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By the way —

We herewith present a brief summary of our feature article, "Introduction to Television", which is reprinted by courtesy of RCA Service Company Inc., Camden, New Jersey, U.S.A.

U-H-F reception varies with distance, terrain and transmitter power output. In the Bridgeport tests, with a radiated power of 13.9 Kw, it was found that the average distance for good reception extended to approximately 15 miles. Good reception has also been obtained up to 25 miles away from the transmitter. In one direction, over fairly level terrain and water, good reception was obtained at 35 miles. It is possible that transmitters of the future utilizing greater power may result in coverage comparable to V-H-F.

Tests indicate that interference problems in the U-H-F band are few compared to the V-H-F band. Ignition, diathermy and similar interferences encountered in V-H-F reception do not normally occur at U-H-F. For example, one U-H-F installation was made in a city about 10 miles from the transmitter where interference on V-H-F was severe due to heavy truck traffic, machine shops and diathermy. V-H-F signals there were jittery and difficult to lock in, while the U-H-F installation showed no trace of interference.

In summing up U-H-F transmission and reception, comparisons can be made with V-H-F as follows:

1. U-H-F has slightly less range.
2. U-H-F installations require greater care.
3. U-H-F antennas in general, are smaller, less conspicuous and offer much less wind resistance.
4. U-H-F reception is relatively free from man-made interference.
5. U-H-F allocations provide greater co-channel and adjacent channel protection.
6. U-H-F has space needed to accommodate many more channels, thus making television possible in practically every home in the United States.

U-F-H holds great promise of providing a truly nationwide television service. RCA has contributed greatly towards this new service through exhaustive laboratory research, culminating in the Bridgeport tests. Field testing of U-H-F television was available to all interested parties and many manufacturers made tests on their designs of U-H-F receiving equipment.

RCA has completed design on a one kilowatt and a ten kilowatt U-H-F transmitter utilizing completely new tetrode tubes in cavity type circuits. These transmitters, with their newly developed high gain antennas, will be ready for new stations as they become licensed by the Federal Communications Commission.

U-H-F receiving equipment consisting of one, two and all-channel selectors, complete receivers for V-H-F/U-H-F, and a combination V-H-F/U-H-F tuner that can be interchanged with the tuner in the 40 megacycle RCA Victor television receivers produced since August, 1951, will be available. The RCA Service Co. plans a series of small antennas of designs radically different from those of the present V-H-F antennas.

INTRODUCTION TO U-H-F TELEVISION

In the relatively short time since its inception, television has become a part of the American way of life; the infant industry has outgrown the segment of the radio spectrum which had initially been deemed adequate to fulfill its needs.

The reasons for this are: one, the rapid acceptance and resulting demand for more and more stations, and two, the nature of the television signal which requires a six megacycle band for each station. In comparison the entire AM Broadcast band occupies approximately one megacycle of the radio spectrum. The complete spectrum is shown in figure 1.

The present day assigned space for television, known as the VHF (Very High Frequency) band, will not accommodate a sufficient number of new stations. At present, many interference problems arise when stations operating on the same frequency, yet spaced fairly far apart, conflict with each other. In order to bring television to many more cities in the United States, more channels are required.

The Federal Communications Commission, finding the present VHF band limited in respect to additional channel assignments, carefully studied the results and findings of experiments on still higher frequencies. Based on these it allocated a band of higher frequencies for future television channels and thus opened the way for nationwide television service. This group of frequencies is referred to as the UHF (Ultra High Frequency) television band.

The entire UHF band extends from 300 to 3000 mc. However, UHF television is concerned only with that portion from 470 to 890 mc. Therefore, 420 mc. of additional frequency range is available for new television channels. In terms of channels using 6 mc. for each channel, 70 new channels can be assigned throughout the United States, making possible a television station in practically every community. These channels are numbered from 14 to 83 and have been allocated for both educational and commercial purposes.

Channels specifically for educational purposes, have been reserved in all communities that have or will have, three or more channels, UHF and VHF. They have also been reserved in educational centers, even though some of these centers may not have a commercial television station.

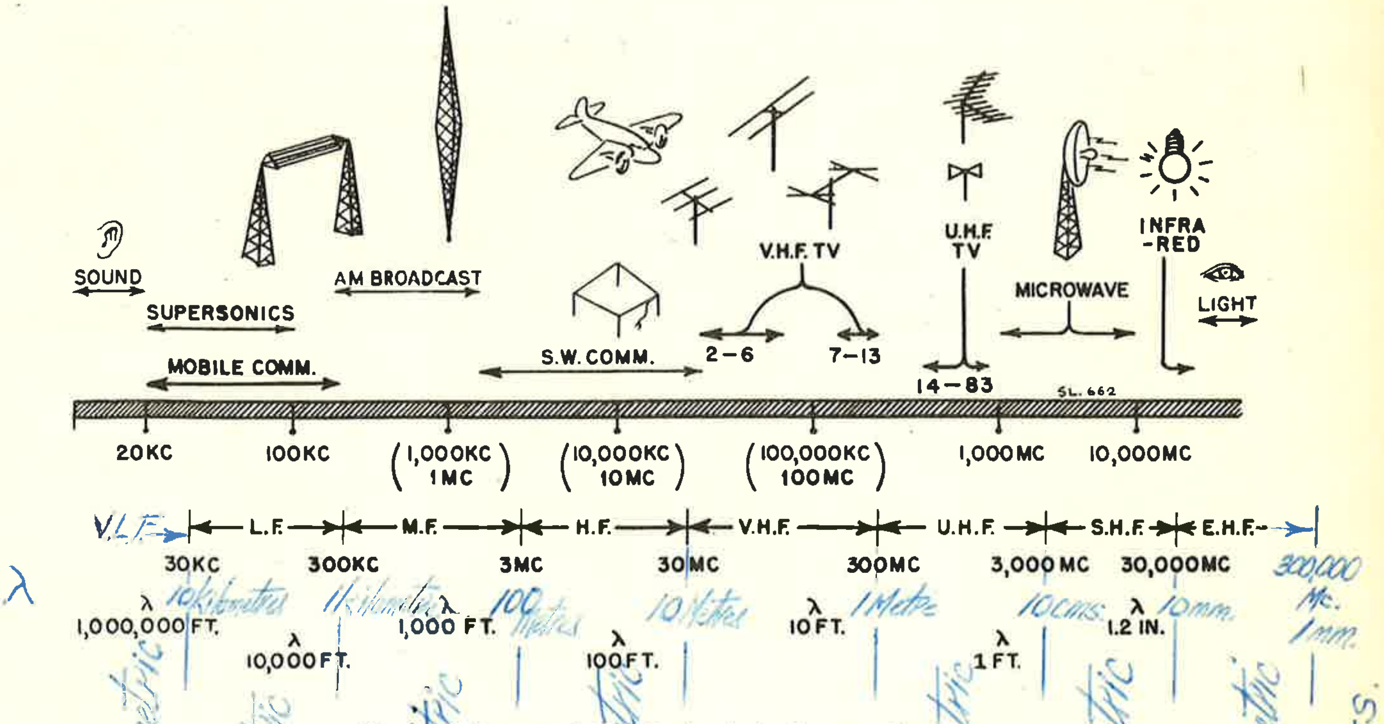


Fig. 1.—Radio and Television Services in the Frequency Spectrum.

The allocation has been done in such a manner as to eliminate completely or at least minimize considerably, all interferences that have been present when transmitting stations conflict with each other. Types of interference referred to are co-channel and adjacent channel interference.

Even at the border areas of the United States, care has been taken in allocating channels in order that interference problems between United States and Canadian, or United States and Mexican television channels will be minimized.

With the allocation of UHF channels as of today, it will mean more than 1300 new television stations.

Early in 1952 there were 108 VHF stations operating in 65 cities. FCC allocations for VHF stations total 557, including the 108 now in operation. These 557 stations will be located in 342 cities.

The UHF allocations total 1357 stations located in 1139 cities. Of these, 897 will be in cities that are not included in the VHF allocations. Thus, the inception of UHF will bring television to many areas that otherwise would not have television service.

Transmitting standards for the UHF stations will be the same as those now in use for VHF stations. Thus, no changes will be required in present television receivers, with the exception of providing means to tune this new range of frequencies.

Using external attachments, it is possible for present owners of VHF television receivers to be assured of UHF reception, thus providing a tremendous expansion in television service.

In this discussion we will use the term UHF (Ultra High Frequency) as described and also make references to "VHF", the present frequencies used in established television service.

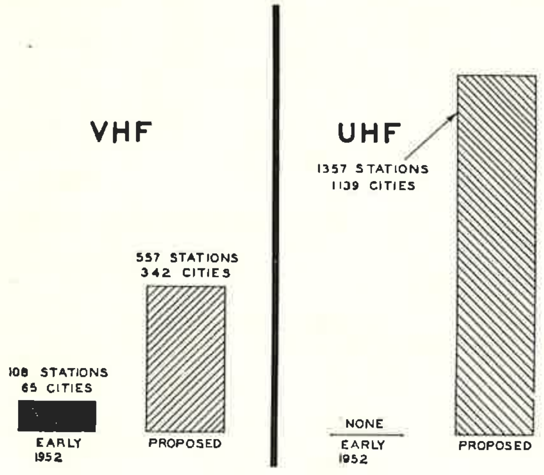


Fig. 2.—VHF/UHF Allocations.

Fig. 3.—UHF Television Station KC2XAK.

EXPERIMENTAL UHF STATION KC2XAK

To acquire greater experience in UHF propagation and to determine receiver requirements, the Radio Corporation of America established an experimental UHF television station near Bridgeport, Connecticut, in December, 1949. A view of the station is shown in figure 3. The station was operated by the National Broadcasting Company.

The territory involved provided varied conditions, including populated cities with their concrete, stone and metal structures, and irregular terrain. The latter made the location an ideal place for tests that could and do apply in practically all sections of the country. It has hills, not mountainous in size, but high enough to give a good idea as to how signals will behave in hilly country. In one direction the signal goes out over Long Island Sound with only the curvature of the earth as the limiting factor and tests were also made in that direction. The area provided a wide variety of signal conditions and an opportunity to investigate the resulting problems.

In general, the experimental station, KC2XAK, was designed and erected as any commercial station would be. However, instead of originating programs, it is supplied material from its parent station WNBT in New York.

The elevation at the base of the transmitting tower, shown in figure 4, is 195 feet; the height of the tower is 200 feet and the slotted antenna mounted at its peak is about 50 feet tall. The construction of the tower is the same as would be found in any VHF transmitter installation. Situated near the top of the tower are two receiving antennas, one a micro-dish (parabolic reflector) type, for picking up the video signal on a microwave frequency from the parent station, and the other a stacked Yagi antenna cut for the channel 4 frequency of the parent station and used to pick up the audio signal directly on VHF. Figure 5 indicates the location of the UHF station in relation to the parent station.

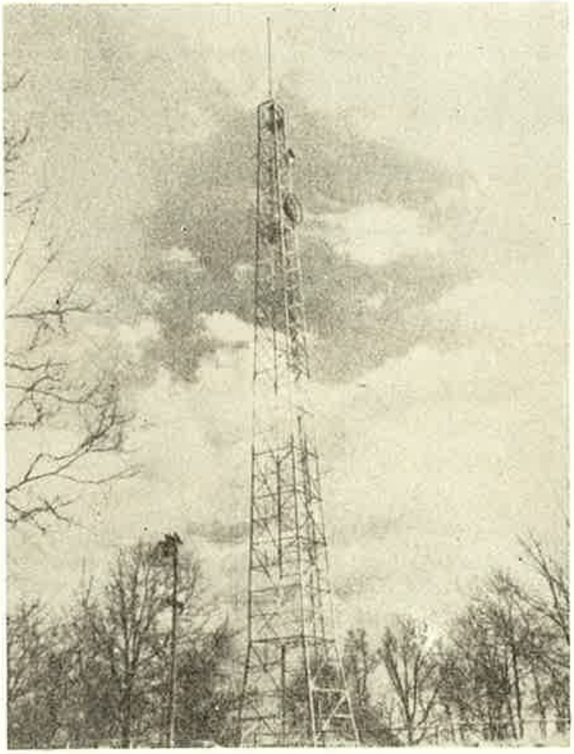


Fig. 4.—Antennas at Station KC2XAK.

The received signals are demodulated in a receiver and then fed to the transmitter; there, through doublers, triplers, amplifiers, and slotted antenna, the signal is radiated on the assigned frequencies, 529 to 535 mc.

The effective radiated power output of the visual part of the transmitter is about 13.9 kilowatts with the sound about 7.0 kilowatts. Views of the control and transmitting equipment are shown in figures 6 and 7. Two cavity resonators inside the transmitter are shown in the latter. The lower one functions as a tripler and the upper one as the final amplifier.

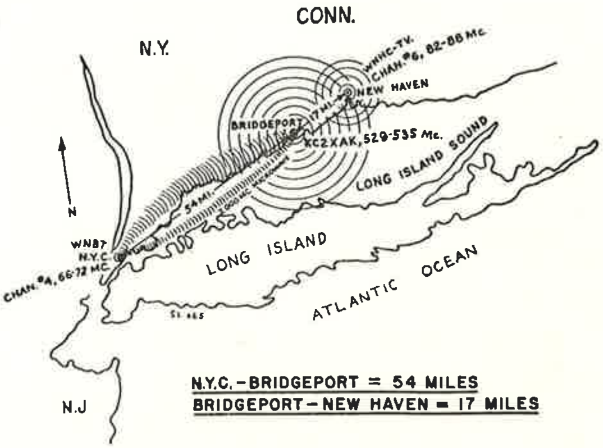


Fig. 5.—Map Showing Location of KC2XAK in Respect to "Parent Station" WNBT.

To complete the test arrangements a number of UHF selectors, and receivers with built-in selectors, were installed in the area around the transmitter. The installations were made by RCA Service Company personnel. Both UHF and VHF antenna installations were made for the receivers, while only UHF antenna installations were required in locations where selectors were attached to the receiver already

Fig. 6.—Interior View of Station KC2XAK

Fig. 7.—Control Console and Cavity Resonators at Station KC2XAK.

at the home. Comparisons of receiving conditions were made and photographs taken of resulting kinescope images on both UHF and VHF. After a period of time, installations were removed and tried in other locations using the same procedure. A map of the area covered is shown in figure 8.

A truck was equipped with both UHF and VHF antennas mounted on a telescopic mast. A station wagon with field strength meters was also a part of the field unit. The truck and station wagon are shown in figures 9 and 10. The mobile units were used to determine signal strengths along various radial paths, and during a test run, both vehicles would be stopped periodically to make field strength measurements. This pattern was followed in all directions away from the transmitting tower, until a large area was covered,

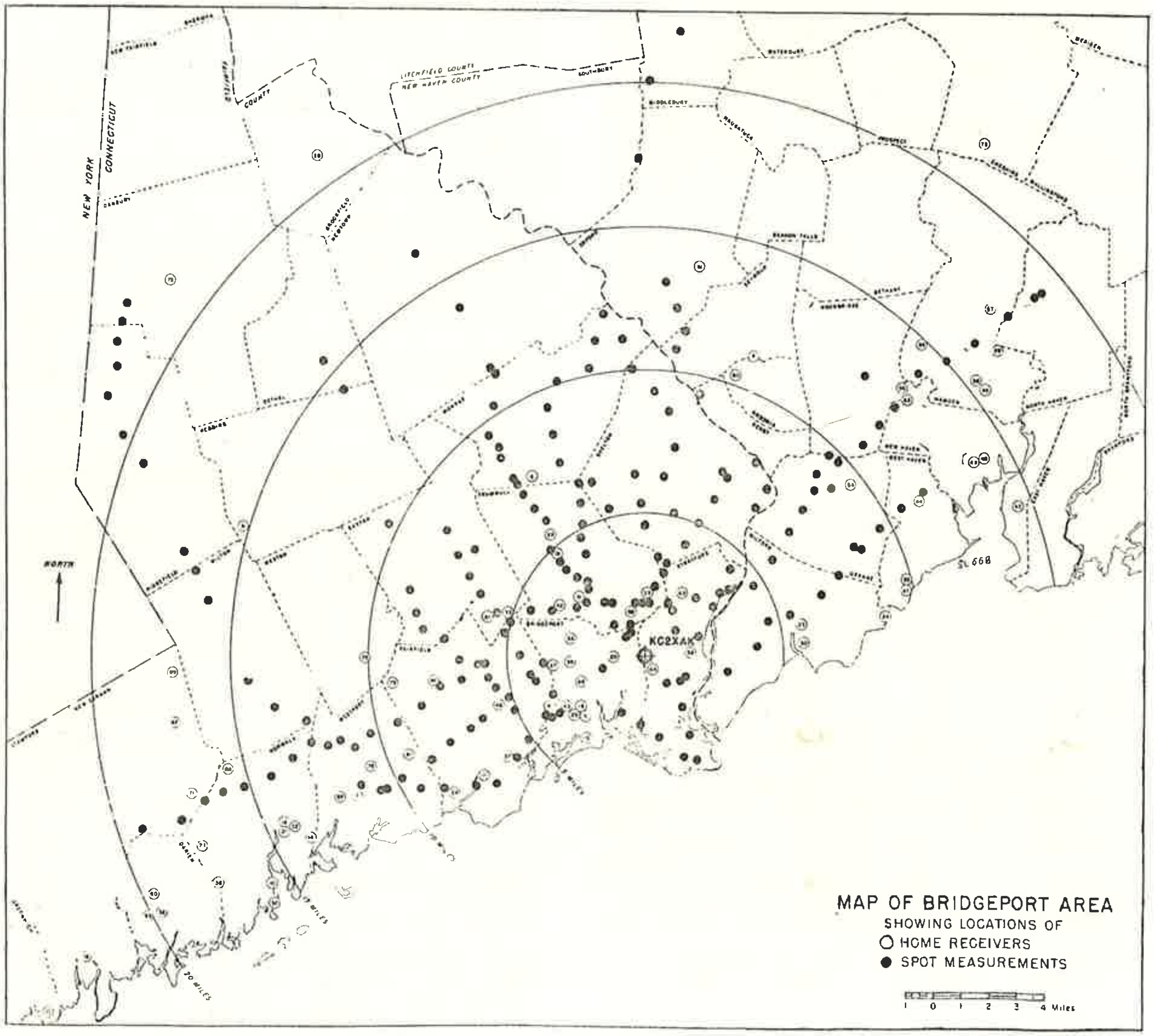


Fig. 8.—Map Showing Location of Receivers During Bridgeport Tests.

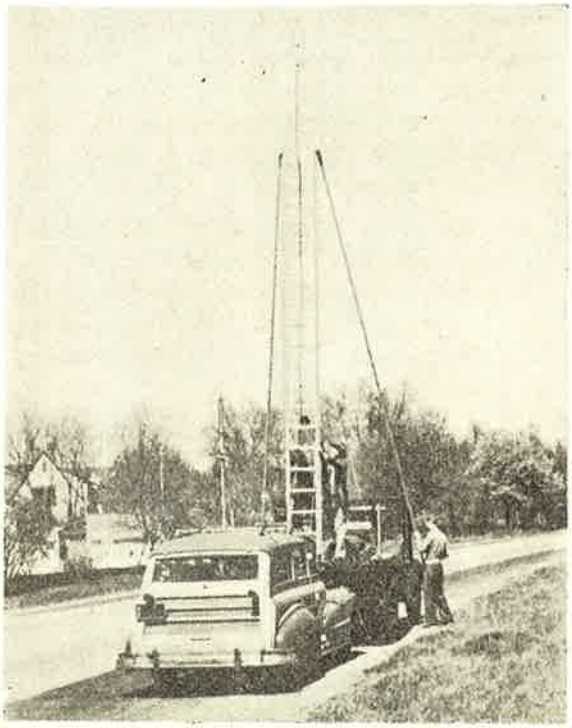


Fig. 9.—Mobile Units Used in Field Tests.

as shown in figure 11. Comparisons were made of VHF and UHF signals. These results were tabulated against topographical maps of the area. Elevations were noted and also recorded.

Various types of receiving antennas were tested in selected areas. Each antenna was tested by placing it in all points of the area, moving to and from the station, horizontally and diagonally with the station. Field strength readings varied with types of antennas used, but the location of maximum and minimum signals were the same with each antenna.

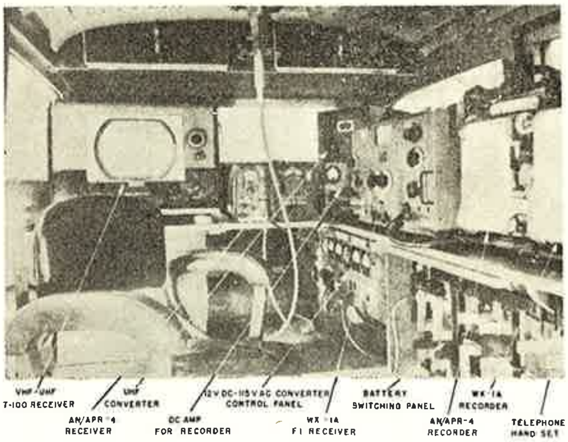


Fig. 10.—Interior View of Station Wagon Showing Equipment Used in Field Tests.

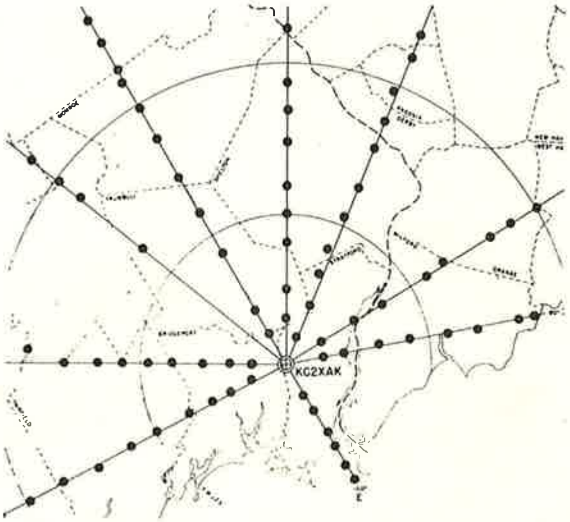


Fig. 11.—Map Showing Locations of Spot Measurements Made in Field Tests.

During the antenna tests, various transmission lines were checked for best results. To determine weather effects, lines were soaked with water and notations made on the apparent losses.

UHF ANTENNAS

Antenna requirements for television reception on the UHF band are, in many respects, much the same as on the VHF band. Antennas used for UHF reception, however, differ greatly with those used for VHF —chiefly, being much smaller in size and lighter in weight. There are several antenna types which may be used in strong and weak signal areas. For the most difficult fringe areas, or locations where reflections are severe, special antenna types have found favor. In some instances, in strong signal areas, reception was obtained by using the existing VHF antenna, but as the distance from the transmitter was increased, it was necessary to use the regular UHF types. The characteristics of antennas which were used and tested in UHF service are detailed under their own separate titles. Each antenna type outlined here possesses properties peculiar to its individual design, and these should provide a choice that will meet the requirements of even the most difficult locations.

VHF Antenna Operation at UHF

Most VHF Antennas are not very satisfactory at UHF, except in medium and high strength signal areas which are free from reflections. The gain is very variable over the UHF range. The directivity is poor in both the horizontal and vertical planes. This is due to the many lobes present and the strong responses at various angles. Figure 12 shows a typical horizontal polar pattern of a VHF dipole with reflector when used on UHF. This diagram may be regarded as similar to the response obtained for other types of VHF antennas. Another major disadvantage is that the lobes shift direction with frequency, requiring separate orientation for stations operating on widely separated channels. In general, VHF antennas are not very practical for UHF use.

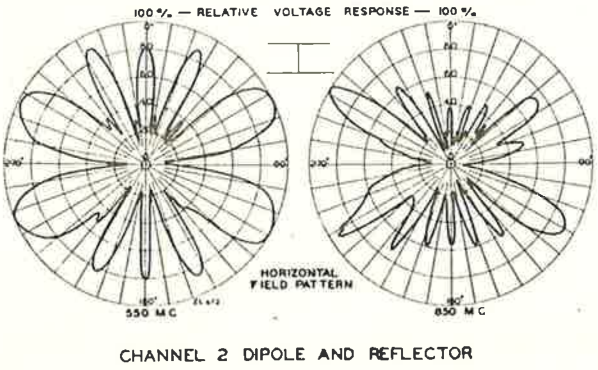


Fig. 12.—Horizontal Field Pattern of VHF Dipole Antenna With Reflector When Used at UHF.

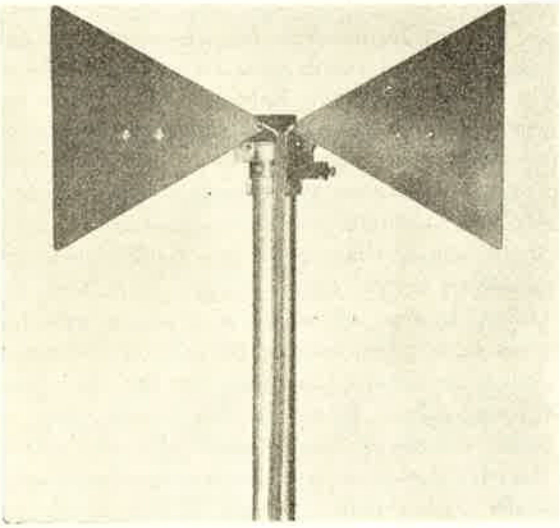


Fig. 13.—UHF Fan Dipole Antenna.

Fan Dipole

The fan dipole (bow tie) is the simplest of all UHF antennas. This antenna is illustrated in figure 13. The antenna is constructed of two metal triangles lying in the same plane. The fan dipole shows some gain over a half-wave dipole. A typical directivity pattern is shown in figure 14. The fan dipole possesses excellent band-width. Its usage has generally been confined to strong signal, reflection-free areas.

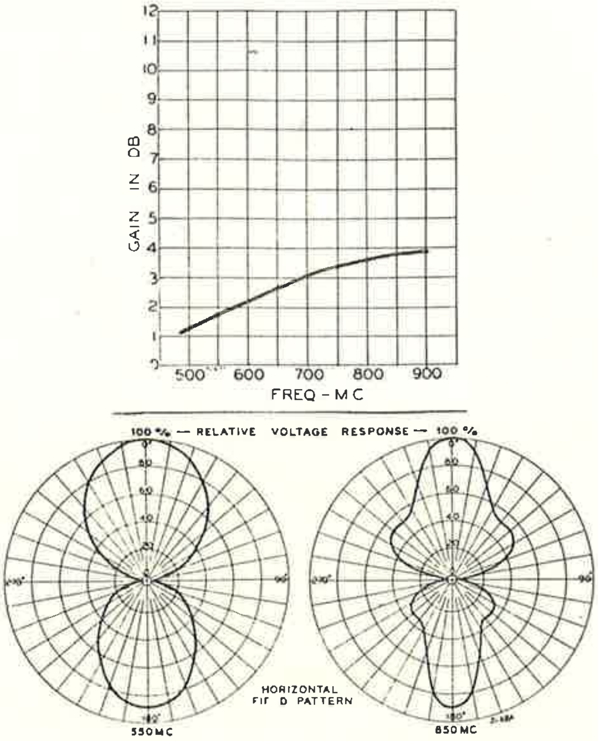


Fig. 14.—Fan Dipole Gain Curve and Horizontal Field Pattern.

Stacked Fan Dipoles

To obtain added gain and vertical directivity, the fan dipole can be stacked vertically. One arrangement used is illustrated in figure 15. The gain is increased over that of a fan dipole, and displays a rising characteristic with frequency (figure 16). Additional gain (figure 18) may be obtained by stacking four of these antennas, as shown in figure 17 The horizontal directivity pattern of the stacked units is essentially the same as the single unit.

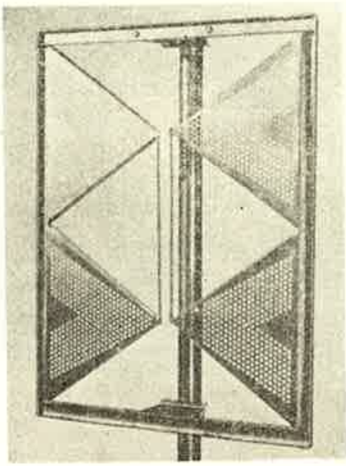


Fig. 15.—Two Stacked UHF Fan Dipole Antennas.

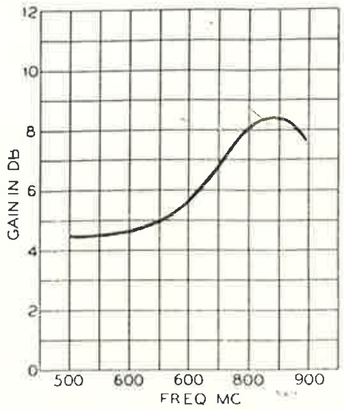


Fig. 16.—Gain Curve of Two Stacked Fans.

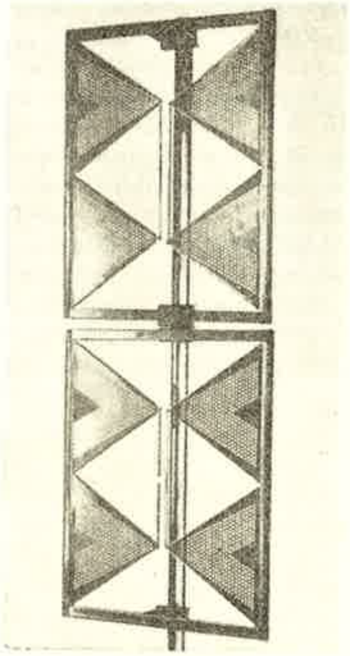


Fig. 17.—Four Stacked UHF Fan Dipole Antennas.

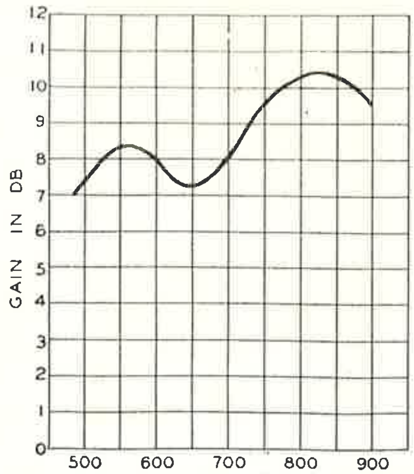


Fig. 18.—Gain Curve of Four Stacked Fans.

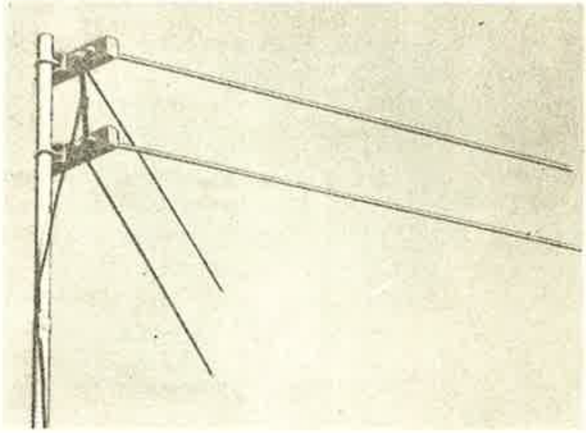


Fig. 19.—UHF Stacked "V" Antenna.

Stacked "V" Dipoles

An antenna which has given promising results is the stacked "V", shown in figure 19. This antenna consists of two "V" antennas, using elements the same length as a channel 2 dipole. It is a very efficient antenna, considering its simplicity of construction, and is relatively easy to mount on existing masts. It is a high gain antenna (5.5 to 10.5 db) and has reasonably good directivity, as shown in figure 20. In some instances this antenna may also suffice for VHF reception.

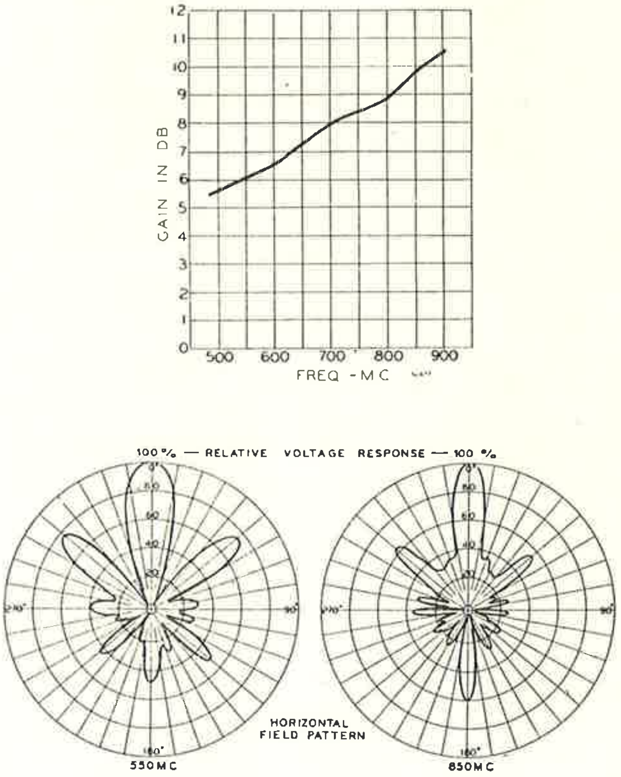


Fig. 20.—Stacked "V" Gain Curve and Horizontal Field Pattern.

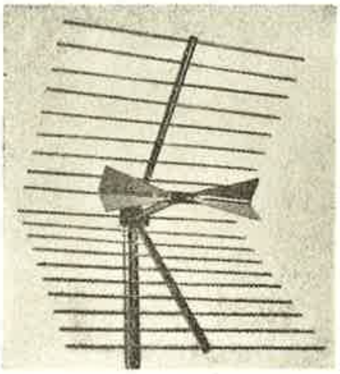


Fig. 21.—UHF Corner Reflector Antenna

Corner Reflector Antenna

At UHF frequencies, the constructional limitations encountered at VHF are considerably eased, and the use of a sheet reflector-type antenna becomes practical. The corner reflector is one antenna of this type that has been used and found to yield very good results. It may be made light in construction, and electrically has outstanding characteristics. This antenna is illustrated in figure 21. It is a high gain antenna, with substantially uni-directional field pattern in the horizontal plane, as shown in figure 22. The almost complete absence of unwanted lobes should minimize reflections and multipath reception.

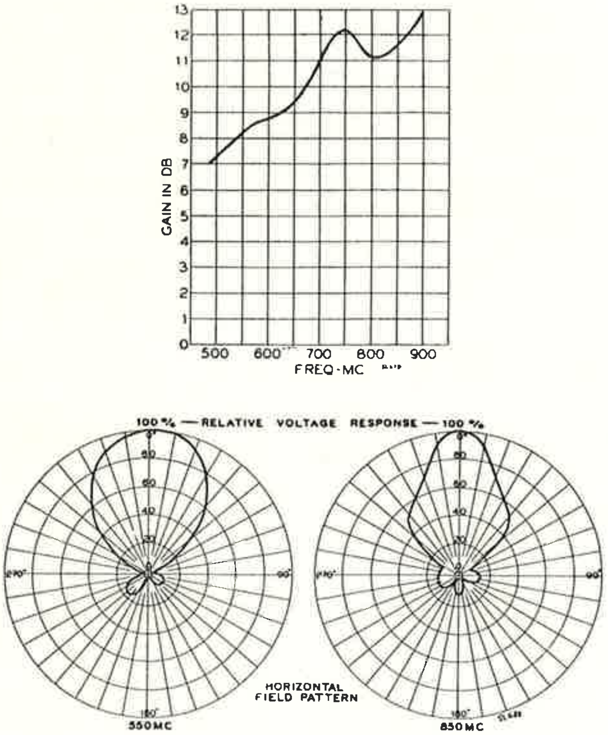


Fig. 22.—Corner Reflector Gain Curve and Horizontal Field Pattern.

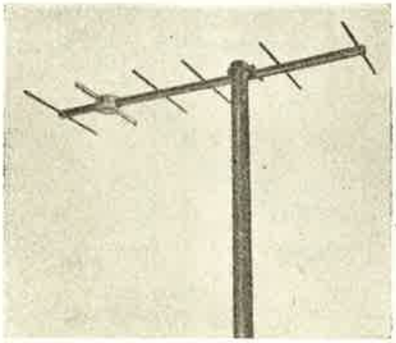


Fig. 23.—UHF Six Element Yagi Antenna.

Yagi Antenna

The Yagi antenna has been found equally as useful at UHF as at VHF. It produces more gain for its size and weight than any other type of antenna. However, to obtain optimum results, the mechanical construction is very critical, and close dimensional tolerances must be held if its potentialities are to be realized. This antenna is shown in figure 23. A gain of approximately 10 db was obtained with the antenna shown. The Yagi antenna is an excellent performer with respect to reflection elimination and unwanted signal reduction; however, it is a narrow band antenna. To obtain increased gain, Yagi's may be stacked if desired. Its field pattern is shown in figure 24.

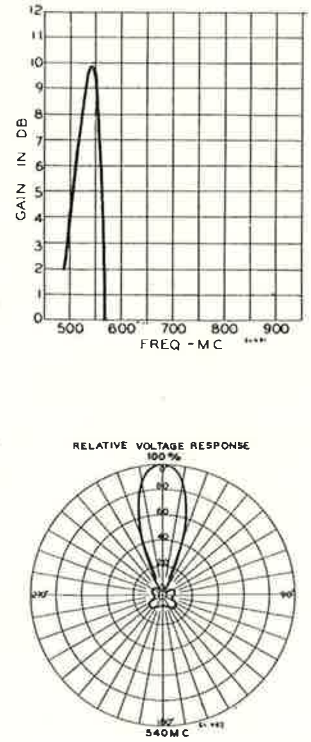


Fig. 24.—Six Element Yagi Gain Curve and Horizontal Field Pattern.

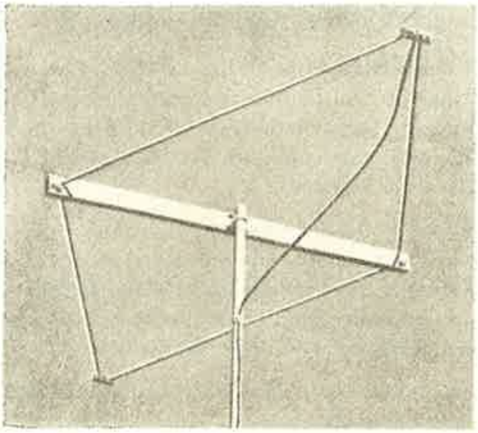


Fig. 25.—UHF Rhombic Antenna.

Rhombic Antenna

Rhombic antennas have been built and used very successfully during the UHF field tests. One of these is illustrated in figure 25. The rhombics were adjusted for unidirectional operation, being terminated at the far end with a suitable resistor. A gain of approximately 5.5 to 11 db was obtained. The rhombic is a broad-band antenna, showing a desirable rising gain characteristic at the higher frequencies in the UHF television band. It has very good directivity, as indicated in figure 26, with the major forward lobe quite narrow in the horizontal direction.

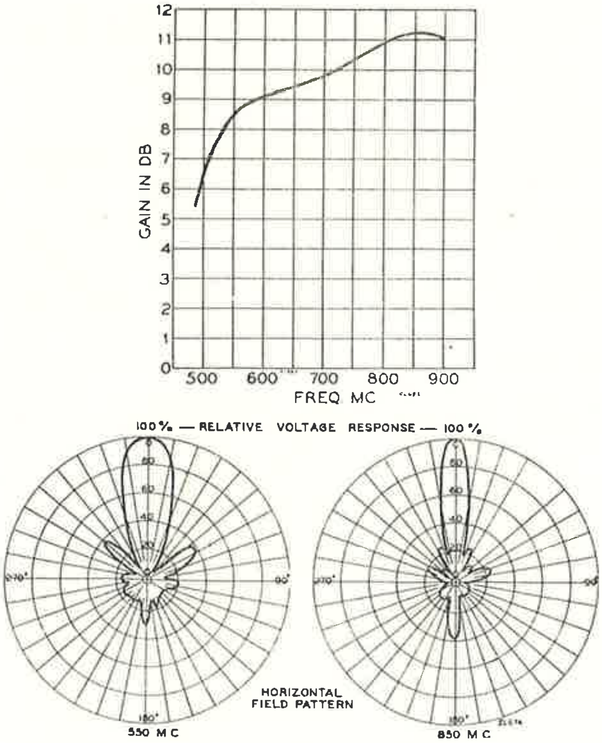


Fig. 26.—Rhombic Gain Curve and Horizontal Field Pattern.

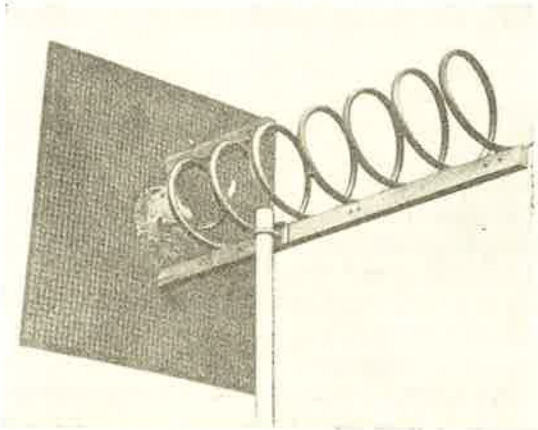


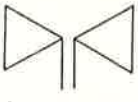
Fig. 27.—UHF Helical Antenna.

Helical Antenna

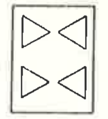
A helical antenna is shown in figure 27. This antenna showed fairly high gain and broad bandwidth. In field tests, it was found difficult to mount due to its bulk. It would also acquire a heavy ice load and offer high wind resistance.

Choice of Antenna

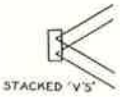
Among the antennas tested, it appears that the fan, stacked fan, stacked "V", and corner reflector antennas are considered most practical for present purposes. For convenience, a summary of the characteristics of these antennas is shown in figure 28. Under some conditions it may be found that one of the other types listed may provide a solution for a particular receiving problem. Results of field tests show that installation of a separate UHF antenna is necessary in most cases to provide optimum UHF reception.



Bandwidth better than straight dipole. Bi-directional. Not suited for bad reflection areas. Low cost.



Higher gain than single fan. Otherwise essentially the same. Moderate cost.



Higher gain than two stacked fans. Better front-to-back ratio than fans. However has side lobes. Fair for use on VHF. Low cost.

Highest gain. Uni-directional. Best for weak signal areas. Best for bad reflection areas. Expensive compared to other types.

Fig. 28.—Summary of Four UHF Antenna Types.

TRANSMISSION LINES

In connection with the testing of UHF Antennas a study of transmission lines was also made. It was found that the selection of transmission lines for UHF is of extreme importance. Fringe areas require a low loss line and strong signal areas often require shielded line to minimize reflections. Rain will affect transmission lines more on UHF than on VHF If tubular line or a shielded line is used, sealing the antenna end of the line is very important. In the case of the tubular line, even sealing is not enough, as changes in temperature will produce condensation inside the line. To remedy this, a drip loop should be made at the point of entrance to the building and a small hole cut through the insulation at the bottom of the drip loop to allow the accumulated moisture to run out.

Various types of lines were tested and the results obtained with some are listed below These types are shown in figure 29

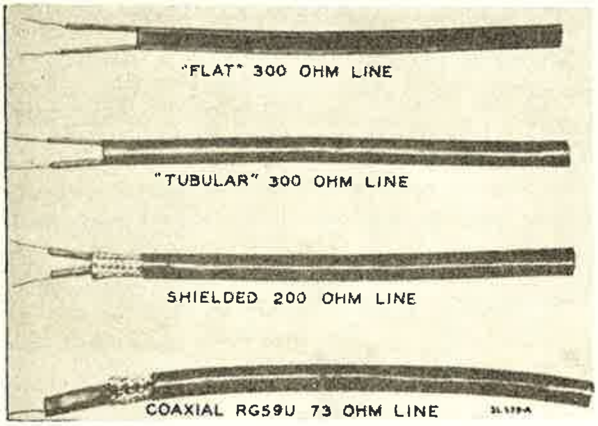


Fig. 29.—Transmission Line Types

1. "Flat" 300 ohm line showed an approximate loss of 3 db per hundred feet at 530 mc. The signal loss increases greatly when the line is wet, or rests on wet wood or metal surfaces.
2. "Tubular" 300 ohm line has approximately the same loss (3 db per hundred feet at 530 mc.) as the "flat" 300 ohm line, but is not affected as much by water. This line can be very effectively used on UHF installations.
3. Shielded 200 ohm line has an approximate loss of 8.0 db per hundred feet at 530 mc. This line is effective for elimination of stray pickup.
4. Coaxial RG-59/U 73 ohm line has an approximate loss of 9.5 db per hundred feet at 530 mc. This line is also effective for eliminating stray pickup and is quite free from weather effects.

UHF RECEIVER INSTALLATIONS

UHF installation procedure is similar to that of VHF, but the requirements are more critical. In UHF the receiving location and associated signal conditions are the principal factors in determining the type of installation to be made.

Of course, the requirements in strong signal areas are not as important as in weak signal areas, but nevertheless more attention should be given to selection of the antenna and transmission line than might be considered necessary for a VHF installation.

It should be kept constantly in mind that dielectric losses in materials at several hundred megacycles are far greater than at the comparatively low frequencies used in the VHF band. These losses make it necessary to select materials with care and to install the antenna and transmission line in the best mechanical and electrical way to avoid high losses. The transmission line should be as short as possible.

Before starting an installation determine the signal conditions for the receiving location, making a field strength survey if necessary. In fringe areas the latter is advisable. In many instances the best mounting location for the antenna may not be the best receiving location. Various points of the structure should be surveyed, moving the antenna up or down and on a horizontal plane, in respect to the transmitting antenna. Results should be noted and the best location and height chosen. The signal strength and general signal conditions indicated by the survey will determine the type of antenna and transmission line that should be used. Extreme care should be given to their selection and a very thorough installation should be made. In running unshielded transmission line, care should be taken to keep it taut and free from metal roofing or rain pipes, etc. If it is necessary to tape the transmission line to supporting standoffs for security, friction tape should not be used, because when water-soaked, it will increase the signal losses. It is recommended that a plastic tape be used.

Successful UHF reception depends largely on the quality of the installation.

UHF RECEIVING EQUIPMENT

It will be possible to add UHF television reception to present day receivers simply and at a nominal cost by adding conversion equipment. The number of UHF stations available at the receiving location will determine the particular equipment to be used. In many cases, conversion will be effected merely by securing the conversion unit in place, connecting power and making necessary antenna connections.

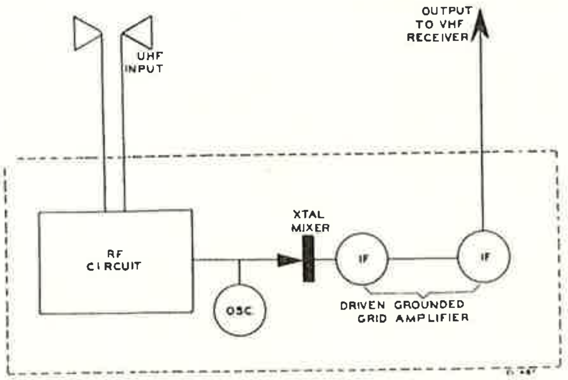


Fig. 30.—Typical UHF Selector Design.

This will be no more complicated than connecting an R-F booster to a VHF television receiver. For best results it is considered desirable that a separate UHF antenna be erected. Some of the units that are representative of present design are described below. These selector units follow the general plan shown in figure 30. Tuned R-F circuits are used to secure the desired selectivity. The output of these tuned circuits is fed into the mixer, utilizing a crystal diode which has been designed to provide especially favorable characteristics at ultra high frequencies. A local oscillator is used to generate R-F frequencies which are fed to the crystal diode mixer to produce a beat frequency falling into one of the unused VHF channels of the television receiver. This signal is handled in the VHF receiver in the same manner as any other signal within the tuning range of the VHF tuner. Present design thinking considers the use of channel 5 or 6 for this purpose. There are definite reasons for considering these channels, but this reasoning is beyond the scope of this lecture.

One Channel Selector

In communities where only one UHF television station is located, a one channel selector has been designed to provide UHF reception with a VHF receiver. A unit of the type used in the Bridgeport tests is shown in figure 31.

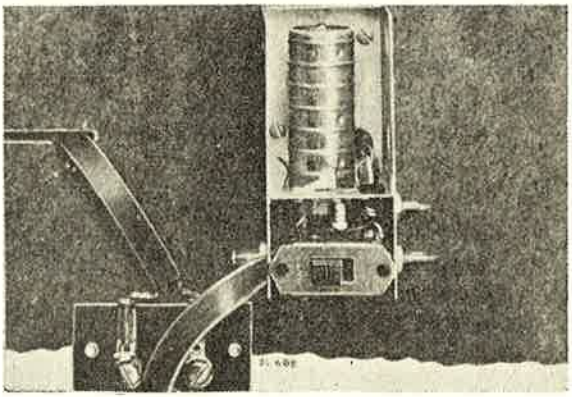


Fig. 31.—One Channel UHF Selector of Type Used in Bridgeport Tests.

This unit may be tuned to any one of the UHF channels. Tuning is accomplished by varying the adjustment screws provided for this purpose, the adjustment being made at the time of the installation. Once adjusted, no further tuning is required to receive the UHF station. Change-over from VHF to UHF reception is accomplished by actuating a switch located on the selector unit.

This unit is quite small in size and it is intended for mounting on the back of the television receiver, as shown in figure 32.

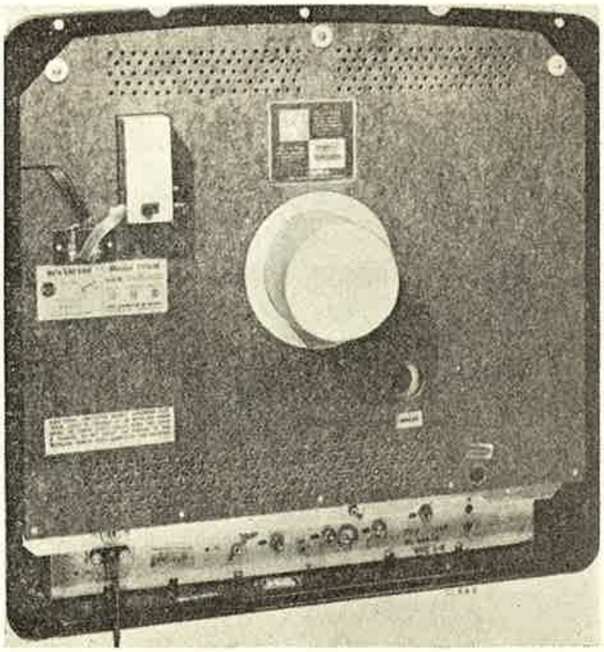


Fig. 32.—Installation Location of One Channel UHF Selector.

Two Channel Selector

A two channel UHF selector of the type used in the Bridgeport tests is shown in figures 33 and 34. This unit was intended for placement on top of the VHF receiver or on an adjacent table. The unit would be tuned to the two available UHF channels at the time of installation and switching from VHF to the two UHF channels would be accomplished by a front panel control, as shown in figure 33.

NOTE: *The selectors shown on pages 15 and 16, figures 31 through 36, inclusive, are not production models. These are development models and may or may not be similar to models which will be produced.*

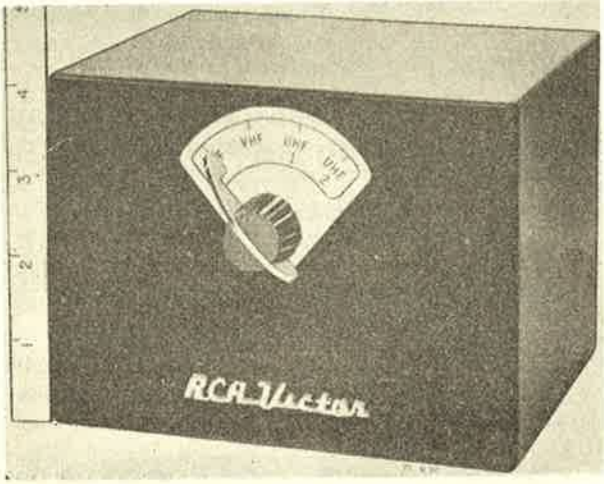


Fig. 33.—Two Channel UHF Selector of Type Used in Bridgeport Tests.

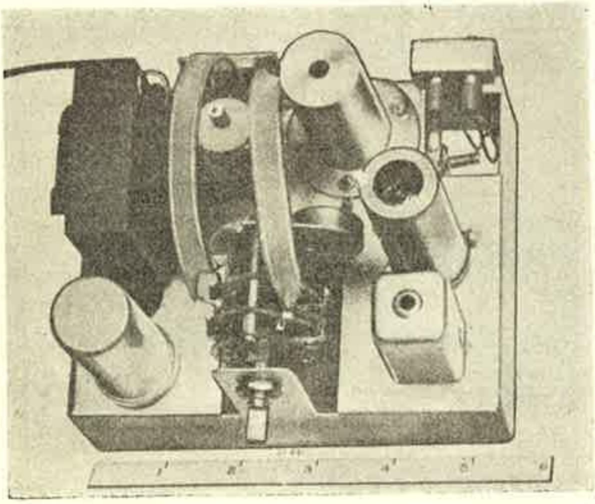


Fig. 34.—Chassis of Two Channel UHF Selector.

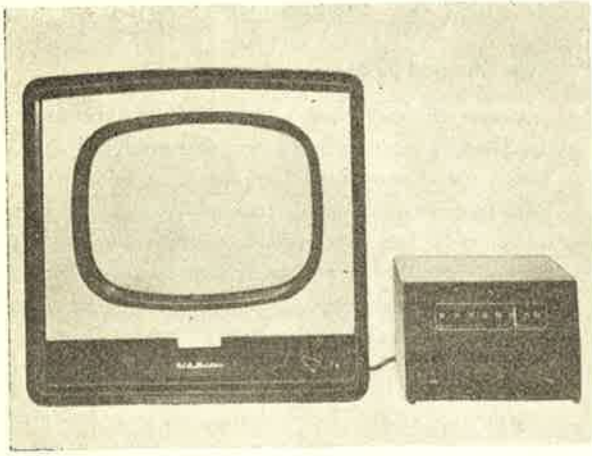


Fig. 35.—All-Channel UHF Selector Connected to RCA Victor Receiver.

All Channel Selector

An all channel selector of the type used in the tests is shown in figures 35 and 36. In this selector the tuned circuits are ganged and are continuously variable by means of a front panel control. Thus, the entire range of the UHF television band may be covered.

A unit of this type, by necessity, must be larger in size than the one and two channel types. It is intended for placement on top the VHF receiver or an adjacent table, as shown in figure 35.

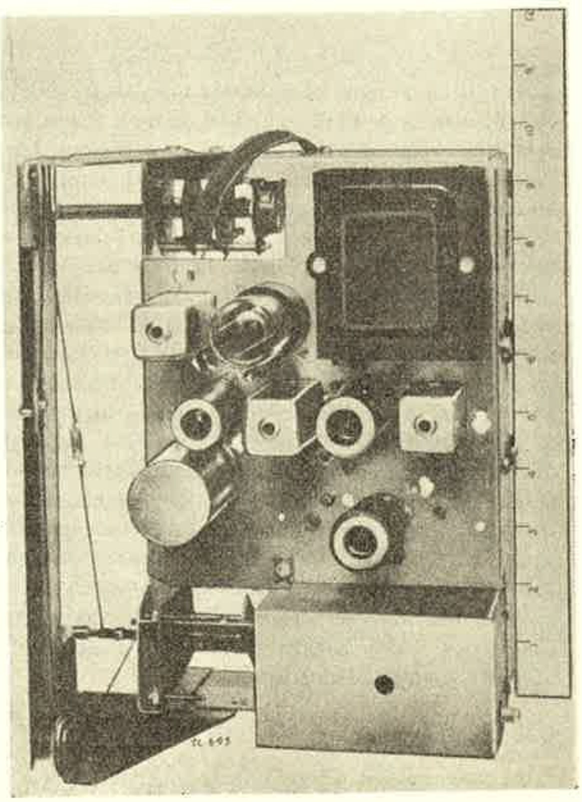


Fig. 36.—Chassis of All-Channel UHF Selector.

VHF/UHF Receivers

RCA Victor 40 mc. I-F television receivers of the future will incorporate a tuner that will permit tuning a combination of VHF and UHF stations as required in any particular area. Contemplated design of the tuner provides for sixteen channels, any number of which can be adjusted for UHF reception.

It will also be possible to install this tuner in place of the existing one in the 40 megacycle RCA Victor television receivers produced since August, 1951. Thus, those receivers can be modified for UHF reception without the need of an external selector.

RADIOTRON 6BV7

MINIATURE DUO-DIODE POWER AMPLIFIER PENTODE *

APPLICATION

The Radiotron type 6BV7 is a nine-pin miniature duo-diode output pentode with a transconductance of 10,000 micromhos and a power output of 4 watts for 10% total harmonic distortion under recommended 250 volt operating conditions. The valve was designed primarily for use in low cost four valve receivers in which good performance is required with reduced plate and screen voltages and low cathode current. In this application with plate, screen and control grid voltages of 180, 180 and –4 volts respectively, Radiotron 6BV7 will deliver 2 watts output for 10% distortion with a plate current of only 20 mA.

Diodes

The location of the diodes in the output valve allows a very convenient layout of the conventional 4 valve straight or reflexed receiver and enables higher i-f gain to be obtained without excessive regeneration, or without neutralizing, than is possible when the diodes are located in the i-f amplifier valve.

In receivers with an a-f amplifier between the detector diode and the grid of the pentode section it is recommended that the diode connected to pin 6 be used for detection as this diode has the lower capacitance to pentode plate. In other types of receivers either diode may be used for detection.

Pentode

Grid resistor. The maximum permissible value of grid resistor for Radiotron 6BV7 under maximum dissipation conditions is 0.5 megohm for cathode bias operation and 0.1 megohm for fixed-bias operation. In conventional back-biased receivers in which the pentode is operated at maximum ratings the grid resistor should be reduced from 0.5 megohm in the ratio that the cathode current of the 6BV7 bears to the total current drawn by the receiver.

Larger values of grid leak may be used when the dissipation of the valve is reduced. For example, under the 180 volt conditions quoted above in a back-biased receiver in which at least half of the total B supply current is drawn by the output valve, the maximum permissible value of grid resistor is 1 megohm.

Grid stopper. The high transconductance of Radiotron 6BV7 provides good power sensitivity, and under 250 volt operating conditions an input of 0.25 volt r.m.s. gives 50 mW. output. Under 180 volt conditions an input of only 2.6 volts r.m.s. gives full rated output. In addition to its usefulness from the point of view of pure sensitivity, the high transconductance of Radiotron 6BV7 makes possible the use of a larger degree of negative feedback than would otherwise be possible. Even in the case of a four valve straight receiver a worthwhile degree of negative feedback can be applied to the output stage while still maintaining good overall sensitivity.

Because of the high transconductance of Radiotron 6BV7 a grid stopper should always be used, and a value of 5,000 ohms is recommended.

In four-valve straight receivers a large audio voltage appears on the diode, and with the volume control turned to minimum the amount of playthrough is proportional to the impedance between control grid and ground. For this reason, the grid stopper should not be too large — 5,000 ohms is as effective as 50,000 ohms in suppressing parasitic oscillation — nor should the grid coupling capacitor be too small. Under these conditions playthrough will be very low.

Use with low-level pick-ups.

When Radiotron 6BV7 is used as part of a high-gain pick-up amplifier, such as is required with some low-level pick-ups, it is desirable to arrange the radio-gramophone switching to remove the detection diode from the circuit in the high-gain pick-up position in order to remove the possibility of feedback through the diode circuit. As such switching is incorporated in most receivers to prevent interference with recorded items from radio programmes, this arrangement does not normally involve additional cost.

Ventilation.

The envelope of Radiotron 6BV7 becomes very hot in operation, and free circulation of air around the valve is necessary.

***Tentative data**

RADIOTRON TYPE 6BV7 DUO-DIODE POWER AMPLIFIER PENTODE

GENERAL DATA

Heater, for Unipotential Cathode:

Voltage (a.c. or d.c.)	6.3 volts
Current	0.8 amps.

Direct Interelectrode Capacitances:°

Pentode Unit:	Grid to Plate	0.5 μμF	max.
	Input	11.5 μμF	
	Output	9.5 μμF	
Diode Units:	Diode (pin 1) — Diode (pin 6)	0.01 μμF	max.
	Diode (pin 1) — Pentode Plate	0.7 μμF	max.
	Diode (pin 6) — Pentode Plate	0.3 μμF	max.
	Diode (pin 1) — Pentode Grid	0.1 μμF	max.
	Diode (pin 6) — Pentode Grid	0.1 μμF	max.

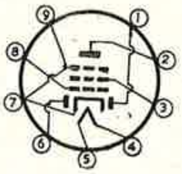
° With no external shield.

Mechanical:

Mounting Position	Any
Maximum Overall Length	2$\frac{5}{8}$″
Maximum Seated Length	2$\frac{3}{8}$″
Length, Base Seat to Bulb Top (excluding tip)	2″ ± $\frac{3}{32}$″
Maximum Diameter	$\frac{7}{8}$″
Bulb	T-6-$\frac{1}{2}$
Base	Small-Button Noval 9-Pin

Base Connections for Bottom View:

Pin 1 — Diode Plate
Pin 2 — Pentode Plate
Pin 3 — Pentode Grid No. 2
Pin 4 — Heater
Pin 5 — Heater



Pin 6 — Diode Plate
Pin 7 — Cathode and Pentode Grid No. 3
Pin 8 — Pentode Grid No. 1
Pin 9 — Cathode and Pentode Grid No. 3

PENTODE UNIT

A-F POWER AMPLIFIER—CLASS A_1

Maximum ratings, design-centre values:

Plate Voltage	250 max. volts
Grid No. 2 Voltage	250 max. volts
Plate Dissipation	10 max. watts
Grid No. 2 Dissipation	2 max. watts
Peak Heater-Cathode Voltage	
Heater negative with respect to cathode	90 max. volts
Heater positive with respect to cathode	90 max. volts

Typical operation and characteristics:

Plate Voltage	180	250	volts
Grid No. 2 (Screen) Voltage	180	250	volts
Grid No. 1 (Control-Grid) Voltage	–4	–5	volts
Peak A-F Grid No. 1 Voltage	4	5	volts
Zero-Sig. Plate Current	20	38	mA
Zero-Sig. Grid No. 2 Current	3.5	6.0	mA
Plate Resistance (Approx.)	130,000	100,000	ohms
Transconductance	8,000	10,000	umhos
Load Resistance	7,000	7,000	ohms
Max.-Sig. Total Harmonic Distortion	10	10	%
Max.-Sig. Power Output	2	4	watts

Maximum circuit values (for maximum rated conditions):

Grid No. 1 — Circuit Resistance:

For fixed bias	0.1 megohm
For cathode bias	0.5 megohm
For back bias	See under Application

DIODE UNITS.

Maximum ratings, design-centre values:

Plate Current (for each diode)	1.0 max. mA.

Diode considerations:

The two diode units are placed on opposite sides of, and parallel to the cathode, the sleeve of which is common also to the pentode unit.

The minimum diode current per plate with an applied d.c. voltage of 10 volts is 0.8 mA.