only one oscillator stage. This is accomplished through the use of harmonics of the local oscillator to fundamental frequency of operation.

Although a description of the operation of these strips is, of necessity, a rather lengthy discussion, it should be studied carefully as it is quite important that the technician understand their operation in order to properly install and diagnose troubles.

Installation Procedure -

The installation of these strips in a tuner is quite simple. After the proper strips are obtained, determine which VHF strips are to be removed. These, of course, should be those upon which no signal can be received in that particular area. After this is determined, remove both the antenna and oscillator-converter strips from the tuner. The UHF antenna strip (5 contact) should be installed in the tuner first. Figure 8 illustrates this installation step. When installing the UHF oscillator-converter strip (6 contact), the harmonic generator output prong must be engaged into the small socket provided on the companion strip (see Figure 9). Take care that this prong is not bent. When properly lined up, the strip will go into place without forcing it. If a bottom cover was employed on the tuner it should be replaced. This completes the actual installation of the UHF strips. The next step is the adjustment of the oscillator slug. Turn on the receiver and rotate the station selector knob to the position at which the strips were installed. Allow at least five minutes warm-up time (preferably fifteen minutes) before adjusting the oscillator slug. Set the fine tuning control to the mid-point of its range and, using an insulated alignment screw driver, adjust the oscillator slug for best sound and picture. Only a SLIGHT ADJUSTMENT of This Core Should Be Made. If this slug is turned too far in either direction, a different mode of operation might, in a few cases, be found. This improper setting, however, will result in inferior performance.

The physical size of the UHF strips prevents the use of two UHF strips in adjacent positions in the turret. This limits the number of UHF strips that can be used in a given tuner, to six. There is no set order that need be followed in installing the strips. They may be installed in any desired order but do NOT attempt to install 2 UHF strips next to each other as damage to the strips will result.

Many TV receiver selector knobs are designed so that the channel numbers can be attached directly to the knob. Since the regular sequency of channels is broken after the UHF strips are installed, it is a definite advantage to identify the UHF channel positions. This is possible by means of channel number strips which are supplied by some of the receiver manufacturers. Figure 10 shows a set of these tab number sheets which are supplied by Majestic for use in conjunction with their receivers. In this particular case, the backs of the sheets are gummed so that they may be attached directly to the selector knob. When obtaining UHF strips from the distributor, it might be well to check to see if such tab number sheets are available for the particular model receiver in which the UHF strips are to be used.

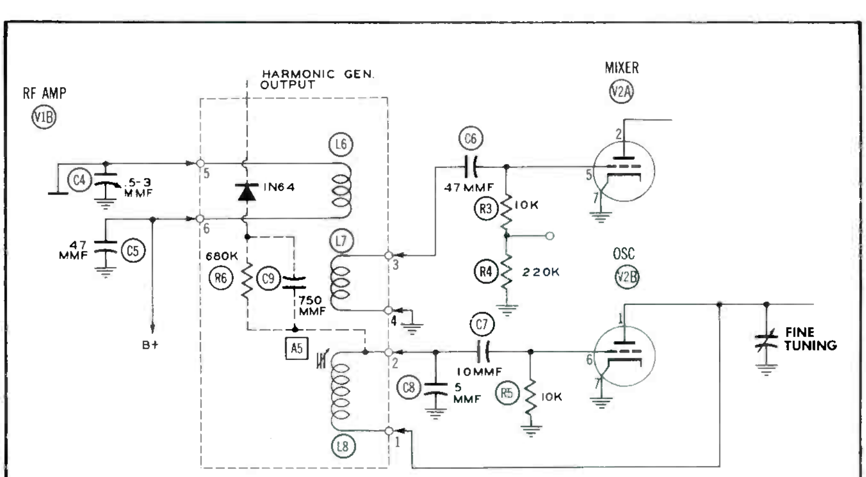


Figure 7. RF Plate, Mixer Grid and Oscillator Circuits.

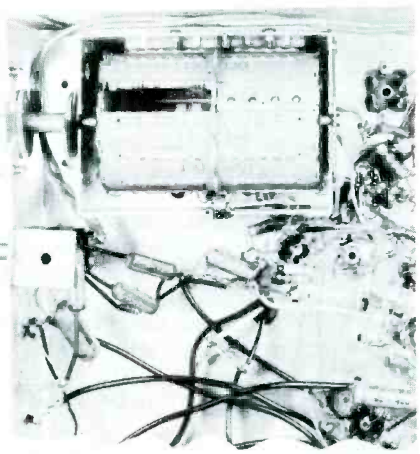


Figure 8. Set with UHF Antenna Strip Installed.

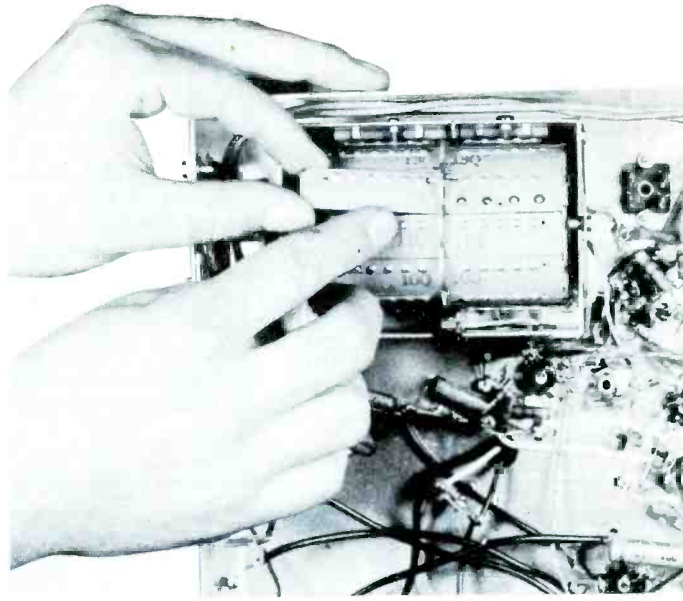


Figure 9. Installing the UHF Cscillator-Converter Strip.

Another use for these UHF strips is their incorporation in Standard Coil tuners employed in Field Strength Meters. The Simpson Model 488 Field Strength Meter employs a series 200 Standard Coil tuner. One of these meters was used in our South Bend field survey. Although our sensitivity measurements were taken with a RCA U2 converter coupled to the Field Strength Meter input, a channel 34 strip was installed and used for monitoring purposes during out tests. This set up provided for two methods of operation and a double check in the event that equipment failure was suspected.

The installation of these strips in the Field Strength Meter is identical to those previously described. The oscillator slug should be adjusted to provide maximum field strength reading. Again, the oscillator slug should be turned only a slight amount. Otherwise improper operation will result. Figure 11 shows the UHF strips being installed in the Simpson Model 488 Field Strength Meter.

The use of UHF strips in Standard Coil tuners, when properly installed, should prove very successful, particularly in strong signal areas. Since no provision is made for separate UHF antenna connections, the VHF antenna will normally be tried for UHF reception. Our experiences during our field survey indicated that this practice will usually be successful within 10 miles of the transmitter. Of course, many variables will effect the success of this plan of operation. Such things as obstructions, terrain, and of great importance the power output of the transmitting station, are but a few of the things which will effect operation. If greater pickup is required to provide satisfactory reception, an all-channel antenna or separate VHF and UHF antennas, with a coupling device that will provide single lead-in operation, should be installed. Either setup will eliminate the necessity of switching from one antenna to the other when tuning from VHF to UHF channels.

Summarizing our experiences with these UHF strips during our field survey, I would say that satisfactory results were obtained in every case. After making the necessary oscillator slug adjustment, no further adjustments were required. The units were very stable and any retuning which was required during warm-up was hardly noticeable.

W.W. HENSLER

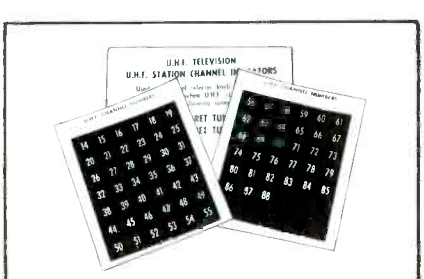


Figure 10. UHF Channel Tabs.

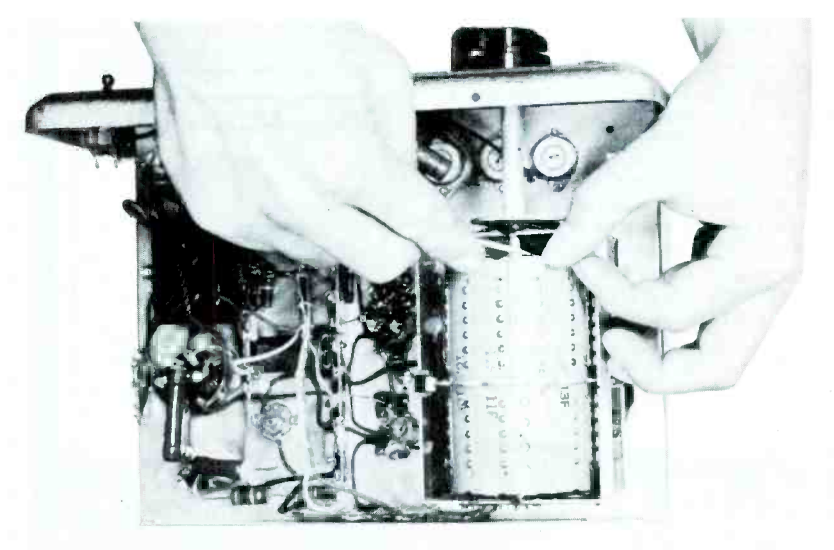


Figure 11. Installing UHF Strips in a Simpson 488 Field Strength Meter.

Dollar and Sense
(Continued From Page 49)

FISHBOWL. A cute sales gimmick seen in a country fair tent of an appliance dealer was a goldfish bowl filled with nickels, dimes and quarters. Anyone buying one of the appliances could reach into the bowl with one fist and bring out his down payment. This stunt could be applied equally well to TV set sales. The prospect of getting money for nothing appeals to people, yet there are few hands that can hold anywhere near the equivalent of a 10 per cent discount on the average TV set. Try it.

CRASH. Just as the 40-foot, 2,000-lb UHF antenna of York, Pennsylvania's channel-43 WSBA-TV was within a few feet of its final position atop a 380-foot tower, an eyebolt let go and the antenna plunged to ruin. Fifteen feet into the ground it went, a total loss. Though covered by insurance, it meant delaying the debut of the UHF station One workman atop the tower was whiplashed by a steel cable attached to the antenna, receiving leg cuts and a fractured elbow. In similar accidents several years ago, TV and FM antennas crashed in Philadelphia and Dallas when almost up.

JOHN MARKUS

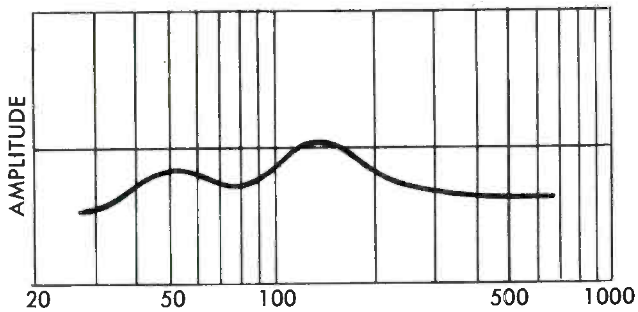
AUDIO FACTS
(cont'd from page 45)

evision receiver, which in most cases is the open back box or baffle. This type (Figure 1), which includes the flat baffle, gives a very uneven response with deep valleys and high peaks, due mainly to the front and back sound waves cancelling or adding at various frequencies and the effects of the resonant frequency of the speaker itself. This uneveness is most noticeable as a boominess in the reproduction of speech and music. The open back cabinet would have to be very large, so as to approach an infinite baffle, if these ragged effects are to be overcome.

The totally enclosed or infinite enclosure (Figure 2) completely isolates the front and back wave. In fact the radiation from the back of the cone is eliminated by using a sufficiently large well-braced box, padded to kill reverberation. To be effective and obtain good low-frequency response, the cubic content must be larger for larger speakers. But there is a definite limit, for above a certain point there is no lowering of response with an increase in size. The response is fairly smooth, other than for a broad resonant point slightly higher than the natural resonant frequency of the speaker. This can be a very satisfactory system if a suitable speaker is used and the cabinet is of succifient size.

The vented enclosure, better known as the bass reflex (Figure 3) has been, and is, a very popular enclosure. Excellent results can be attained with this type; good low-frequency response with no extreme peaks or dips, and in a moderately sized cabinet, IF (this "if" is the important thing) the enclosure is designed for, and tuned for, the particular speaker used with it. Otherwise, the bass reproduced will be very boomy, with a certain few low tones greatly emphasized.

The horn is practically ideal for converting the electronic signal to acoustical power, since a correctly designed horn operates as a transformer to couple the speaker efficiently to the air. Here we will concern ourselves chiefly with the horn type enclosures (Figure 4) for use with cone speakers. The horn has the disadvantage of large size, since it must have sufficient length and mouth area in order to give good low-frequency response. To overcome this disadvantage of size, various folded horn enclosures



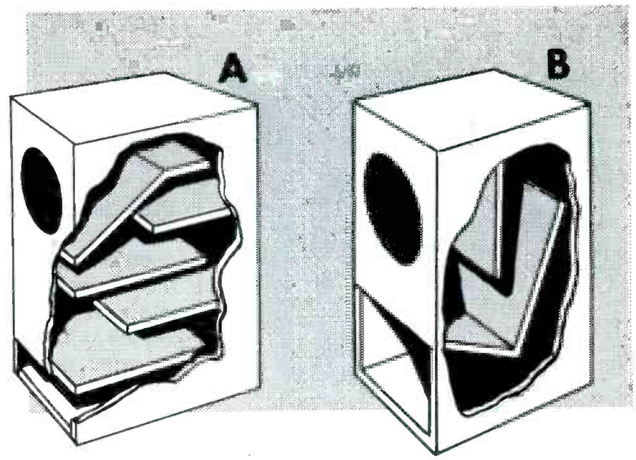


Figure 5. (A) Acoustical Labyrinth. (B) Exponential Acoustical Labyrinth With Impedance Curve.

have been designed, resulting in very good operation with cabinets suitable for installation in rooms of moderate size. Horns make an interesting subject which we hope to discuss at greater length later.

The acoustical labyrinth (Figure 5) has been used in various forms since it can be constructed in a fairly small cabinet, and does have the effect of lowering the resonant frequency of the speaker, thereby affording good low-frequency response. The labyrinth is sometimes built in such a rate of expansion (Figure 5B) that it is actually a horn.

These basic forms have been used in all manner of variations and combinations, making them sometimes hard to recognize. To classify and try to explain the operation and theory of all the available speaker systems would fill many books. But broken down to basic ideas, most of it would be found to be very interesting and easily understood.

The curves included with the drawings illustrate the impedance readings obtained at the lower frequencies, when experimenting with the various type enclosures. The impedance of the speaker at these frequencies does have a great influence upon the bass response, although the extreme peaks are smoothed out considerably by the damping action of most high quality power amplifiers. Of course such curves vary with different enclosures of the same type and with different speakers, but those shown are typical.

We have done some experimenting with speakers and enclosures and will endeavor to prepare some detailed articles in subsequent issues.

ROBERT B. DUNHAM

UHF CONV. (cont'd from page 33)

tween the receiving equipment and the connections of the transmission line. In Figure 8A separate lead-ins are employed for the VHF and the UHF antennas while a matching unit for a common lead-in is shown connected in Figure 8B. Note that in those cases where it is desired to use a VHF booster and a UHF converter, the VHF booster is placed between the VHF antenna and converter, and not between the UHF converter and receiver. The latter arrangement would not impair VHF reception, but UHF reception may be impaired due to the addition of the switching arrangement in the booster being placed between the UHF converter and receiver. Thus the booster and the converter should be connected as shown in Figure 8A.

If the system of using a common transmission line proves to be extremely popular, antenna matching units may be installed in the future inside the receiving unit at the manufacturing level. Thus only one terminal strip need be used to receive the input from a common lead-in for both VHF and UHF reception.

Ward Products Corp. and the JFD Manufacturing Company have

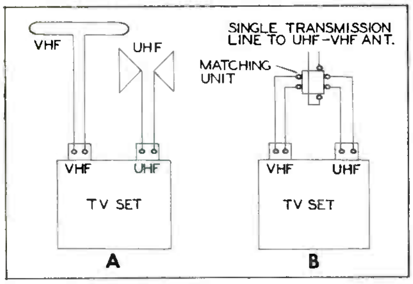


Figure 6. Methods for Connecting Transmission Lines to VHF-UHF Receivers.

already announced matching units in their line. It is probably that such units will be available from several more companies in the near future. We were unable to make operational tests on these units, however we plan to do so as soon as possible and we will pass along our findings.

The second phase of the tests, as applied to the use and operation of UHF converter and receiving systems, was made using portable auxiliary equipment, such as our portable power plant and antenna trailer tower. It was thereby possible to actually observe UHF oper-

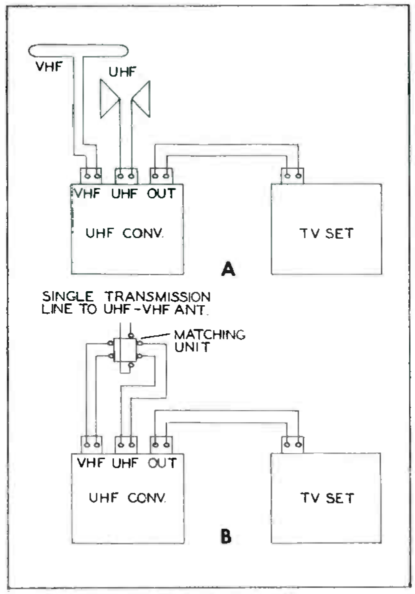


Figure 7. Common or Separate Transmission Lines Connected to Separate UHF Converter and TV Set.

ation at a number of different locations. A receiver with a built-in converter unit was used in the tests, along with a separate two channel converter unit of the pre-set type. Figure 2 illustrates this test setup. We found that even at 60 miles the signal was strong enough to provide synchronization of the picture but was rather weak as far as contrast was concerned. No deliberate attempt was made to try an elaborate antenna array to improve the reception, but it was felt that through careful selection of the antenna and lead-in, a satisfactory picture might be obtained at this location. This speaks pretty well for the sensitivity of the receiver.

As a tribute to the engineering put into each of the UHF receiving devices tested, which were subjected to abnormal conditions while being transported in the trunk of a car, sometimes in very cold weather, the abuse in no way impaired their performance during the two weeks period. The units proved to be stable, rugged, and simple to operate. Their use in the home should prove highly satisfactory in providing excellent television reception from UHF stations.

MERLE E. CHANEY

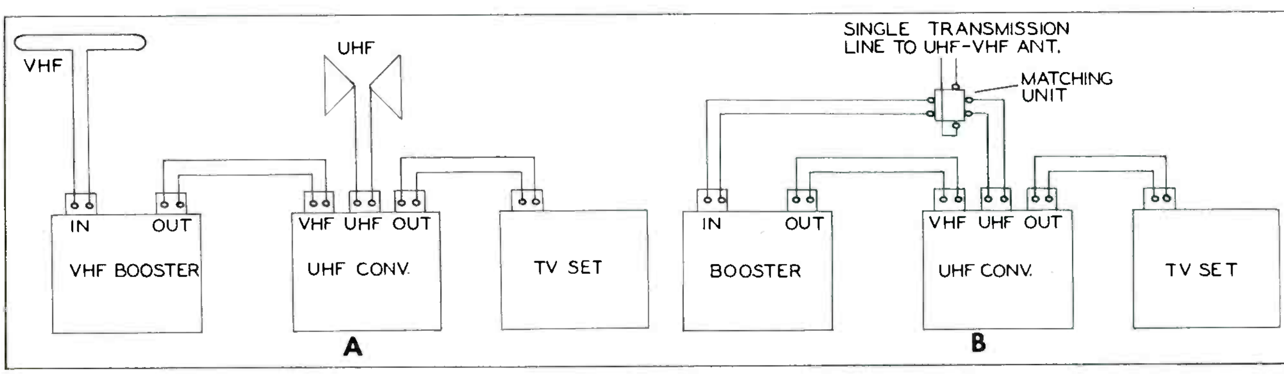


Figure 8. Connections for Common or Separate Transmission Lines to a Combination of Booster, UHF Converter, and Receiver.

UHF ANTENNA (cont'd. from page 25)

of handling the ghost trouble. One further point about the terrain--there was a rise of ground between the test position and the transmitter site. The elevation of this ground was about 25 or 30 feet above the test location.

The first antenna used was a bow-tie with screen reflector (Channel Master, Model 403). At a height of 25 feet, a ghost-free picture could be obtained, but it was necessary to orient the antenna to within 5 degrees of the transmitter direction. Any deviation resulted in the reflected signal from the gas storage tank appearing on the picture in the form of a ghost. When the antenna was turned so that it pointed toward the storage tank, the reflected signal dominated the sync circuits of the receiver, and the direct signal showed up as a leading ghost on the picture screen.

When the height of the antenna was raised to 30 feet, it was found that the angle of rotation, through which a ghost-free picture appeared, was larger. The angle increased with each successive rise in height until at the 45 foot level the picture was clear over a rotational angle of 90 degrees. This signified that the strength of the direct signal, though weak at the 25 foot height because of the ground rise obstruction, increased considerably in comparison to the strength of the reflected signal as the antenna was raised.

A pair of bow-ties, vertically stacked, with their individual screen reflectors (Walsco, Model 4402) were tried next, and reception quality was checked at various heights. A ghost-free picture could not be obtained at either the 25 foot level or the 45 foot level. However, there were one or two heights in between at which a clear picture did show. This particular antenna seemed, therefore, to perform with medium effectiveness in a ghost-ridden location.

The third antenna given a trial at Position P-2 was the stacked dipoles with screen reflector (Radiart, Model U-4). The picture re-

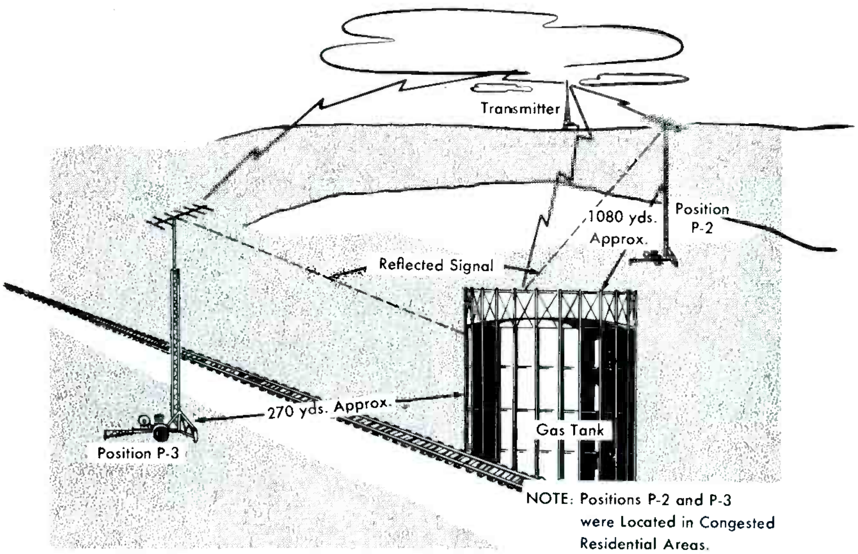


Figure 5. Sketch of the Terrain of Positions P-2 (3 Miles) and P-3 (3-1/2 Miles).

ceived with this antenna style was quite unsatisfactory; the reflected signal could not be eliminated from the picture despite reorientation of the antenna or changes of height up to 45 feet.

A circular folded dipole antenna (Rytel, Model RDO-1) was raised in the air next, and the signal showed a strong reflection present throughout 360 degree rotation of the antenna. Consequently, this antenna type is not recommended for installations where reflections are present.

Our final test at Position P-2 was a check of the clover V-beam antenna (Telrex, Model 100). This antenna was mounted on a mast section (See Figure 6) and put up about 48 feet in the air. It was found that there were three directions in which the antenna could be pointed to receive a ghost-free picture; however, these points were very critical and the least deviation one way or the other brought a ghost pattern on the screen. In view of this, the clover V-beam type of antenna is not very suitable in such an application.

Position P-3 was plagued with a reflected signal coming in at right angles to the direct signal as can be noted in the sketch of Figure 5. A railroad angled past this position only ten or twelve yards away. The bed of the right-of-way was about 12 to 15 feet higher than the average terrain; however, as results proved, the presence of the railroad had no appreciable effect on the signal reception. The gas storage tank, located about 270 yards off to the right of Position P-3 in relation to the direction of the transmitter, was the principal source of reflected signal.

With the stacked dipoles and screen reflector (Radiart, Model U-4) much better results were obtained at this position than at Position P-2. At a height of 25 feet a ghost-free picture could be maintained over a full 60 degree rotation of the antenna. At a height of 45 feet the orientation of the antenna became more exacting, though a very clean picture could be obtained. Both direct and reflected signals seemed to get stronger with increase in height.

A bow-tie with screen reflector (Channel Master, Model 403) was also checked at this position with very satisfactory results. A good picture with no reflections was received over a wide angle of antenna rotation at both the 25 and 45 foot levels.

Figure 6. The Clover V-Beam (Telrex, Model 100) Being Installed on a Section of Mast.

The circular folded dipole antenna (Rytel, Model RDO-1) was given a trial at Position P-3. Again this type of antenna indicated less directivity as the ghost signal persisted in the picture regardless of where the antenna was pointed.

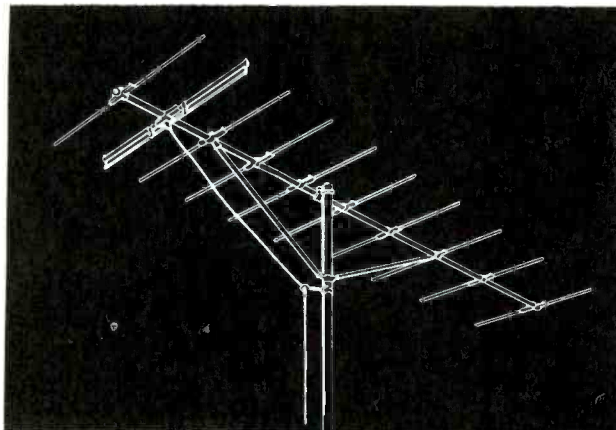
Position P-4 was located approximately 5 miles north of the transmitter. This was at the north edge of South Bend in open, flat terrain. The only obstructions were scattered houses to the south of the test setup. One antenna, a stacked V type (Channel Master, Model 404), was checked at this position. Due to adverse weather conditions, no further tests on other antennas were performed at Position P-4, (5 miles). The results of the one test are shown graphically in Figure 7.

The graph of Figure 7 shows that the signal strength followed a definite pattern with changes in height of the antenna. The strongest signal was received at a height of 24 feet, which means that a normal rooftop installation under these conditions would give satisfactory results. As evidenced by the graph, there would be no advantage in positioning the antenna higher than the 24 foot level.

The picture on the receiver was of good quality with no sign of reflected signals. This was to be expected since there were no high obstructions which would normally cause reflections in the area.

A fifth test location, Position P-5, was established at a distance of approximately eight miles from the transmitter. Of the several tests conducted at this position, only one had a direct bearing on the subject of this report. This was a test using an all channel UHF-VHF antenna which featured a simple V-dipole and reflector as its UHF section (Vee-DX, Model Ultra Q-Tee). The picture qualities of the local UHF signal and of the VHF signals coming in from Chicago, approximately 70 miles away, were checked. The UHF signal was free of snow and very acceptable; the VHF signals were comparable to those obtained on VHF antennas employed in the area.

In summary, we might say that the antenna problems in the primary service area of a UHF transmitting station resolve themselves into two major questions:



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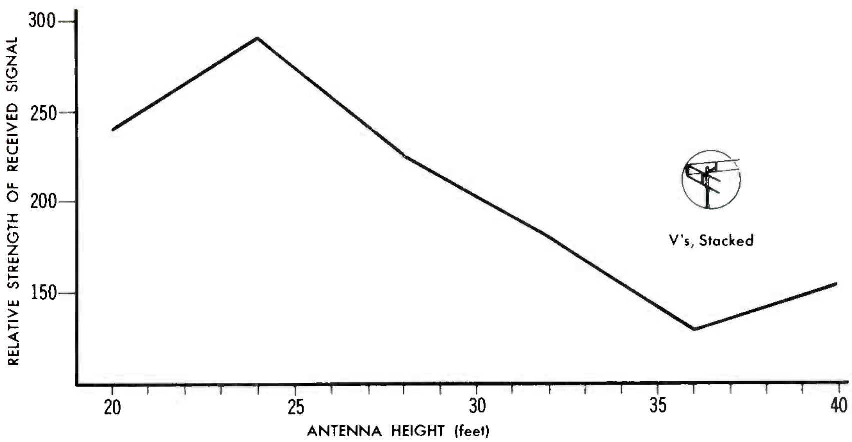

Figure 7. Relative Strength of Received Signal Versus Antenna Height at Position P-4 (5 Miles).

What antenna height will provide strongest and best signal reception?

What antenna type should be used to best combat a ghost problem?

Judging from the outcome of our tests conducted in the primary service area of WSBT-TV in South Bend, it can be stated that antenna height does determine in some measure the quality and strength of the signal received. Also it was found that low antenna heights may frequently provide better reception than the higher ones.

In areas with reflection problems, the antennas which have very good directivity, namely, those having reflecting surfaces or elements which reduce pick-up from the rear and sides are to be preferred over antennas not having such features. On the other hand, in those locations where ghosts are not troublesome, the less directive types may be used quite satisfactorily.

It may be well to briefly mention at this point that two types of indoor antennas were given trials in the primary service area at South Bend and the results were very unsatisfactory. Snowy and ghost-ridden pictures were obtained with both types. Judging from such results, we are hesitant to recommend indoor antennas for UHF reception.

Chart B shows those antennas which we found particularly suitable for outdoor installations in the primary service area of the UHF television station at South Bend. In those areas where reflections are bothersome, more directive types may be needed, such as the corner reflector or the other antennas having reflector screens of some form or other. Chart B excludes all of the higher gain, and frequently more expensive, types of antennas; even though the use of such antennas in the primary area is perfectly permissible.

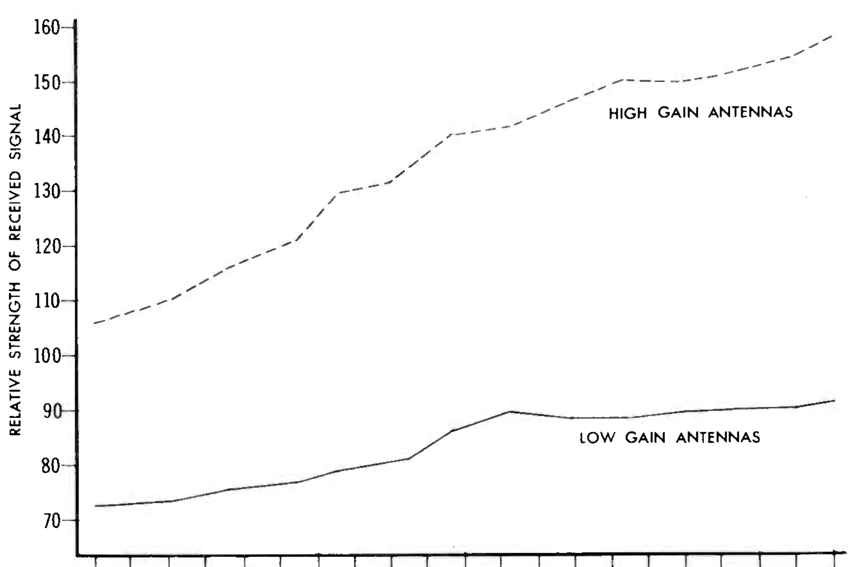

Figure 8. Graph of the Effect of Height on High Gain Antennas and Low Gain Antennas.

Secondary Service Area -

A test position, which we shall designate as Position S-1, was established at a distance of 20 miles from the transmitter site. The position was in open, rural country on a very slight rise of ground. A building was situated in the direction away from the transmitter, but it could not be considered a source of reflections.

A total of twelve different UHF and UHF-VHF antennas were tried at this location so that comparisons could be made. Each antenna was checked at several heights between 25 and 45 feet. Generally speaking, it was found that all the antennas picked up more signal with increasing height. However, one trend was noted and that was that the higher gain antennas showed a more pronounced increase in signal pickup with rise in antenna height than the lower gain antennas. An average was calculated from readings obtained from groups of high and low gain antennas at heights from 25 to 45 feet. The relationship of these averages is shown in Figure 8. From an installer's viewpoint, it would seem, therefore, that it is less practical to install a low gain antenna at a high level for sufficient signal pickup than it is to install a high gain antenna at a medium level.

In all the tests at Position S-1 (20 miles) the picture was very clear and sharp and, for the most part, free of snow. To show the comparative gains of the various antennas, an average gain figure for each was calculated from the data of the tests and the results are shown graphically in Figure 9. The readings obtained from 37 to 45 feet which included the maximum reading for each antenna, were used for these calculations. Two of the antennas in this graph were not tested with the others at this specific position, but have been included because the conditions under which they were tested at a later date made possible a direct comparison.

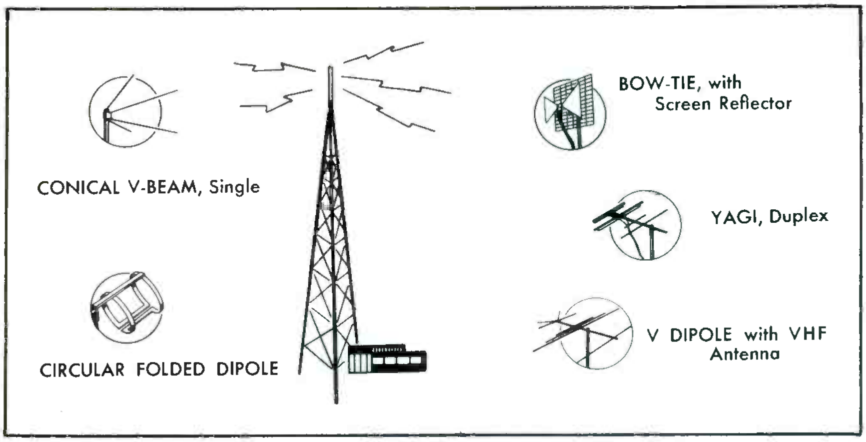

Chart B.
Antenna Recommended for the Primary Service Area, (0-15 miles).

NOTE: In Areas Having Reflection Problems, See Text for Additional Recommendations.

The rhombic (Tricraft, Model U-1) and the 12 element Yagi (Vee-DX, Model LLJU-28-39) were both high gain antennas. The rhombic was extremely directive. The rotator which was used with the antenna had a speed of approximately one revolution per minute, and the orientation of the antenna for maximum signal reception called for considerable care and precision in manipulating the rotator control. As can be seen in Figure 9, the rhombic matches the 12 element Yagi in being the most sensitive of the antennas tested. Again, it must be kept in mind that all these antenna checks were limited to only one channel out of the group of 70 UHF channels. Their operation on Channel 34 is no positive guarantee of similar operation over the whole range of channels. Still, the results which were obtained are substantiated in great part by theoretical considerations. For example, the rhombic has long been placed high in all gain comparisons, and it also has been noted for the long narrow lobe in its horizontal pattern, the feature which marks it as being a highly directional antenna.

The corner reflector (Walsco, Model 4450) is shown in Figure 10 as it was being mounted on the mast in preparation for its test. Its gain characteristic on Channel 34 came close to that of the 12 element Yagi and the rhombic, though its directivity was not quite as critical.

The order of the other antennas as far as their respective gains were concerned is shown in the bar graph of Figure 9. The fact that some of the Yagi antennas assumed positions near the bottom of the group may or may not be significant since it is not definitely known whether the particular antennas involved were cut specifically for Channel 34 or whether they may have been designed for a broad group of channels. If the latter case is true, gain probably suffered a good deal in achieving the added bandwidth.

Positions S-2, S-3, F-1, and F-2 should be discussed as a group. The reason is that tests at these positions were performed with one objective in mind. This objective was to set a course going north from the transmitter to check the signal strength at the 15, 20, 25, and 30 mile points. Position S-2 was located at the 15 mile limit; S-3 at the 20 mile limit; F-1, which marks the beginning of the fringe area, at the 25 mile limit; and F-2 at the 30 mile limit.

The type of antenna used at these four positions was the stacked bow-tie with screen reflector (Walsco, model 4402). Only this one antenna was used because it was desired to compare the signals received at all four positions. The test equipment remained the same in all tests and the results of the tests are shown graphically in Figure 11.

As is shown on the graph, the signal strength was, on the average, proportional to the height of the antenna. As the height was increased the signal strength increased for all four positions. Consequently, at maximum height of the antenna the signal strength was at maximum.

In comparing the results of the four positions it is seen that the strongest signal was received at test position S-3, (20 miles). The reason it was much higher than that received at Position S-2, (15 miles) was because of the difference in terrain at these two locations. The 15 mile location was at the lowest point in Niles, Michigan, near a two story

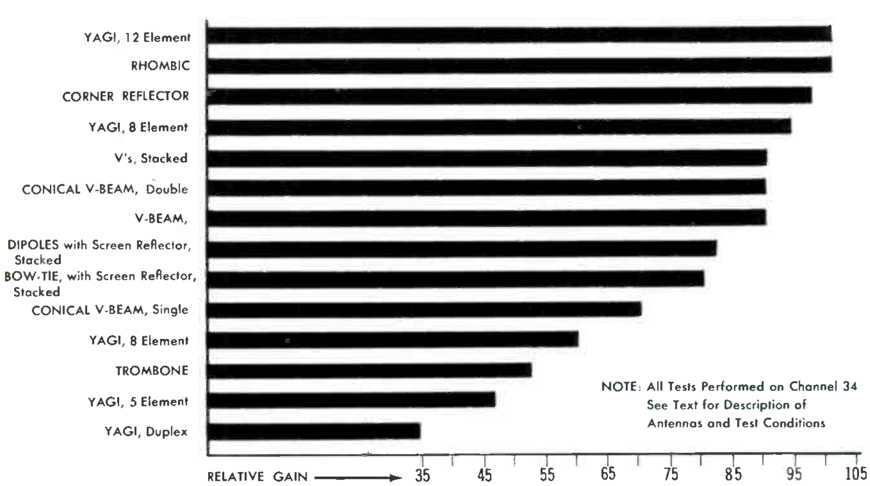

Figure 9. A Bar Graph Showing the Comparative Gains of the Various Antennas Tested at Position S-1 (20 Miles).

Figure 10. The Corner Reflector Being Mounted on the Mast in Preparation for its Test.

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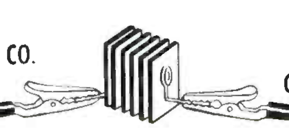

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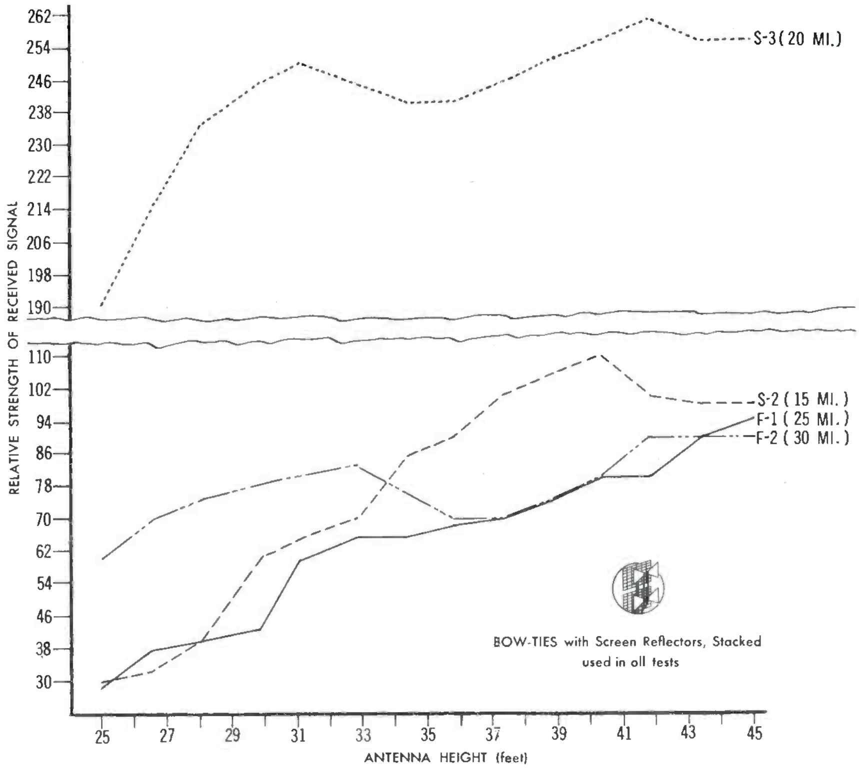

Figure 11. Graph Showing the Results Received Using the Stacked Bow-Tie with Screen Reflector at Positions S-2 (15 Miles), S-3 (20 Miles), F-1 (25 Miles), and F-2 (30 Miles).

warehouse. The warehouse was in direct line with the transmitting tower. Moreover, the elevation of Niles is considerably lower than that of the transmitting antenna; it is only 743 feet above sea level while the elevation of the transmitting antenna is 1350 feet above sea level. Figure 12 is a photograph taken at the Niles test position. On the other hand, the terrain at test position S-3 was the opposite of that at Position S-2. Position S-3, (20 miles) was located in a rural district on a hill higher than the average terrain. (See photograph of test position S-3 in Figure 13.) Although this position was five miles farther north than Position S-2, the differences in the average terrain produced a great difference in the signal strength received at these positions.

In comparing Positions F-1 and F-2, (25 and 30 miles respectively) it is seen that, on the average, the signal strength at Position F-2, (30 miles) was slightly higher than that received at Position F-1, (25 miles). Up to a height of 37 feet the signal at F-2 (30 miles) was considerably higher. At heights above 37 feet the signal strength for both positions remained almost the same. Examination of the terrain at these two positions could also be the basis of an explanation of these results. The location of Position F-1 (25 miles) was in a rural district but with a 20 to 40 foot rise to the south of it. The location of Position F-2 (30 miles) was also in a rural district but the terrain sloped downward toward the direction of South Bend, which probably placed Position F-2 (30 miles) a higher elevation than Position F-1 (25 miles). Since Positions F-1 and F-2 were located in the fringe area the readings obtained were very low. The type of antenna used for these tests was not sensitive enough for operation in the fringe area. If a higher gain antenna type, such as the rhombic, 8 or 12 element Yagi, or corner reflector had been used, greater readings would probably have been realized.

The picture at Position S-2 (15 miles) was considered satisfactory with a small amount of snow, while the picture quality at Position S-3 (20 miles) was very clean--almost free of snow. This was to be expected because of the difference of signal strength as shown on the graph of Figure 11.

The pictures at Positions F-1 and F-2 (25 and 30 mile points respectively) were found to contain a considerable amount of snow and at times the picture became unstable. This was to be expected since the signal strength at both of these posi-

Figure 12. Photograph Taken at the Niles Test Position S-2 (15 Miles) showing the Terrain at this Location.

Figure 13. Photograph Taken at Test Position S-3 (20 Miles), Showing the Terrain at this Location.

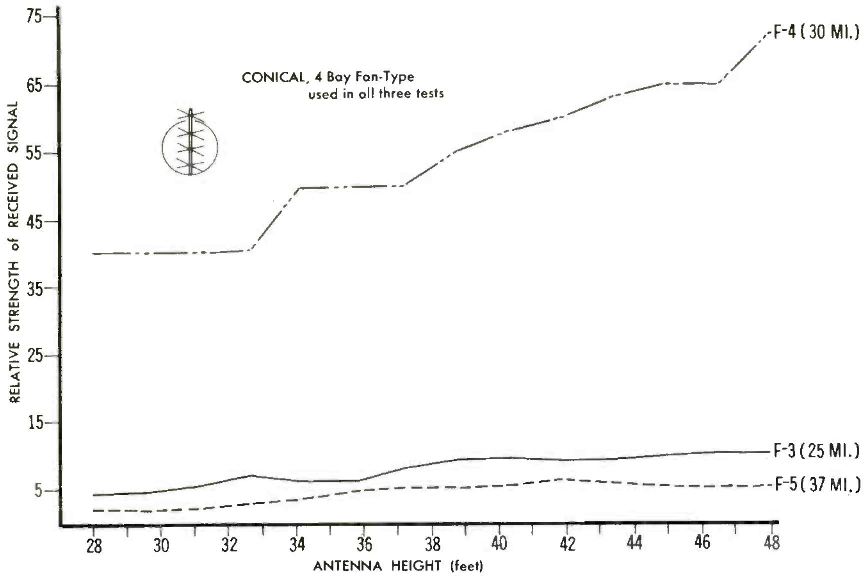

Figure 14. Graph of the Results Obtained Using the 4-Bay Fan-Type Conical at Positions F-3 (25 Miles), F-4 (30 Miles), and F-5 (37 Miles).

Figure 15. Photograph of the Test Setup at Position F-3 (Argos) Showing the Town's Water Tower.

tions was weak and a high gain antenna was not used.

At Position F-2 (30 miles) a test was made with an antenna that had been cut for a channel other than Channel 34. A 5 element Yagi, which is not listed in Chart A, was selected for this test. Upon installing this antenna and orienting it toward the transmitting tower, a very weak signal was received. By using the rotator to reverse the orientation of the antenna, it was found that a much stronger signal was obtained. That is, the best reception was received when the antenna was picking up the signal from the back side. The signal strength was practically tripled when the antenna was in this position. This phenomenon has been mentioned here so that, should it occur, its probable cause may be known.

To sum up briefly the important features of television reception in the secondary service area surrounding a UHF transmitting station, we found that the antenna installation problems are essentially the same as those encountered with VHF service. There seems to be no problem with unusual vertical field strength distribution. Also the problem of reflected signals does not appear to be as bad at this distance from the station as it is closer in. In the event the latter problem is encountered, however, the best solution would be the use of a highly directional antenna such as a rhombic, a Yagi, or a corner reflector. Another point to remember is the great effect of terrain on the UHF signal; low elevations will generally require taller masts and higher gain antennas. However, in ordinary circumstances, acceptable reception in the secondary service area will be achieved by using one of the medium gain antennas in Chart C.

Fringe Area -

A total of 9 test positions were established in the fringe area. Two of these positions, F-1 and F-2, were discussed in the previous section. The fringe area, as shown in Figure 3, is the area beginning at the 25 mile limit.

Positions F-3, F-4, and F-5 are to be discussed as a group be-

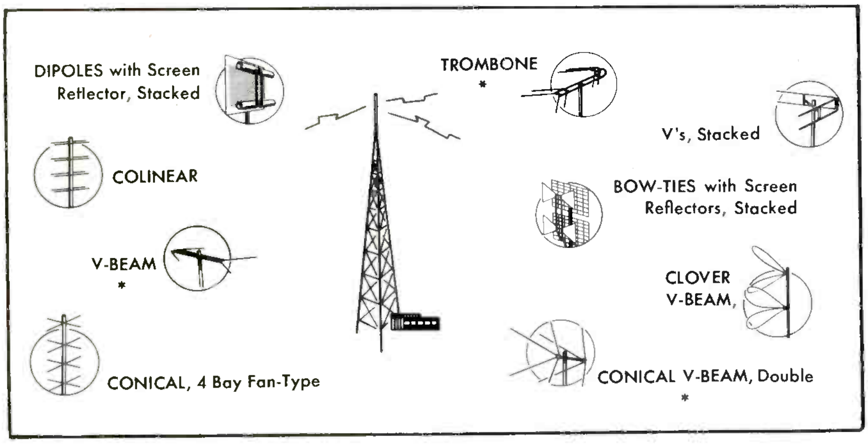

Chart C.
Antennas Recommended for the Secondary Service Area, (15-25 miles).

NOTE: In Areas Having Reflection Problems or Abnormally Low Signal Level, See Text for Additional Recommendations.

*May be Stacked for Additional Gain.

Figure 16. Photograph of the 12-Element Yagi being Prepared for Installation on the Tower.

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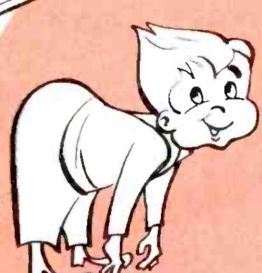

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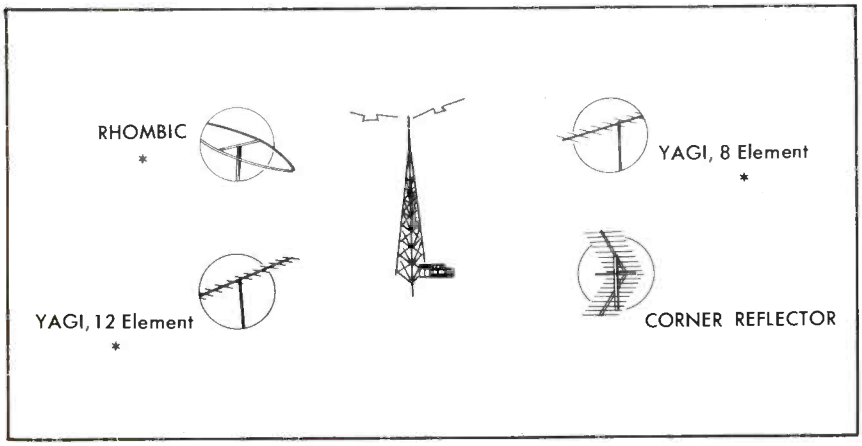

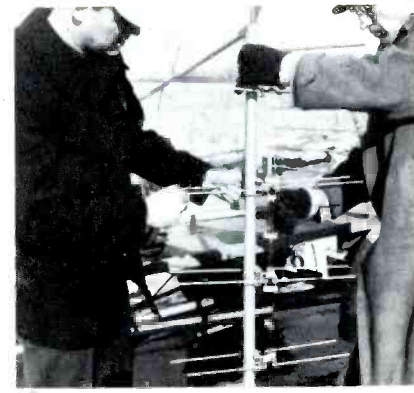

Chart D.
Antennas Recommended for the Fringe Area (beyond 25 miles).

*May be Stacked for Additional Gain.

Figure 18. Photograph Showing the Colinear Antenna Being Attached to a Section of Mast.

cause at these three different positions the same type of antenna was used. Position F-3 was located just past the 25 mile limit; F-4 at the 30 mile limit; and F-5 seven miles beyond Position F-4.

The type of antenna used in all three tests was the 4 bay fan-type conical (Taco, Catalogue #3005), and the whole procedure was rather closely patterned after the excursion north of Niles. The graph of Figure 14 shows the results of the tests.

A situation similar to the one at Niles arose at Position F-3; which was in the town of Argos, Indiana, about 25 miles from the transmitter. The readings of signal strength obtained at Position F-3 (25 miles) were abnormally low, so much so that we suspected faulty test equipment. Another possibility was that the town's water tower, located about 500 feet from the test position (See Figure 15), was affecting the signal. Some idea of how low the signal was can be gained from examination of the graph in Figure 14 and comparing the signal at F-3 (25 miles) with the signal at Position F-4 (30 miles), five miles further away from the transmitter. The strength at F-4 was six times that at F-3.

To relieve our suspicions about Argos, we returned a week later and set up our equipment about one-half mile from our former Position F-3 (25 miles). We were away from the water tower but still within the town's limits. Here we checked a 12 element Yagi (Vee-DX, Model LLJU-28-39), a corner reflector (Walsco, Model 4450), and a clover V-beam (Telrex, Model 100). Figure 16 shows the 12 element Yagi being prepared for installation on the tower. Each one of these antennas performed so much below expectations that we were obliged to conclude that Argos was definitely a very weak signal area. Whether it was due to elevation differences or to other factors is unknown. We can say that normally at 25 miles from the transmitter a medium gain antenna would be very satisfactory. However, in areas such as our Position F-3 (25 miles) at Argos, a high gain antenna would be needed for best reception.

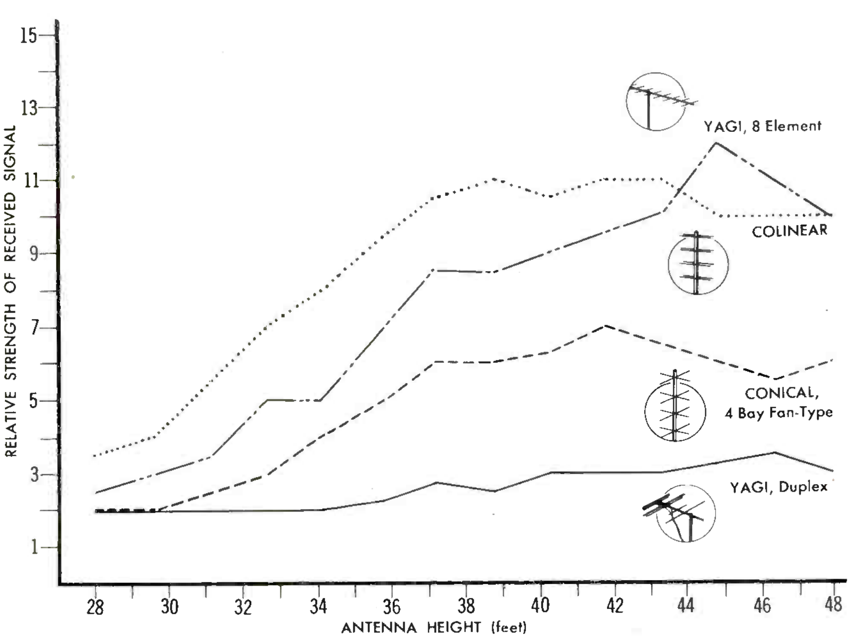

Figure 17. Graph of the Results Obtained at Test Positions F-5 (37 Miles) Using Four Different Types of Antennas.

At Position F-5 (37 miles), located in the outskirts of a small city, a number of tests were made using three antennas other than the 4 bay fan-type conical (Taco, Catalogue #3005). These other antennas were the colinear (Vee-DX, Model CAU), the duplex Yagi (Telrex, Model 300), and an 8 element Yagi (Vee-DX Model LJU). The results of these tests are shown in the graph of Figure 17.

The colinear and the 8 element Yagi provided satisfactory reception when they were raised to the maximum height of 45 feet. The 4 bay stacked conical and the duplex Yagi failed to perform well enough to merit recommendation for use at this distance from the transmitter.

Subsequent to this series of tests, more investigations into the quality of reception of UHF signals in the fringe areas were undertaken. One test position was established at a distance of 60 miles from the transmitter. This location we shall call F-6. The country surrounding Position F-6 (60 miles) was open and almost flat. The antenna which was selected for this check was a colinear antenna (Vee-DX, Model CAU). Figure 18 shows this antenna being attached to a section of mast preparatory to raising it in the air.

A weak tone signal and a barely perceptible picture were all that could be received even with the antenna at the maximum height of 45 feet. However, since we were using an antenna of only medium sensitivity, we believe that had we stacked a pair of strictly high gain antennas and used them at this 60 mile distance it would have been possible to receive a fairly acceptable picture.

Positions F-7 and F-8 were set up at 43 and 32 mile distances respectively from the transmitter. Again the colinear antenna was used in each of these tests. At F-7 (43 miles) the picture was discernible and fairly stable but contained considerable snow.

Finally Position F-9 was established in a rural area at a distance of some 27 miles from the transmitter site and reception was found to be very acceptable. An 8 element Yagi antenna (Vee-DX, Model LJU) was given a trial at this position and performed very well. The height of the antenna above ground had surprisingly little effect on the signal reception. By holding the mast in the hand it was possible to get a picture with the Yagi as low as one foot from the ground. As the antenna was raised, a sharp increase in signal strength occurred at the 5 foot level and the strength continued to rise steadily up to the 12 foot level which was the limit of our reach. The orientation of the antenna was not as critical as might be expected. It could be rotated for approximately 30 degrees and still provide a very acceptable picture.

In summarizing the results of our research in the fringe area of a UHF television station, we might say that 60 miles is about the limit for usable signal reception. This figure of 60 miles is, of course, based on our tests with a television station which was transmitting with an ERP (effective radiated power) of 17.5 kilowatts. In the case of a station with greater power than this, proportionately farther distances would probably be covered.

The type of antennas recommended for use in the fringe area (See Chart D) are the ones that are considered high gain antennas. The antennas in this class are the 12 element Yagi, the 8 element Yagi, the rhombic, and the corner reflector. However, in the area just beyond the 25 mile limit a few of the antennas recommended for the secondary service area could be used. Some of these types would be the V-beam, the double conical V-beam, the 4 bay fan-type conical, and the colinear. Under conditions of undesirable terrain, where the signal strength is low, the higher gain antennas should be employed.

In the area beyond 40 miles, the high gain antennas are definitely recommended. In fact, stacking of the high gain antennas is recommended at this distance. By stacking antennas and by making the installations at the maximum height possible, an acceptable picture should be received at distances up to 60 miles.

Installation Problems in General -

Up to this point in the report, little has been said about the problems presented by more than one station in an area or by combined UHF-VHF service in an area. All antenna installations should be made with a view to the future. If, for example, an area has only one UHF station on the air but one or more additional channels are in prospect, the receiving antenna should be selected with those facts in mind. It should have broad frequency response and sufficient gain to bring in the farthest station, and it should have a provision for rotating its directional response pattern to receive every station, including the proposed ones.

In an area which has had some VHF fringe service and now is in the primary service ring of a new UHF station, there are two general classes of installations. One is the new installation where the customer has no outdoor antenna of any kind. The preferred antenna for this installation would be an all-channel (2-83) antenna, one which provides high gain for the distant VHF stations and at least low to medium gain for the local UHF station. Also some means of antenna rotation is essential.

The second class of installation is one of converting from VHF reception alone to combined UHF-VHF reception. The customer may be able to receive a satisfactory UHF signal by using his VHF antenna, particularly if he has a rotator. Beyond the UHF primary service area (0-15 miles), however, this will not be possible as a rule. If a satisfactory picture cannot be obtained with the VHF antenna, mounting a separate UHF antenna part way up the mast will often serve very well.

It is hoped that this report has added some measure to the growing fund of information that is developing out of the new UHF branch of television communications. More information will become available to the service industry as the field expands; and the subject of antennas will come in for a large share of this coverage.

GLEN E. SLUTZ
C.P. OLIPHANT

UHF Lead-ins (cont'd from page29)

scribed transmission lines is very similar to that experienced with VHF installations. The main difference is the spacing considerations for UHF installations.

In any installation procedure, the first step is the acquisition of all of the components and accessories necessary to complete the job. Assuming that the antenna and the lead-in selection has been made, it must then be decided what accessory items are required. For this discussion we are particularly concerned with the type of insulators which are best suited to hold the transmission line so that a minimum loss is experienced.

Many reports have indicated that a standoff insulator providing maximum spacing between the lead-in and building must be used. In order to obtain factual data, we performed several tests during our field survey using various lengths of standoff insulators. This was accomplished by mounting complete sets of 3", 5" and 7" insulators on the three corners of the antenna tower. Figure 2 shows these insulators so mounted. The tests were then performed in the following manner.

A position was selected where the signal strength was rather low, so that any attenuation caused by the proximity of the lead-in to the tower would be more pronounced. The test position selected was 25 miles from the transmitter. The first step was to obtain a reading with the lead-in held in free space, that is, not in proximity to the tower or ground at any point. This figure was then considered to be a result of minimum attenuation or, in effect, an ideal installation. The

Figure 3. Set-up for Making Standoff Insulator Test.

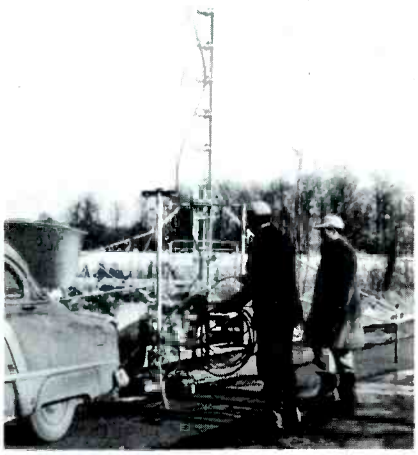

Figure 4. Installing Tubular Lead-in for Testing Purposes.

next steps in this particular test were performed by taking readings with the transmission line held by the different length standoff insulators. Figure 3 shows the antenna, tower and lead-in during one of these tests. The line on the right of the tower is the lead-in properly positioned in the insulators. The line on the left of the tower is the rotator control cable and has no bearing on the tests. The transmission line was held in the insulators for only 15' and since in some applications a longer lead-in may be required, the effects will be even greater than those sighted in our tests.

During the particular test shown in Figure 4, a relative reading of 12 was obtained with the lead-in held in free space. After inserting the lead-in in the set of 7" standoff insulators, a reading of 11.5 was obtained. With the lead-in in either the 5" or 3" sets of insulators, a reading of 10.5 was obtained. This is a reduction of 12-1/2%. It might be well to point out that the triangular construction of the tower produces a less noticeable effect than would be experienced from a flat wall. Thus, it can be expected that even greater attenuation will be experienced in the actual installation. This series of tests showed conclusively that the 7" insulators are most desirable for UHF installations. They should be used whenever possible.

Now let us consider the differences in handling the tubular type line as compared to the flat twin-lead usually associated with VHF installations. The first thing which was noticed was the rigid characteristics of this type of line.

Our field crew had no previous experience in handling this type of lead-in. Our first impression concerned the difficulty of uncoiling the line, due to its greater stiffness over the flat line. Figure 4 shows the field crew at a test position in the process of setting up for a test using a tubular twin-lead line. Note that the lead-in is in the form of a corkscrew, caused by the inability to keep the line straight. It is well

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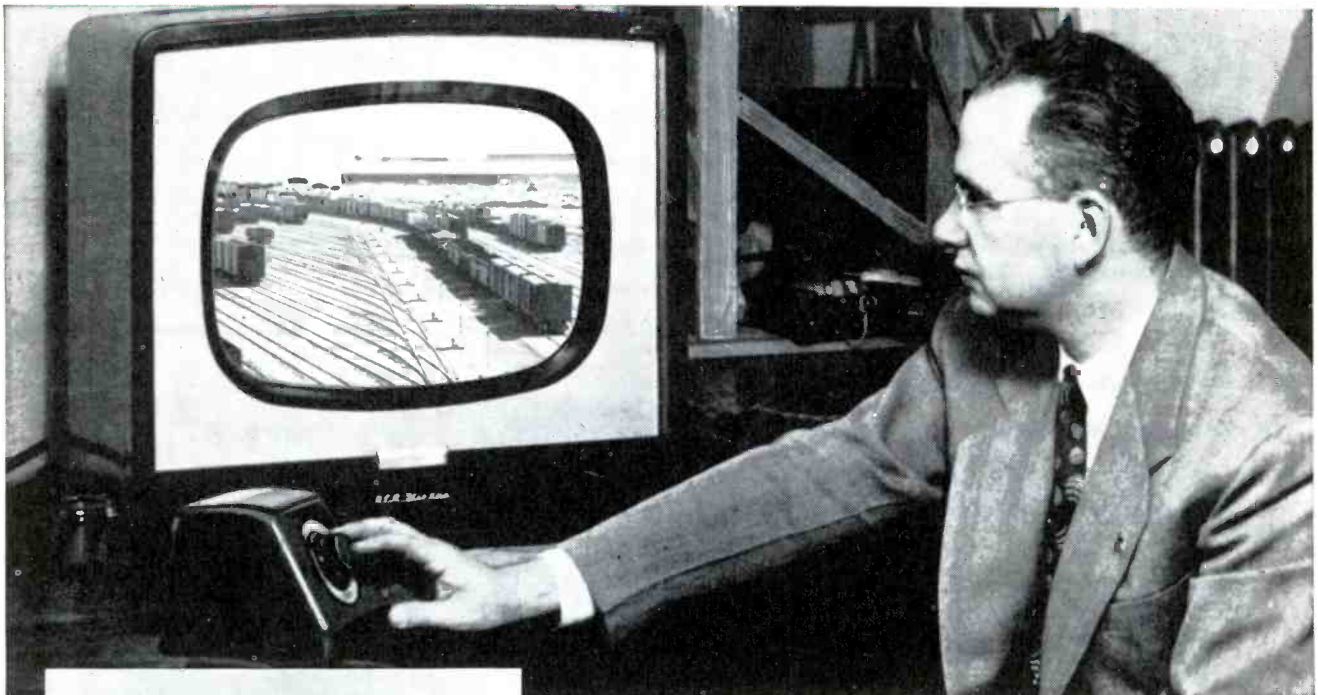

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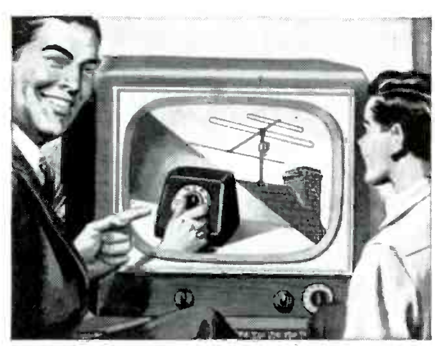

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CHART A - UHF LEAD-IN RECOMMENDATIONS

	ADVANTAGES	DISADVANTAGES	RECOMMENDED APPLICATIONS
Punched flat twin-lead	Only moderate losses	High losses when wet	Indoor runs
	Very flexible	Affected by dirt deposits	Installations not subjected to moisture and dirt
	Insulators readily available		Installations requiring only a few feet of external lead-in
	No impedance matching problem		
Tubular type twin-lead	Only moderate losses	Quite stiff - especially when cold	All outdoor installations (other than exceptionally long runs in fringe areas where losses must be kept to a minimum)
	Small change in attenuation when wet	Tendency of wires to break at terminals if side strain is placed on line	
	Not greatly affected by dirt deposits		
	Does not flutter in breeze	Line must be sealed at end	
	Easily cleaned	Requires large hold at feed-through point	
	No impedance matching problem		
Open-wire line	Very low losses	Difficult to mount	Installations where losses in the line are of prime importance, particularly if a long run is required.
	Hardly affected by weather conditions	Requires special handling to prevent change in spacing	
		Impedance matching problem with types other than nominal 300 ohm rating	

to point out at this time, however, that many of our tests were performed with the temperature at rather low levels. This made the line even more unmanageable, making it evident that the line should be kept, whenever possible, in a warm place just prior to installation. In one instance, upon completion of a test, the line was tossed aside on the ground and it coiled itself into a spool of almost identical size to that in which it had been stored. This illustrates how unmanageable the line can be when cold. When uncoiling tubular lead-in, it is recommended that the line be rolled off the spool and not slipped off the end of the spool. The latter usually results in twisting of the line, making it even more difficult to handle.

Another difficulty which was experienced was the breaking of the wire at the end of the lead-in. This was brought about by the fact that any side motion of the lead-in placed so much strain on the wires that they would break.

The stiffness of the line is a very important consideration when making installations using a rotator. A much larger loop around the rotator must be used with this type of line than is necessary with the conventional flat line. In any such installation, a careful check should be made to be sure that the line does not kink at any position of rotation. Also keep in mind that the line will be less flexible during cold weather.

Another difference which was noted was the fact that the tubular type lead-in is more difficult to strip down than conventional flat twin-lead. The type B line, shown in Figure 1, which is manufactured by American Phenolic Corporation, has two raised ridges on the outside of the line which makes it rather easy to locate the placement of the wire in the cable. Thus, the thinner section of the tube can be cut away using diagonal cutters, which then makes possible the stripping of the leads. When preparing the type D line, shown in Figure 1, greater care must be used since no ridges are present to show the location of the wires. By looking at the end of the line, however, the wires can be seen. The tubing can then be cut away to allow the stripping of the lines themselves.

Figure 5. Tubular Lead-In With Sealed End.

The type C line, shown in Figure 1, is manufactured by Anaconda Wire and Cable Company. So far we have classified this particular line as a tubular type. In reality it is a pair of parallel lines which are properly spaced in a pair of polyethylene tubes which in turn are placed in a polyethylene casing. This construction can be seen by careful inspection of Figure 1. The stripping procedure for this particular type of line is a little more complicated than the other types, in that three casings must be removed. The outer casing may be cut using a knife or diagonal cutter. Cut this outside casing back on both flat sides for about 1-1/2 inches. Trim all the way around and remove the two sections. The casings on the inner sections can then be trimmed about an inch from the end. Care must be taken not to cut the wire itself since it is a solid conductor and any cut or nick may cause it to break more easily.

It is recommended that spade lugs be used for terminating the line. Due to the stiffness of the tubular type line, heavy duty lugs should be employed for this purpose.

Another great difference in tubular lines over that of the flat line is that a sealing process must be used to prevent moisture from entering the line. The tubular type line, such as type B and D in Figure 1, can be sealed by applying a soldering iron to the open end. This causes the material to become soft and tacky which allows the end to be pressed together, forming a seal. Figure 5 shows a section of line which has undergone this treatment. Care must be taken when performing this operation that excessive heat is not used. The iron should not come into contact with the wire itself as the copper, which has high heat conductivity, will melt the insulating material and might allow the wire to become separated from the tube.

A different procedure is recommended for the Anaconda line (Type C in Figure 1). This line may be sealed better by melting a small piece of the outside tubing and allowing the molten material to drop into the ends of the lines. Cut off a small piece of the outside coating (1/4" x 1/4") which was removed during the stripping process. Hold this piece of insulating material with a pair of long-nosed pliers and heat it with a match. The material is flammable and will ignite. Hold the burning material over the end of the line, which should be held at an angle of about 45 degrees, and allow the molten material to drop inside the outer casing as well as the inner casings. Figure 6 illustrates this operation. Only a few drops are required to seal the end. If too much of the heated material is dropped on the line, the inner casings will melt. If this occurs, the line should be cut off and the process repeated. A little practice will make it possible to do a neat job of sealing. Figure 7 shows a section of line which has been sealed in this manner. As a word of warning, this operation should be performed at a point where the drops of molten material will not cause any damage. The end which attaches to the antenna should be sealed before taking the line onto the roof. The other end of the line can be sealed after the desired length is determined.

The insulators should be so positioned that sufficient spacing between the line and the house is maintained. Take special care when passing around metal eaves. A "drip loop" should be employed at the point where the transmission line enters the building. This is made by forming a loop or trap whereby moisture will drip off the bottom of the loop, rather than follow the lead-in into the building. When entering the building, the lead-in should be at a slightly upward angle. This lessens the chance of water following the lead-in into the home. In order to provide an escape for moisture caused by condensation inside the line, a small hole should be punched in the line as illustrated in Figure 8. A feed-through insulator should be used where the transmission line

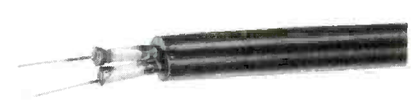


Figure 7. Finished Seal on Anaconda ATV-270 Line.

enters the building. These are now available in various lengths so that a neat installation can be made.

In the event that it is desired to use a plug and socket arrangement for antenna distribution, a high quality plug and socket should be used. The insulating material in the socket and plug should be of a material that is not greatly affected by moisture and the contacts should be non-corrosive so that a good contact can be made. We did not require any plug and socket sets during our field survey; however, our experiences indicated that good clean contacts are mandatory for optimum UHF operation. Select any such plug and socket combinations with care.

In some areas, standoff insulators may not be available for tubular twin-lead. Some distributors may have available inserts that can be pressed into the flat-lead type insulators. Figure 9 shows such an insulator, along with the insert. The tubular-type insulators will undoubtedly become more readily available.

The problem of mounting the open-wire type line is much more difficult than with any of the other types. At this writing, we do not know of a suitable insulator which is readily available. It would appear that such an insulator could be made that attaches in some manner to the insulating spacer on

Figure 6. Sealing the Anaconda ATV-270 Line.

the open-wire line. Since the spacing and/or size of the insulator itself varies with different manufacturers, it may be that insulators will need be supplied for a specific brand of open-wire line. Even though the spacers are rather close together, care must be taken in handling this type of line so as not to disturb the spacing between the wires. Whenever possible the line should be held so that a minimum of flapping would be caused by wind. As suitable insulators become available this can be done quite easily.

The absence of any discussion of coaxial lines may have been noted. This is due to the fact that at no time during our tests were conditions encountered which required the use of a shielded type lead-in; therefore no tests were made using it. Normally, this type lead-in is employed where noise pickup in the transmission line itself is objectionable. UHF reception, we found, is not susceptible to the majority of man-made interferences (ignition, motor noise, neon signs, etc.), thus eliminating the need for a shielded type line. The increased attenuation inherent in

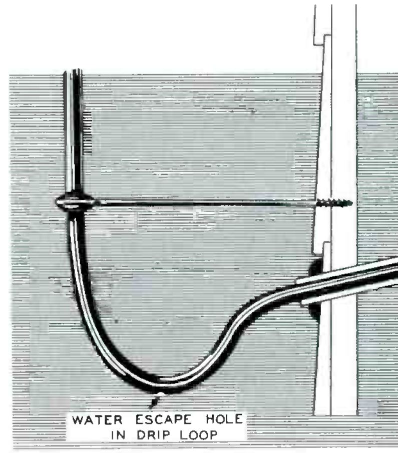


Figure 8. "Drip-Loop" With Condensation Escape Hole in Line.

this type of line more than offsets any advantage which it might have as far as the elimination of interference pickup at UHF is concerned. Therefore this type of line is not recommended for UHF applications.

In summarizing our experiences with the use of various types of transmission lines associated

Figure 9. Flat Line Insulator Standoff With Tubular Insert.

with UHF reception, it appears that the tubular type lead-in is most satisfactory for the majority of UHF installations. Using our tests as a basis, we have drawn up Chart A which points out advantages and disadvantages of the various types of lead-in as well as the recommended application for each.

W.W. HENSLER

TUNER KIT (cont'd from page 41)

instructions supplied with the kit, to the letter. If this is done, the result will be a far more efficient job than would be obtained should improvisation be attempted.

Aside from the operational design considerations, here are some of the problems which had to be overcome by the manufacturer to make any field installation program a success.

1. A tuner had to be supplied which would fit physically in the oftentimes already crowded cabinet.

2. A satisfactory tuning drive system had to be incorporated that would enable easy tuning on the part of the operator. This is usually accomplished by means of some sort of vernier control which had to be free from slippage and backlash. A minimum of controls should be added to the control panel to prevent complicating the operation of the receiver. This is very important as far as the acceptance on the part of the customer is concerned.

3. A kit had to be supplied that was easy to install. The more complicated the installation, the more chances there are for mistakes in mounting and wiring, resulting in inferior operation. Also the less complicated the installation is, the less time will be required to do the job. This will result in lower costs to the customer, which is a big step toward customer acceptance of such an installation.

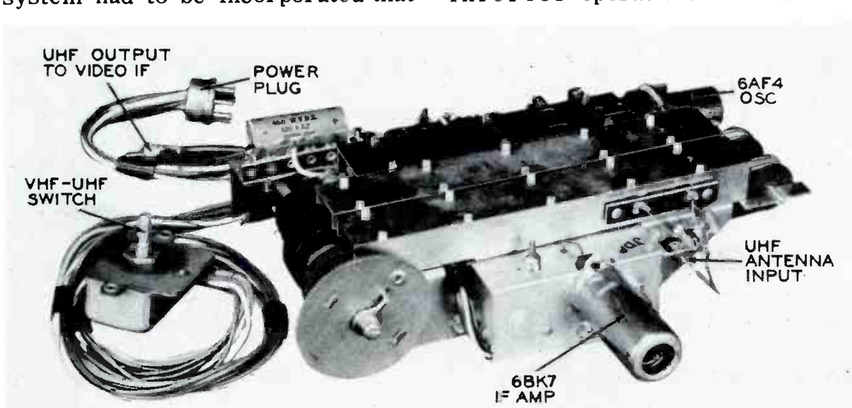
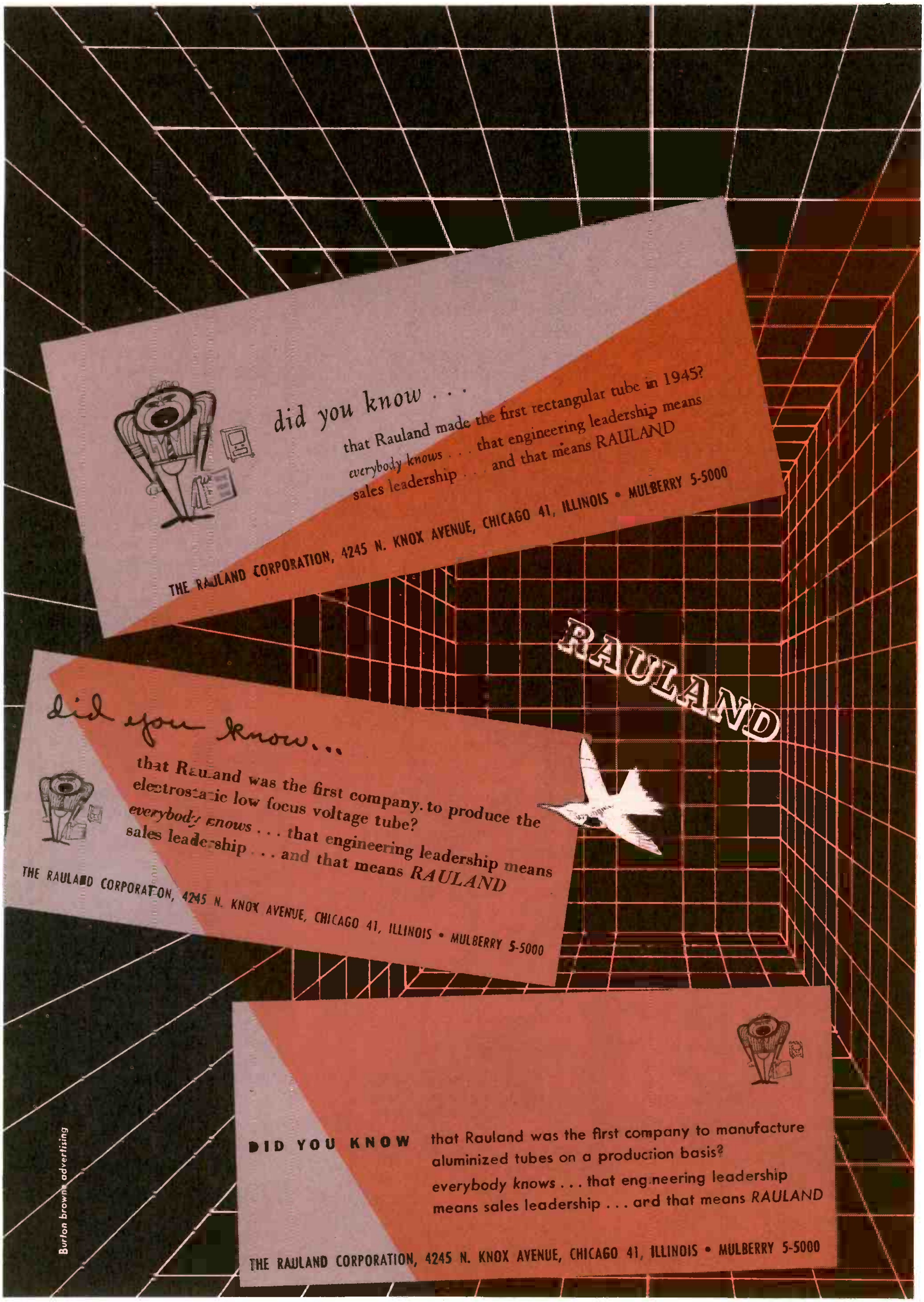


Figure 6. Front View of Raytheon UHF Converter Kit.

Many manufacturers are now supplying UHF field kits which overcome these problems. They are to be congratulated. These kits are the result of very careful designing and planning. The importance of doing a good installation job cannot be overemphasized. As was previously stated, make sure the proper kit is obtained for a specific chassis or model, follow the instructions supplied with the kit and no difficulty should be experienced in making the installation. Not only is the installation itself profitable, but each satisfied conversion customer is a potential service customer.

A few minutes of instruction to the user in operation of the UHF tuner is highly recommended. Most of the UHF kits incorporate continuous type tuning. This system will be new to those people who have switch type VHF tuners, and a little instruction will go a long way to insure customer satisfaction.

W.W. HENSLER
MERLE E. CHANEY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STATUS OF TV BROADCAST OPERATIONS

The maps which follow on Pages 118, 119, 121, 122 and 123, show all cities which either have television stations operating or had been granted Construction Permits through January 31, 1953. The call letters, if assigned, and channel numbers are indicated on the maps. A legend is employed which shows whether the stations are UHF or VHF, operating or has Construction Permit only, and whether commercial or educational.

The chart below lists the cities which have been granted Construction Permits during the month of February, 1953. Thus, the data shown on the map and the chart below indicate the status of television stations through February 28, 1953.

Those cities which had one or more of the 108 pre-freeze stations are indicated on the map with a solid dot. Adjacent to this dot is the number of pre-freeze stations located in that city.

The second chart lists the 30 television stations that are required to shift channels. As of February 28, 1953, seven of these stations had already shifted channels. The proposed dates of changes shown in this chart are estimates. In many cases, these changes must take place in a definite sequence and any delay experienced by one station may delay others.

It is hoped that in presenting the data on Construction Permits in map form, that it would be possible to see the number of permits granted in any given area. We sincerely hope that it serves this purpose.

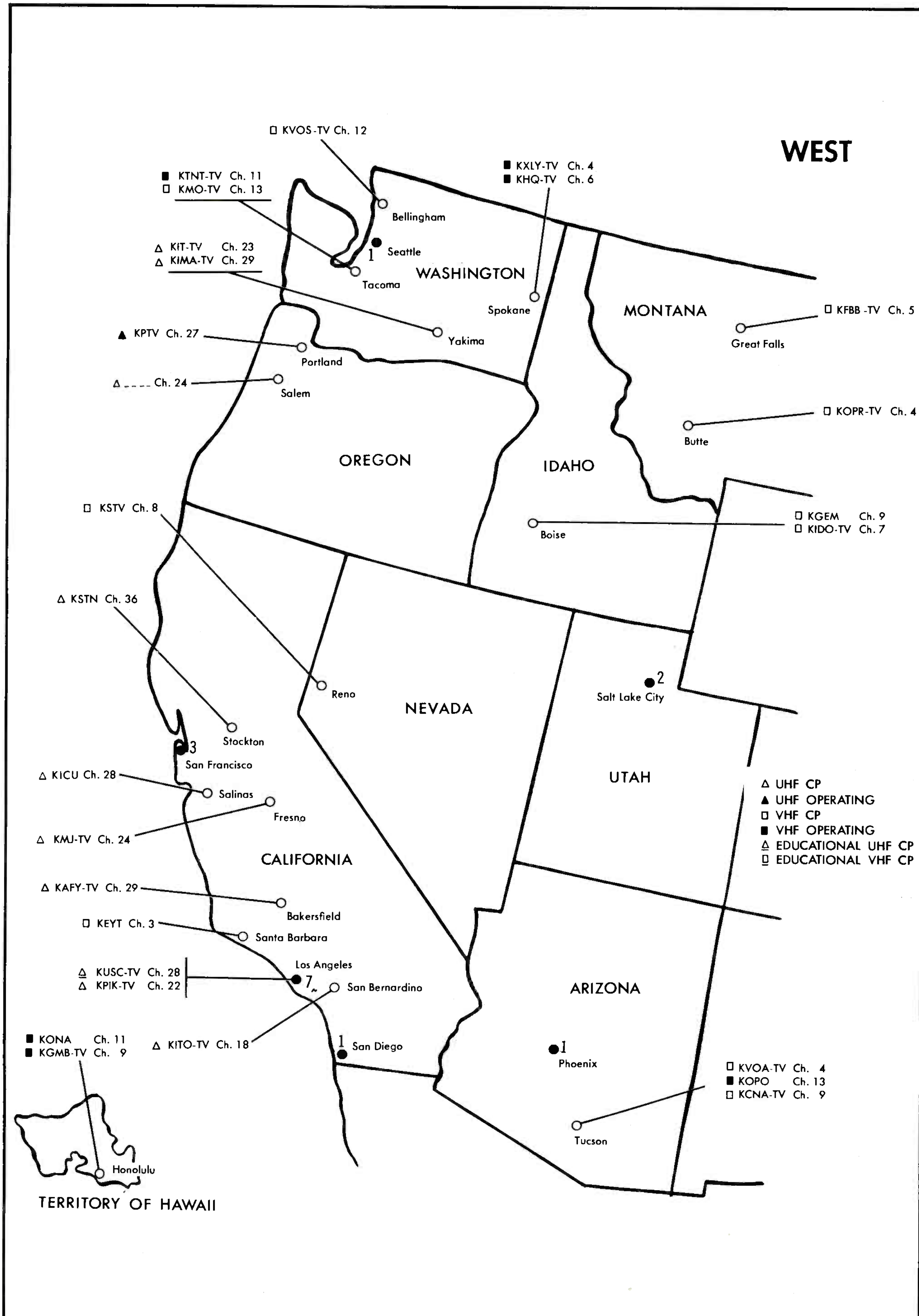
CONSTRUCTION PERMITS GRANTED DURING FEBRUARY, 1953.

(See Map for CP's Prior to this date)

ALABAMA Decatur WMSL CH. 23 ARIZONA Mesa KTYL Ch. 12 CALIFORNIA Eureka KIEM Ch. 3 Monterey KMBY Ch. 8 Salinas KSBW Ch. 8 GEORGIA Macon ---- Ch. 47 Rome WROM Ch. 9 Valdosta WGOV Ch. 37	IDAHO Idaho Falls KID Ch. 3 KIFI Ch. 8 Pocatello KWIK Ch. 10 KJRL Ch. 6 ILLINOIS Champaign WDWS Ch. 3 Springfield ---- Ch. 20 KANSAS Wichita ---- Ch. 16 Pittsburg KOAM Ch. 7 LOUISIANA New Orleans WJMR Ch. 61	LOUISIANA (cont.) ---- Ch. 20 MAINE Portland WPMT Ch. 53 MASSACHUSETTS North Adams WBRK Ch. 74 MICHIGAN Lansing WILS Ch. 54 Benton Harbor WHFB Ch. 42 MISSISSIPPI Gulfport WGCM Ch. 56	MISSOURI Clayton KFUO Ch. 30 Hannibal KHMO Ch. 7 St. Louis WIL Ch. 42 Sedalia KDRO Ch. 6 MONTANA Billings KOOK Ch. 2 Butte KXLF Ch. 6 NEW YORK Elmira ---- Ch. 18 NORTH CAROLINA Winston-Salem WTOB Ch. 26	NORTH CAROLINA (cont.) Charlotte WAYS Ch. 36 Durham ---- Ch. 46 NORTH DAKOTA Minot KCJB Ch. 13 ---- Ch. 10 OHIO Ashtabula WICA Ch. 15 OKLAHOMA Oklahoma City KLPR Ch. 19 ---- Ch. 25 Tulsa ---- Ch. 23	OREGON Eugene ---- Ch. 20 PENNSYLVANIA Scranton ---- Ch. 16 SOUTH CAROLINA Columbia WIS Ch. 10 TEXAS Dallas KLIF Ch. 29 Longview ---- Ch. 32 McAllen KRIO Ch. 20 Midland ---- Ch. 2 Texarkana KCMC Ch. 6	VIRGINIA Hampton WVEC Ch. 15 Newport News WHYU Ch. 33 WEST VIRGINIA Parkersburg ---- Ch. 15 Wheeling ---- Ch. 51 WISCONSIN Beloit WGEZ Ch. 57 Milwaukee WCAN Ch. 25 Eau Claire WEAU Ch. 13

TV CHANNEL SHIFTS

CITY, STATE	STATION	OLD	NEW	CHANGE DATE	CITY, STATE	STATION	OLD	NEW	CHANGE DATE
Ames, Ia.	WOI-TV	4	5	Summer	Huntington, W. Va.	WSAZ-TV	5	3	8-5-52 (changed)
Atlanta, Ga.	WLTV	8	11	Fall	Johnstown, Pa.	WJAC-TV	13	6	10-4-52 (changed)
Birmingham, Ala.	WBRC-TV	4	6	Indefinite	Lancaster, Pa.	WGAL-TV	4	8	11-52 (changed)
Bloomington, Ind.	WTTV	10	4	Indefinite	Louisville, Ky.	WAVE-TV	5	3	4-53
Chicago, Ill.	WBKB	4	2	Indefinite	Louisville, Ky.	WHAS-TV	9	11	2-7-53 (changed)
Cincinnati, O.	WLWT	4	5	5-53	Memphis, Tenn.	WMCT	4	5	12-52 (changed)
Cincinnati, O.	WKRC-TV	11	12	10-26-52 (changed)	Milwaukee, Wis.	WTMJ-TV	3	4	Spring
Cincinnati, O.	WCPO-TV	7	9	3-53	New Haven, Conn.	WNHC-TV	6	8	Spring
Cleveland, O.	WXEL	9	8	Summer	Norfolk, Va.	WTAR-TV	4	3	June or July
Cleveland, O.	WNBK	4	3	Indefinite	Pittsburgh, Pa.	WDTV	3	2	11-23-52 (changed)
Columbus, O.	WLWC	3	4	6-53	Providence, R. I.	WJAR-TV	11	10	Early in 1953
Dayton, O.	WIWD	5	2	4-53	Rochester, N. Y.	WHAM-TV	6	5	June or July
Dayton, O.	WHIO-TV	13	7	3-53	Schenectady, N. Y.	WRGB	4	6	Indefinite
Davenport, Ia.	WOC-TV	5	6	Indefinite	Syracuse, N. Y.	WSYR-TV	5	8	Early Summer
Grand Rapids, Mich.	WOOD-TV	7	8	4-15-53	Wilmington, Del.	WDEL-TV	7	12	Indefinite


WEST
□ KVOS-TV Ch. 12
■ KTNT-TV Ch. 11
□ KMO-TV Ch. 13
■ KXLY-TV Ch. 4
■ KHQ-TV Ch. 6
Bellingham
Seattle
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△ KIT-TV Ch. 23
△ KIMA-TV Ch. 29
Tacoma
WASHINGTON
Spokane
MONTANA
□ KFBB-TV Ch. 5
Great Falls
▲ KPTV Ch. 27
Yakima
Portland
△ ---- Ch. 24
Salem
□ KOPR-TV Ch. 4
Butte
OREGON
IDAHO
□ KSTV Ch. 8
□ KGEM Ch. 9
□ KIDO-TV Ch. 7
Boise
△ KSTN Ch. 36
Reno
NEVADA
Salt Lake City
2
Stockton
3
San Francisco
UTAH
△ KICU Ch. 28
Salinas
Fresno
△ KMJ-TV Ch. 24
CALIFORNIA
△ UHF CP
▲ UHF OPERATING
□ VHF CP
■ VHF OPERATING
△ EDUCATIONAL UHF CP
□ EDUCATIONAL VHF CP
△ KAFY-TV Ch. 29
Bakersfield
□ KEYT Ch. 3
Santa Barbara
Los Angeles
7
△ KUSC-TV Ch. 28
△ KPIK-TV Ch. 22
San Bernardino
ARIZONA
■ KONA Ch. 11
■ KGMB-TV Ch. 9
△ KITO-TV Ch. 18
1
San Diego
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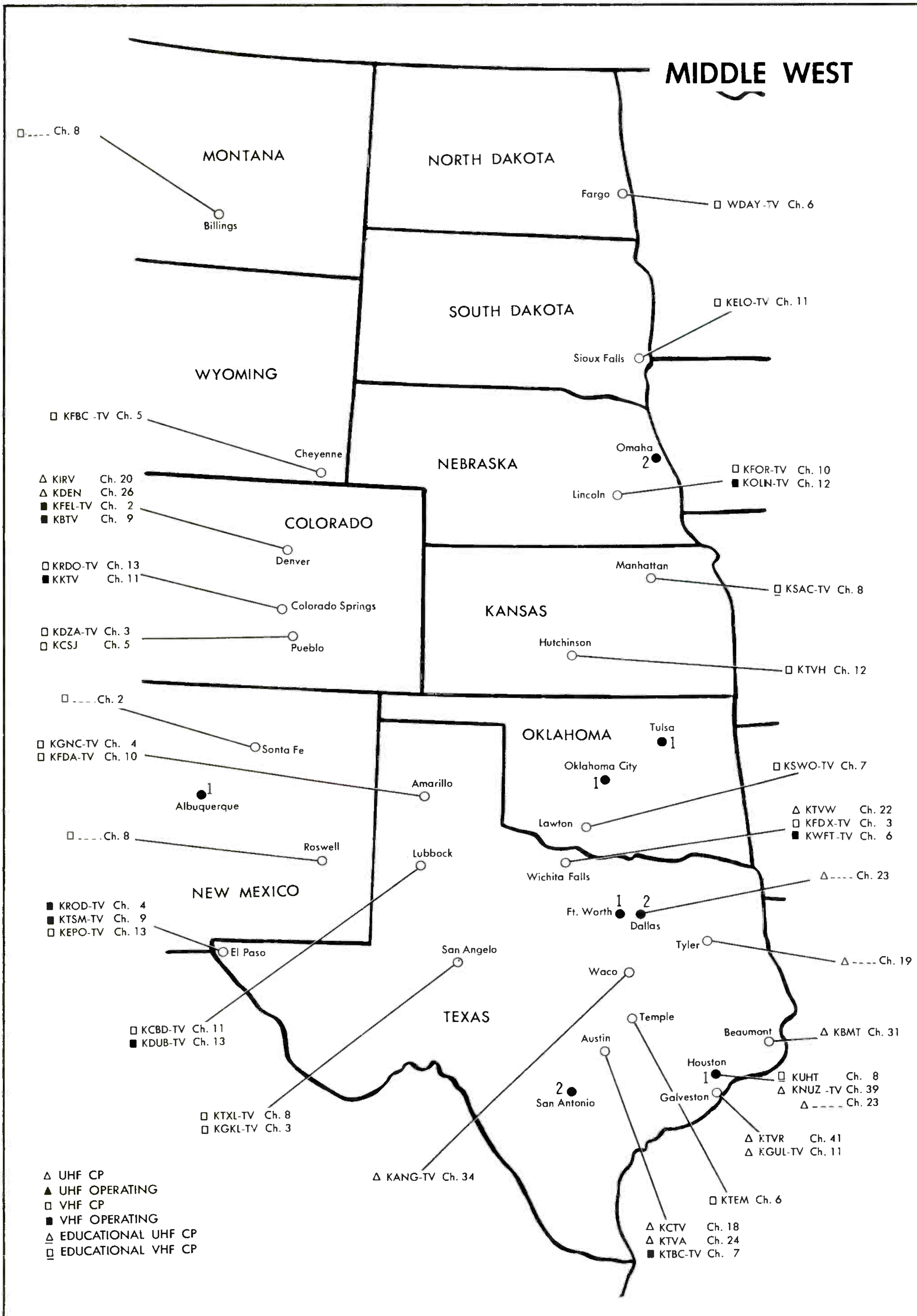
Phoenix
□ KVOA-TV Ch. 4
■ KOPO Ch. 13
□ KCNA-TV Ch. 9
Tucson
Honolulu
TERRITORY OF HAWAII



MIDDLE WEST
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NORTH DAKOTA
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□ ---- Ch. 8
Billings
Fargo
□ WDAY-TV Ch. 6
□ KELO-TV Ch. 11
Sioux Falls
□ KFBC-TV Ch. 5
Cheyenne
Omaha
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□ KFOR-TV Ch. 10
■ KOLN-TV Ch. 12
Lincoln
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Δ KDEN Ch. 26
■ KFEL-TV Ch. 2
■ KBTV Ch. 9
Denver
□ KRDO-TV Ch. 13
■ KKTV Ch. 11
Colorado Springs
Manhattan
□ KSAC-TV Ch. 8
□ KDZA-TV Ch. 3
□ KCSJ Ch. 5
Pueblo
Hutchinson
□ KTVH Ch. 12
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Sonta Fe
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□ KFDA-TV Ch. 10
Amarillo
Oklahoma City
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□ KSWO-TV Ch. 7
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Albuquerque
Lawton
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□ KFDX-TV Ch. 3
■ KWFT-TV Ch. 6
□ --- Ch. 8
Roswell
Lubbock
Wichita Falls
Δ ---- Ch. 23
■ KROD-TV Ch. 4
■ KTSM-TV Ch. 9
□ KEPO-TV Ch. 13
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Ft. Worth
Dallas
El Paso
Tyler
Δ ---- Ch. 19
San Angelo
Waco
Temple
□ KCBD-TV Ch. 11
■ KDUB-TV Ch. 13
Beaumont
Δ KBMT Ch. 31
Austin
Houston
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□ KUHT Ch. 8
Δ KNUZ-TV Ch. 39
Δ ---- Ch. 23
2
San Antonio
Galveston
□ KTXL-TV Ch. 8
□ KGKL-TV Ch. 3
Δ KTVR Ch. 41
Δ KGUL-TV Ch. 11
Δ KANG-TV Ch. 34
□ KTEM Ch. 6
Δ KCTV Ch. 18
Δ KTVA Ch. 24
■ KTBC-TV Ch. 7
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▲ UHF OPERATING
□ VHF CP
■ VHF OPERATING
Δ EDUCATIONAL UHF CP
□ EDUCATIONAL VHF CP

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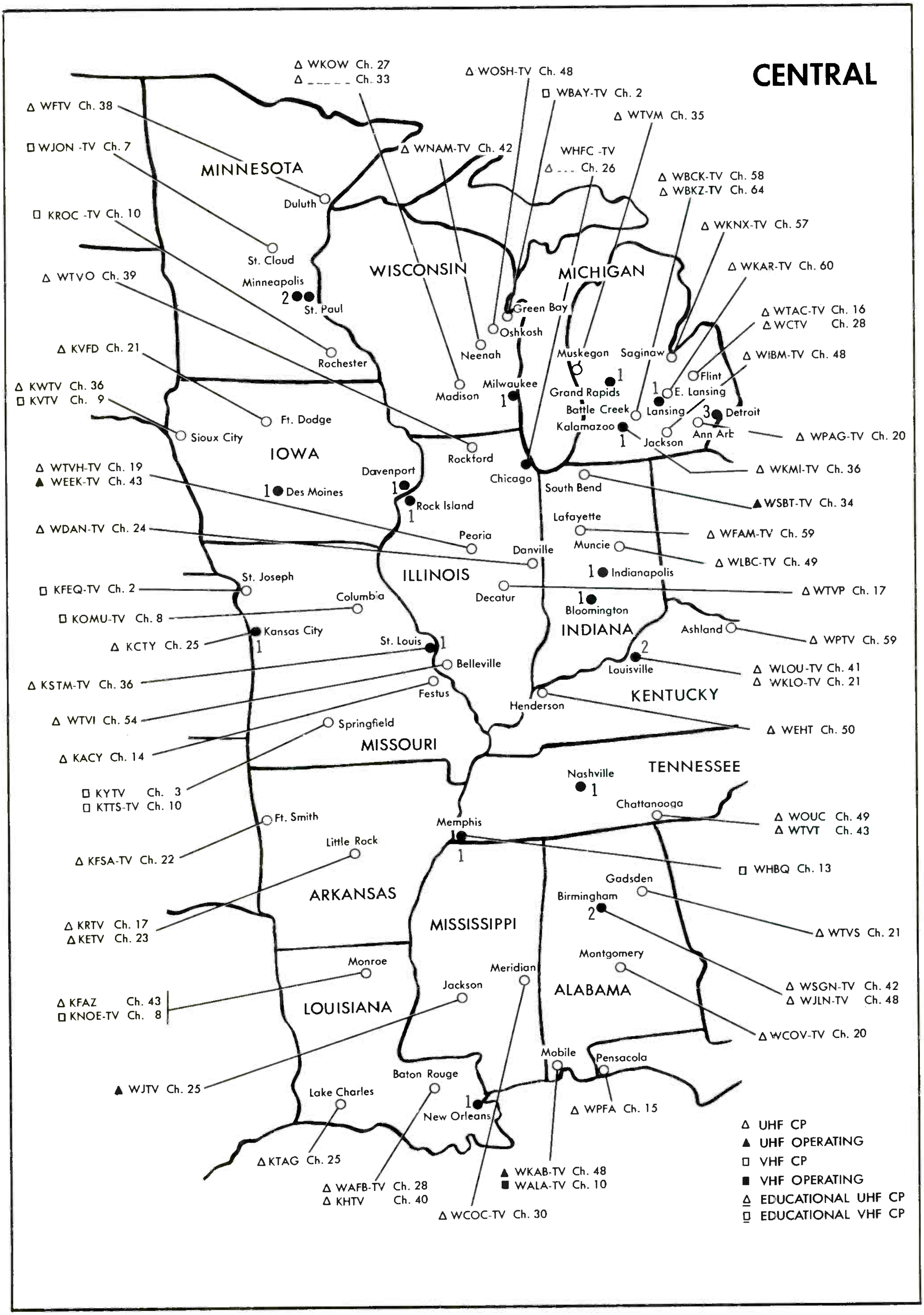
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WHFC -TV
Δ ___ Ch. 26
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□ KROC -TV Ch. 10
Δ WKNX-TV Ch. 57
Δ WTVO Ch. 39
Δ WKAR-TV Ch. 60
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Δ KVFD Ch. 21
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Δ WKMI-TV Ch. 36
Δ WTVH-TV Ch. 19
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▲ WSBT-TV Ch. 34
Δ WDAN-TV Ch. 24
Δ WFAM-TV Ch. 59
Δ WLBC-TV Ch. 49
□ KFEQ-TV Ch. 2
Δ WTVP Ch. 17
□ KOMU-TV Ch. 8
Δ KCTY Ch. 25
Δ WPTV Ch. 59
Δ WLOU-TV Ch. 41
Δ WKLO-TV Ch. 21
Δ KSTM-TV Ch. 36
Δ WTVI Ch. 54
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Δ KACY Ch. 14
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Δ WTVT Ch. 43
Δ KFSA-TV Ch. 22
□ WHBQ Ch. 13
Δ KRTV Ch. 17
Δ KETV Ch. 23
Δ WTVS Ch. 21
Δ WSGN-TV Ch. 42
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Δ KFAZ Ch. 43
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Δ WCOV-TV Ch. 20
▲ WJTV Ch. 25
Δ WPFA Ch. 15
Δ KTAG Ch. 25
▲ WKAB-TV Ch. 48
■ WALA-TV Ch. 10
Δ WAFB-TV Ch. 28
Δ KHTV Ch. 40
Δ WCOC-TV Ch. 30
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WISCONSIN
MICHIGAN
IOWA
ILLINOIS
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KENTUCKY
MISSOURI
TENNESSEE
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Muskegon
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Decatur
Bloomington
Kansas City
St. Louis
Ashland
Belleville
Louisville
Festus
Henderson
Springfield
Nashville
Chattanooga
Ft. Smith
Memphis
Little Rock
Gadsden
Birmingham
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□ VHF CP
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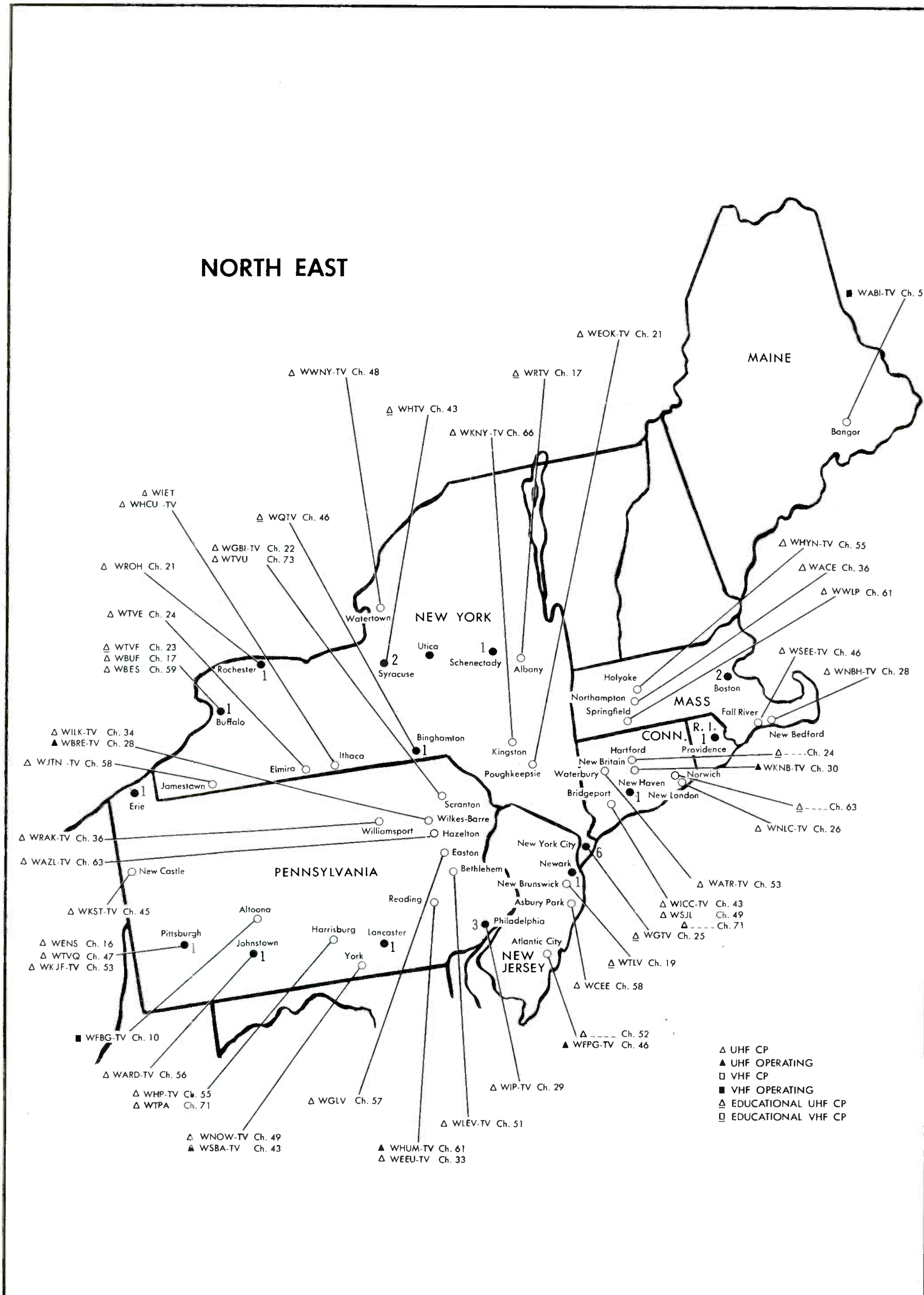
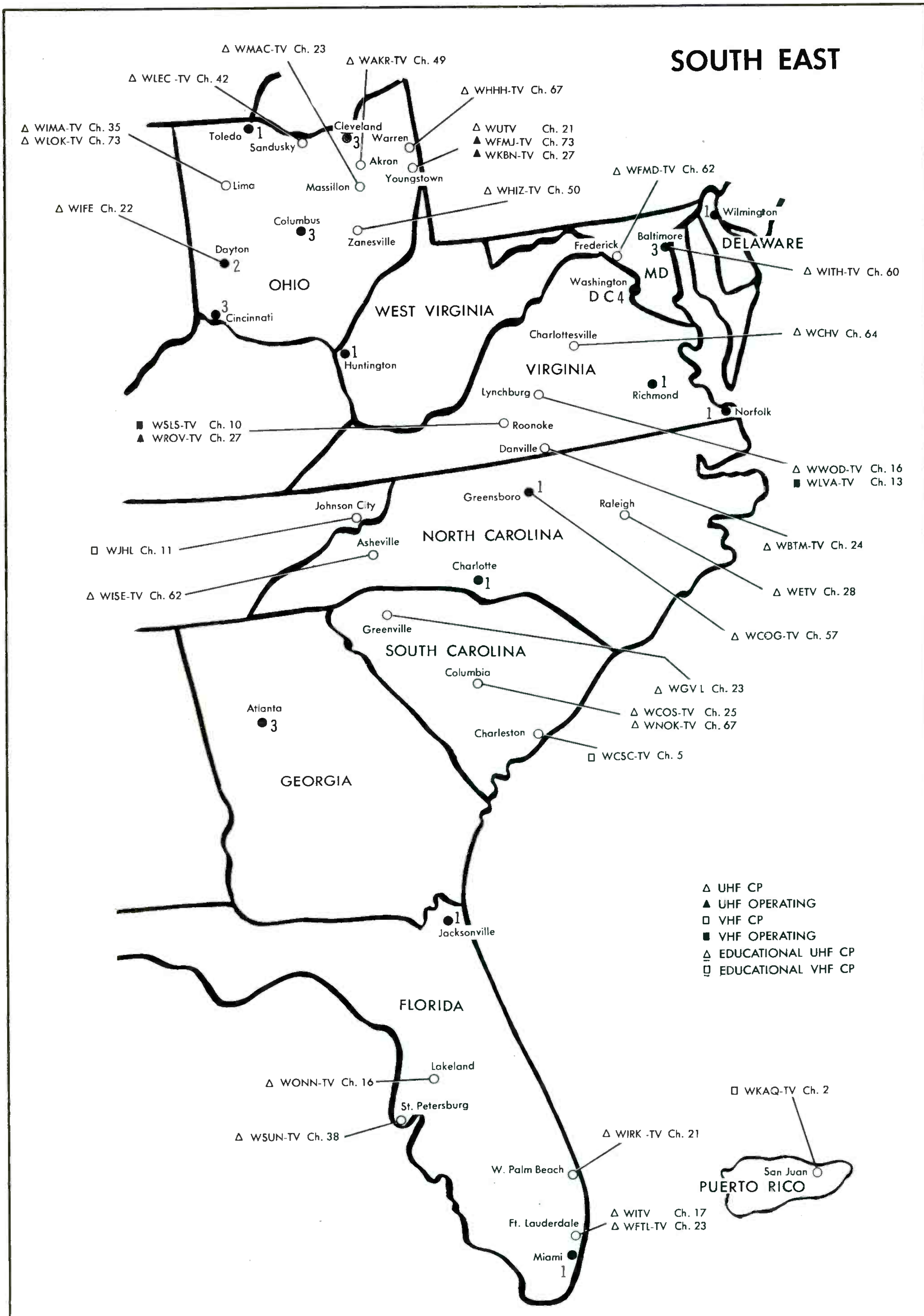
Δ EDUCATIONAL UHF CP
□ EDUCATIONAL VHF CP


NORTH EAST
MAINE
NEW YORK
PENNSYLVANIA
NEW JERSEY
MASS
CONN.
R. I.
■ WABI-TV Ch. 5
Bangor
Δ WEOK-TV Ch. 21
Δ WWNY-TV Ch. 48
Δ WRTV Ch. 17
Δ WHTV Ch. 43
Δ WKNY-TV Ch. 66
Δ WIET
Δ WHCU -TV
Δ WQTV Ch. 46
Δ WGBI-TV Ch. 22
Δ WTVU Ch. 73
Δ WROH Ch. 21
Δ WTVE Ch. 24
Δ WTVF Ch. 23
Δ WBUF Ch. 17
Δ WBES Ch. 59
Δ WILK-TV Ch. 34
▲ WBRE-TV Ch. 28
Δ WJTN -TV Ch. 58
Δ WRAK-TV Ch. 36
Δ WAZL-TV Ch. 63
Δ WKST-TV Ch. 45
Δ WENS Ch. 16
Δ WTVQ Ch. 47
Δ WKJF-TV Ch. 53
■ WFBG-TV Ch. 10
Δ WARD-TV Ch. 56
Δ WHP-TV Ch. 55
Δ WTPA Ch. 71
Δ WNOW-TV Ch. 49
▲ WSBA-TV Ch. 43
Δ WGLV Ch. 57
▲ WHUM-TV Ch. 61
Δ WEEU-TV Ch. 33
Δ WLEV-TV Ch. 51
Δ WIP-TV Ch. 29
Δ ---- Ch. 52
▲ WFPG-TV Ch. 46
Δ WCEE Ch. 58
Δ WTLV Ch. 19
Δ WGTV Ch. 25
Δ WICC-TV Ch. 43
Δ WSJL Ch. 49
Δ ---- Ch. 71
Δ WATR-TV Ch. 53
Δ WNLC-TV Ch. 26
Δ ---- Ch. 63
▲ WKNB-TV Ch. 30
Δ ---- Ch. 24
Δ WHYN-TV Ch. 55
Δ WACE Ch. 36
Δ WWLP Ch. 61
Δ WSEE-TV Ch. 46
Δ WNBH-TV Ch. 28
Watertown
Utica
1 Schenectady
Albany
2 Syracuse
Rochester 1
1 Buffalo
Binghamton 1
Ithaca
Elmira
Jamestown
1 Erie
Kingston
Poughkeepsie
Scranton
Wilkes-Barre
Williamsport
Hazelton
Easton
Bethlehem
New Castle
Altoona
Pittsburgh 1
Johnstown 1
Harrisburg
Lancaster 1
York
Reading
3 Philadelphia
Atlantic City
Asbury Park
New Brunswick 1
Newark 1
New York City 6
Holyoke
Northampton
Springfield
2 Boston
Fall River
New Bedford
Hartford
Providence 1
New Britain
Waterbury
Norwich
New Haven 1
Bridgeport
New London
Δ UHF CP
▲ UHF OPERATING
□ VHF CP
■ VHF OPERATING
Δ EDUCATIONAL UHF CP
□ EDUCATIONAL VHF CP


SOUTH EAST
Δ WMAC-TV Ch. 23
Δ WAKR-TV Ch. 49
Δ WLEC-TV Ch. 42
Δ WHHH-TV Ch. 67
Δ WIMA-TV Ch. 35
Δ WLOK-TV Ch. 73
Toledo 1
Sandusky
Cleveland 3
Warren
Akron
Youngstown
Δ WUTV Ch. 21
▲ WFMJ-TV Ch. 73
▲ WKBN-TV Ch. 27
Lima
Massillon
Δ WFMD-TV Ch. 62
Δ WHIZ-TV Ch. 50
Δ WIFE Ch. 22
Columbus 3
Zanesville
Wilmington 1
Dayton 2
OHIO
Frederick
Baltimore 3
DELAWARE
MD
Δ WITH-TV Ch. 60
Washington DC 4
Cincinnati 3
WEST VIRGINIA
Charlottesville
Δ WCHV Ch. 64
Huntington 1
VIRGINIA
Richmond 1
Lynchburg
Norfolk 1
■ WSLS-TV Ch. 10
▲ WROV-TV Ch. 27
Roanoke
Danville
Δ WWOD-TV Ch. 16
■ WLVA-TV Ch. 13
Greensboro 1
Raleigh
Johnson City
□ WJHL Ch. 11
Asheville
NORTH CAROLINA
Δ WBTM-TV Ch. 24
Charlotte 1
Δ WISE-TV Ch. 62
Δ WETV Ch. 28
Greenville
SOUTH CAROLINA
Δ WCOG-TV Ch. 57
Columbia
Δ WGVL Ch. 23
Atlanta 3
Δ WCOS-TV Ch. 25
Δ WNOK-TV Ch. 67
Charleston
□ WCSC-TV Ch. 5
GEORGIA
Δ UHF CP
▲ UHF OPERATING
□ VHF CP
■ VHF OPERATING
Δ EDUCATIONAL UHF CP
□ EDUCATIONAL VHF CP
Jacksonville 1
FLORIDA
Lakeland
Δ WONN-TV Ch. 16
□ WKAQ-TV Ch. 2
St. Petersburg
Δ WSUN-TV Ch. 38
Δ WIRK-TV Ch. 21
W. Palm Beach
San Juan
PUERTO RICO
Δ WITV Ch. 17
Δ WFTL-TV Ch. 23
Ft. Lauderdale
Miami 1

TV SUPPLEMENTARY SHEET NO. 2

MODEL & CHASSIS	PART #	CATALOG #	FUNCTION	DESCRIPTION	LIST PRICE
ARVIN					
6175TM 6179TM	E22464-20	RTV-259	Vert. Lin./ Height	3000/2.5 Meg. 2W-W.W./carbon Conc. Dual	$3.10
	E22464-27	RTV-352	Contrast Vol./Sw.	1500/250 Ω Conc. Dual carbon--SPST	$3.70
	E22464-34	AG-49-S KSS-3	Bright.	100K Ω carbon	$1.25
CHASSIS TE-331 TE-331-2	E22464-36	AG-83-S KSS-3	Vert. Hold	1.5 Meg. Ω carbon	$1.25
	E22464-38	AG-40-S KSS-3	Hor. Hold	25K Ω carbon	$1.25
BELMONT-RAYTHEON					
C-1729A C-1731A M-1726A M-1728A	A10A-18441	RTV-218	Contrast/ Vol./Sw.	5000/1Meg. Tap 100K Ω Conc. Dual carbon DPST	$4.50
	A10B-17275	AG-49-S KSS-3	Vert. Hold	100K Ω carbon	$1.25
	A10B-17764	AG-44-S KSS-3	Bright.	50K Ω carbon	$1.25
	A10B-19218	AG-19-S FKS-1/4	Vert. Lin.	5000 Ω carbon	$1.25
	A10B-19220	AG-61-S FKS-1/4	Height	750K Ω carbon	$1.25
	A10B-19542	AG-63-Z KSS-3	Tone	1 Meg. Ω carbon	$1.25
BENDIX					
0AK3 21K3 21KD 21T3 21X3	CH262022-4	AG-42-S FS-3	Hor. Hold	30K Ω carbon	$1.25
	CH262024-15	AG-27-S FKS-1/4	Noise Inverter	10K Ω carbon	$1.25
	RV4C10 CH262025-4 CH262025-14	AG-83-S FKS-1/4	Vert. Hold	2 Meg. Ω carbon	$1.25
	RV4C07 CH262025-7	AG-85-S FKS-1/4	Height	3 Meg. Ω carbon	$1.25
	RV4C07 CH262025-7 CH262025-12	AG-85-S FKS-1/4	Focus	3 Meg. Ω carbon	$1.25
	RV4C11 CH262025-10 CH262025-13	AG-58-S FKS-1/4	Vert. Lin.	600K Ω carbon	$1.25
	CH262041-2	AT-90 FS-3/SWA	Vol./Sw.	500K Ω carbon--SPST	$1.25
	LH262045-1	RTV-373	Bright./ Contrast	100K/1200 Ω Conc. Dual carbon	$3.10
CROSLEY					
DU-20CDM, CHB, CHM, COB, COM,	B-148952	AG-83-S RS-2	Vert. Hold	1.5 Meg. Ω carbon	$1.25
DU-21CDM1, CDN, CHM,	B-148953	AG-44-S RS-2	Hor. Hold	50K Ω carbon	$1.25
COB, COL, COLB, COM	B-148966	AG-43-S RS-2	Bright.	40K Ω carbon	$1.25
	B-149893	A10-1500 KSS-3	Focus	1500 Ω 4W-W.W.	$1.85
	B-151634	AG-15-S RS-2	Vert. Lin.	3000 Ω carbon	$1.25
CHASSIS 357 357-1	B-152129	AG-83-S RS-2	Height	1.5 Meg. Ω carbon	$1.25
	C-151111	RTV-327	Contrast/ Vol./Sw.	1500/1Meg. Tap 250K Ω Conc. Dual carbon SPST	$4.30
	W-148861	Order From MFR.	AGC	1000 Ω 1W-W.W.	
EMERSON					
711B 712B 720B	390156	AG-61-S KSS-5	Vert. Hold	1 Meg. Ω carbon	$1.25
	390181	AG-52-S KSS-5	Bright.	200K Ω carbon	$1.25
	390183	AG-44-S KSS-5	Hor. Hold	50K Ω carbon	$1.25
	390196	AG-83-S FKS-1/4	Height	2 Meg. Ω carbon	$1.25
CHASSIS 120164B	390196	AG-83-S FKS-1/4	Focus	2 Meg. Ω carbon	$1.25
	390197	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	390201	RTV-296	Contrast Vol./Sw.	1500/1 Meg. Conc. Dual carbon--SPST	$3.70
	390202	AG-83-S FKS-1/4/SWB	Fringe Compensator	2 Meg. Ω carbon--SPST	$1.25 .60
FADA					
7C42 7C52	* D220076G20	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert./ Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25
	52.74	AG-84-S FKS-1/4	Focus	2.5 Meg. Ω carbon	$1.25
	* Some Models Use Part # 52.68				
7T32, 77T32, 721	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	* 52.24	AG-84-S FKS-1/4	Focus	2.5 Meg. Ω carbon	$1.25
	52.64	RTV-109	Contrast Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert/ Hor. Hold	1 Meg/50K Ω Conc. Dual carbon	$3.10
	52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25
	* Some Models Use Alternate Part # 52.74				
20C22 20T12 24T10	52.24	AG-84-S FKS-1/4	Height	2.5 Meg. Ω carbon	$1.25
	52.54	RTV-109	Contrast/ Vol./Sw.	750 Tap 500/500K Ω 2W-W.W./carbon Conc. Dual--SPST	$4.50
	52.66	RTV-110	Vert./Hor. Hold	1 Meg./50K Ω Conc. Dual carbon	$3.10
	52.68	A43-5000 FKS-1/4	Vert. Lin.	5000 Ω 2W-W.W.	$1.25
	52.69	AG-44-S FS-3	Bright.	50K Ω carbon	$1.25

Form No. 751836010-5M-11/52

CLAROSTAT

This supplementary sheet is for use as an up-to-the-minute addition to your Clarostat RTV Manual. Manuals are available through your distributor or directly from Clarostat. Price $1.00.

CLAROSTAT MFG. CO., INC.
DOVER, NEW HAMPSHIRE

PF INDEX

AND TECHNICAL DIGEST

INDEX TO ADVERTISERS
March-April 1953 Issue

+ More or Less —

In the first issue of the PF INDEX and Technical Digest (No. 24, January 1951) a questionnaire was enclosed. The primary objective of this questionnaire was to obtain guidance in selecting material for future issues that would be of greatest interest and benefit to the service technician.

Enclosed with PF INDEX and Technical Digest No. 36 was another questionnaire with the same purpose in mind. Your comments, suggestions and criticisms have been very enlightening and will be used as a guide in selecting PF INDEX subject material for forthcoming issues.

The top ranking subject requested two years ago was test instrument applications. From a rough estimate of the returns to date it would seem that this subject, or subjects concerning test instruments directly or indirectly, are still of high interest.

A review of past issues of the PF INDEX indicates, I believe, how much we have valued and tried to abide by your requests.

PF INDEXES Nos. 24, 25 and 26 included application of test instruments in troubleshooting and aligning of the RF and video IF sections of TV receivers. No. 27 contained an article on the construction of an impedance measuring device and the use of test instruments in tracking down TV receiver intermittents.

An article in PF INDEX No. 28 described the modification of scopes for 120-cycle synchronization and the application of the 120-cycle sweep in visual alignment of AM or FM receivers and the sound IF systems in television receivers.

A test for shorted turns in horizontal output transformers using standard test instruments was given in Index No. 29.

An article entitled, "The Value of Waveform Analysis," started in Index No. 30. It has, at this writing, appeared in four parts in Nos. 30, 31, 32 and 35.

No. 36 featured an article concerning test instruments and their application in servicing and aligning UHF equipment.

In addition to the above mentioned specific articles on test instruments and their uses, there have also been portions of other articles devoted to the subject.

"In the Interest of Quicker Servicing," has included alignment tools and accessories, picture tube circuit tester, power consumption measurements, coding of test leads, and general hints and kinks on test instruments and gadgets.

In "Shop Talk" you will find an article entitled: "What Test Equipment Will I Need and How Much Must I Spend for it?" Also featured in "Shop Talk" have been such subjects as: Signal Generator Calibration Check, High Voltage Probes, Oscilloscope Probes, Peak-to-Peak Probes, RF Probes, Signal Injection Probes, etc.

No. 36 and this, No. 37, have been almost entirely devoted to UHF. The speed with which UHF TV stations have begun operations in several sections of the country has warranted as rapid and complete coverage as we could possibly give you.

If these articles have been of interest and benefit to you, you take the bow, for you have been the guide. You, the service technician, requested - we have tried, and will continue to try, to fulfill.

- L. H. N.

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From: