MODELS 55, 56, Ch. 1620; 77, Ch. 1610

MODELS 77-55-56 GENERAL DESCRIPTION

Model 77 is a thirty-one tube direct view 16 inch metal Kinescope receiver. Model 55-56 is a twenty-nine tube direct view 16 inch metal Kinescope receiver.

In all three models the receiver is operated by the use of seven front panel controls. Features include four stages of video I-F amplification and two stages of video amplification. Carefully regulated voltage supplies provide good vertical interlace. A three stage sync. separator and clipper and automatic Frequency Control system provide stabilized horizontal hold. Stagger tuned circuits provide full frequency response for maximum definition to four megacycles. Crystal video detector employed for accurate gradation and contrast. Automatic Gain Control circuit gives equalized reception on all available channels without changing brightness or contrast controls, and minimizes disturbances caused by aeroplanes. A completely shielded high voltage supply delivers 13kv. for maximum picture brilliance.

FM sound system utilizes three I-F stages with limiter and Foster-Seeley discriminator. Two stages audio amplifier with tone control and inverse feedback is incorporated in all three models. #77 utilizes an 8 inch permanent magnet speaker. Model 55-56 utilizes a 12 inch extended range permanent magnet speaker.

Metal Kinescope envelope is carefully insulated and is integrally mounted in cabinet with picture surface sealed in dust-tight chamber by a polyethelene gasket to prevent accumulation of ionized dust particles and mist behind heavy Kinescope mask.

Mahogany cabinet constructed of fine imported and domestic woods and carefully finished.

MECHANICAL SPECIFICATIONS

Dimensions (inches)	Width	Height	Depth
Cabinet (outside)	21	41	24
Chassis Base (outside)	18	3-3/4	18
Chassis (overall)	18	12-1/2	21

Picture size: -- 13-3/4 X 10-1/4 (126 square inches)

ELECTRICAL SPECIFICATIONS

Power Supply Rating 115 volts 60 cycles 340 watts

R-F FREQUENCY RANGES

Channel Number	Channel Freq. Mc.	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	54-60	55.25	59.75	81
3	60-66	61.25	65.75	87
4	66-72	67.25	71.75	93
5	76-82	77.25	81.75	103
6	82-88	83.25	87.75	109
7	174-180	175.25	179.75	201
8	180-186	181.25	185.75	207
9	186-192	187.25	191.75	213
10	192-198	193.25	197.75	219
11	198-204	199.25	203.75	225
12	204-210	205.25	209.75	231
13	210-216	211.25	215.75	237

FINE TUNING RANGE: Channel 2: Plus and minus 300 kc. Channel 13: Plus and minus 750 kc.

ANTENNA INPUT 300 ohms balanced

PICTURE I-F FREQUENCIES

Picture Carrier Frequency	25.75 mc.
Adjacent Channel sound trap	27.25 mc.
Accompanying channel sound trap	21.25 mc.
Adjacent channel picture carrier trap	19.75 mc.

SOUND I-F FREQUENCIES

Sound Carrier Frequency	21.25 mc.
Sound Discriminator band width (Between peaks)	350 kc.

VIDEO RESPONSE 4 mc.

AUDIO POWER OUTPUT RATING

Undistorted	4 watts
Maximum	6 watts
Frequency Response	Flat from 200 to 12,000 cycles

LOUDSPEAKER	**MODEL 77**	**MODEL 55-56**
Type	8 inch PM	12 inch PM
Voice Coil Impedance	3.4 ohms	6-8 ohms

FOCUS Magnetic

DEFLECTION Magnetic

SCANNING Interlaced, 525 lines

HORIZONTAL SCANNING FREQUENCY 15,750 cps.

VERTICAL SCANNING FREQUENCY 60 cps.

FRAME FREQUENCY (Picture Repetition rate) 30 cps.

TUBE COMPLEMENT

FUNCTION	MODEL 77	MODEL 55-56
R-F Amplifier	6J6	6AG5
R-F Oscillator	6J6	6J6
Converter	6J6	
1st. Sound I-F Amplifier	6BA6	6BA6
2nd. Sound I-F Amplifier	6BA6	6BA6
3rd. Sound I-F Amplifier	6AU6	6AU6
Sound Discriminator and 1st. Audio	6T8	6T8
Audio Output	6V6GT	6V6GT
1st. Pix I-F Amplifier	6AG5	6AG5
2nd. Pix I-F Amplifier	6AG5	6AG5
3rd. Pix I-F Amplifier	6AG5	6AG5
4th. Pix I-F Amplifier	6AG5	6AG5
A.G.C. Det. and D.C. Restorer	6AL5	6AL5
A.G.C. Diode and Amplifier	6T8	6T8
1st. video Amplifier	6AU6	6AU6
2nd. video Amplifier	6V6GT	6V6GT
1st. sync. Amplifier	6SK7	6SK7
Sync. Separator	6SH7	6SH7
2nd. Sync. Amplifier & Horizontal Disch.	6SN7GT	6SN7GT
Vertical Oscillator and Discharge	6SN7GT	6SN7GT
Vertical output	6K6GT	6K6GT
Horizontal Sync. Discriminator	6AL5	6AL5
Horizontal Oscillator	6K6GT	6K6GT
Horizontal Oscillator Control	6AC7	6AC7
Horizontal Sweep Output	6BG6G	6BG6G
Horizontal Reaction Scanning	5V4G	6W4GT
High Voltage Rectifier	1B3/8016	1B3/8016
High Voltage Rectifier	1B3/8016	--------
Power supply Rectifier (High Voltage)	5U4G	5U4G
Power supply Rectifier (low voltage)	5Y3GT	5Y3GT
Picture Tube	16AP4	16AP4
Total	31	29

OPERATING CONTROLS (FRONT PANEL)

Channel Selector Fine Tuning	Dual Control Knobs
Sound Volume and on-off Switch	Single Control Knob
Tone	Single Control Knob
Frame Lock (Vertical Hold)	Single Control Knob
Brightness	Single Control Knob
Picture Control (Contrast)	Single Control Knob

NON OPERATING CONTROLS (Not including R-F and I-F adjustments)

		Model 77	Model 55-56
Horizontal Centering	rear chassis adjustment	X	
Vertical centering	rear chassis adjustment	X	X
Width (In high voltage shield)	rear chassis screwdriver adjustment	X	X
Height	rear chassis adjustment	X	X
Horizontal Linearity (Top of Chassis)	Top chassis screwdriver adjustment	X	X
Vertical Linearity	rear chassis adjustment	X	X
Horizontal Drive	rear chassis adjustment	X	
Horizontal Hold	top chassis adjustment	X	X
Horizontal Oscillator Phase	under chassis-screwdriver adjustment	X	X

		Model 77	Model 55-56
Horizontal Peaking	rear chassis adjustment	X	X
Focus	rear chassis adjustment	X	X
Horizontal Balance	rear chassis adjustment	X	
Phono television switch	rear chassis control	X	X

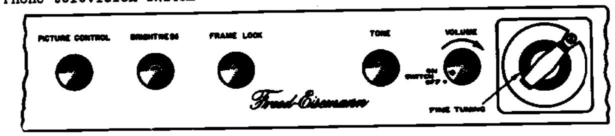

FIGURE 1

OPERATING INSTRUCTIONS

1. Turn the On-Off Switch to the "On" position (a click will be heard) and advance to mid-point in the rotation to reach an audible sound level.
2. Set the Brightness and picture Controls in the extreme counter-clockwise position. Allow 30 seconds for the set to heat up.
3. Set channel Selector Switch at the proper channel number for a desired station. (Check with television program listings in newspaper to be sure the station is on the air.)
4. Turn brightness Control in a clockwise position slowly until the picture tube just begins to glow and light up. Then turn the brightness Control in the opposite direction until there is the barest sign of light on the picture tube.
5. Turn Picture Control slowly in a clockwise direction to give the most pleasing picture.
6. If diagonal white retrace lines persist, reduce brightness until they are just no longer visible (by turning Brightness Control very slowly in a counter-clockwise direction).
7. Adjust the Fine Tuning Control for best sound quality.
8. Adjust Volume and Tone Control as desired.

NOTE: If picture "slips" during the initial tuning, restore its stability by turning Frame Lock in a counter Clock-wise direction if picture is slipping downward; in a clockwise direction if the picture is slipping upward. The Frame Lock should be rotated slowly and carefully

NOTE: An optional method of tuning which provides perfect brightness adjustment: turn picture control to mid-point in rotation and bring up brightness until picture is visible. Then Frame Lock should be turned very slowly until the picture moves down to reveal the area between the picture frames while maintaining its stability. The Brightness Control should be re-adjusted to the point where the area between the frames turns a solid black. The frame lock should be carefully re-adjusted to restore the picture properly within the viewing area.

9. Channel Selector can be turned to any desired station. Under normal conditions, the Brightness and Picture controls will not have to be re-adjusted.
10. After the receiver has been in operation for some time, it may be necessary to re-adjust the Fine Tuning Control for optimum sound quality.

NOTE: When the set is tuned on again after a period of idleness, it will be unnecessary to make any re-adjustments if the controls have not been changed in the interim.

TO USE A RECORD PLAYER WITH THE RECEIVER

If you have a separate record player (either 78 rpm., 33-1/3 rpm., or 45 rpm.) which is equipped with a standard single prong jack plug, it can be used with your television receiver.

1. Turn the phonograph switch on the rear of the channis from the "TV" to the "Phono" position. (Figure 8,9)
2. Plug the line cord of your record player into an electrical wall receptical and the single-prong jack into the phonograph input socket (marked "Phono") located directly below the phonograph switch. (Figure 8, 9)
3. Start the record player with the starting mechanism on the player.
4. Adjust the Volume Control and Tone Control as desired.

INSTALLATION INSTRUCTIONS

A - RECEIVER LOCATION

In recommending a location for placing receiver, the following factors should be taken into consideration.

Greatest Viewing Comfort
Accessibility for service
Length of antenna lead in wire
Availibility of A.C. outlets
Customer's convenience
Possible interference from other equipment
A minimum of direct light should fall on the viewing screen

The receiver should be kept away from wall to provide adequate ventilation. Antenna lead-in wire should be long enough to permit movement of set for cleaning purposes.

B- ANTENNA

The installation of a television antenna is of the utmost importance. The finest instrument is not capable of improving on the signal presented by its antenna. Your customer's satisfaction will depend entirely on the skill with which you erect and adjust the antenna installation.

It is a good practice in many cases to make a pre-installation survey of the reception conditions in a specific area, and to determine what special equipment may be necessary. This will avoid a great deal of added expense and trouble at the time the actual installation is made.

Freed Eisemann Models 77, 55 & 56 television receivers are designed to receive all 12 channels and operate from a 300 ohm balanced system. Under special conditions it may be necessary to install two or more antennae in order to obtain good reception from non-centrally located transmitters.

Depending on location, the following types are recommended:

STRONG SIGNAL AREA

Outdoor Antenna

1. Folded dipole with reflector for low band plus folded dipole with reflector for high band.
2. "Conical Antenna" as manufactured by Telrex, Inc., New Jersey (type 2X-TV) The firm is located in Asbury Park. A Uni-directional, high-gain Conical "V" beam covering all channels. Good for distances up to 50 miles.

Window or Indoor Installation

1. Adjustable V-type table antenna.
2. The "Superex", as manufactured by Telrex, Inc., Asbury Park, N.J. An inconspicuous, inexpensive TV antenna designed to mount on window or wall in metropolitan areas of high signal strength.

FRINGE AREA RECEPTION

1. The Telrex 4X-TV. A uni-directional, hi-gain, stacked Conical "V" Beam. This consists of two hi-gain Conical "V" Bays stacked for additional gain on all frequencies. Presents quarter wave stacking on channel 2, and full wave stacking on channel 13. All signal voltages are additive and in phase. Ideal for long distance.

2. The Telrex 8X-TV. A Uni-directional all channel arrangement consisting of four stacked hi-gain Conical "V" Bays. Ideal for commercial installations or extreme long distances. If the 8X-TV does not produce a usable signal, TV reception is impractical or impossible.

The following points should be closely observed with any type of antenna if clear pictures are to be obtained.

a. The antenna should be placed as high as possible and in line of sight of the transmitting station.
b. The antenna should be aimed correctly at the transmitting station.
c. It is most important that the antenna be correctly oriented for a minimum of ghost signals.
d. Outdoor antenna should be mechanically secure and properly guided to prevent variations in signal.
e. All electrical connections should be soldered.
f. Mast should be grounded and lightning arrestor used on lead-in.

C- TRANSMISSION LINES

Freed-Eisemann television receivers are intended for use with 300 ohm balanced transmission line. This line must be held away from any walls, metal or the antenna mast by means of approved stand-off insulators. The line should be twisted about one turn each foot throughout its length to cancel out direct signal and/or noise pick-up by the transmission line. The transmission line should be firmly anchored to prevent change in position during windy weather.

D - REFLECTIONS

The appearance of multiple images on the television screen slightly displaced from one another are known as ghost multipath images, or reflections. This condition is caused by the arrival of one or more signals at the antenna terminals, which are slightly out of time phase with one another.

Signals eminating from the transmitting antenna are propagated in a radial direction. The shortest and most direct path of the radiated signal would be a straight line between transmitting antenna and receiving antenna. The radiated signal may also arrive at the receiver by an indirect path as in the case of signals being reflected from the side of a building or mountain. The reflected wave traveling over a longer path will arrive at the receiving antenna sometime later than the original signal. In such instances, the receiver reproduces the original picture plus the picture due to the reflected signal, displaced by an amount proportional to the time difference between the two signals.

The problem of ghost elimination due to multipath reception is most pronounced in metropolitan areas. It can be eliminated or its effect reduced by the use of one or more of the following methods.

1. Orientation of antenna or relocation on the roof.
2. The use of a separate antenna for each station.
3. The use of a highly directive antenna to permit reception from very narrow angle.

E - INTERFERENCE

REMEDIES FOR INTER-CHANNEL AND FM INTERFERENCE

Four methods are available for the reduction of interchannel interference- Traps (double conversion interference), Stubs (for double conversion or second harmonic conversion interference), Removal of R-F bias (for double or second-harmonic conversions) and reorientation of the antenna (for double or second harmonic conversion). Use as many of these methods as necessary to eliminate the interference.

Interference has been encountered between stations operating on channels 5 and 7 and between stations operating on channels 6 and 10. The interference is obtained as follows: Assume that two television stations in a city are transmitting on channels 6 and 10. When the receiver is operated on channel 6, the receiver oscillator is at 109 mc. A small amount of the oscillator voltage appears on the receiver R-F amplifier grid. This beat is within the range of the picture channel of the signal from channel 6, is fed into the converter and shows up as interference on the channel 6 picture. Similar interference is obtained between channesl 5 and 7 when the receiver is tuned to channel 5.

The trap in the front end of our input tuner has been designed so that it will ground the R-F amplifier grid for any frequency between 92 and 136 mc. This trap which reduces the oscillator voltage on the R-F amplifier grid will provide interference rejections of from 5 to 100 times depending on the frequency to be rejected, the signal strength of the two stations present at the receiver antenna terminals and other factors. Electrically the trap consists of two series resonant circuits connected between each grid and ground. Such a circuit is resonant from each grid and ground, and from grid to grid, and will provide rejection against balanced or unbalanced signal inputs.

This trap may alternately be employed to provide rejection of FM interference on channel 2, or interference from aircraft communication and beacon equipment on the images of channel 2, 3, 4, 5, and 6. They may also be used to prevent oscillator radiation from a receiver operating on channel 6 from interfering with a nearby receiver operating on channel 3.

TO ADJUST THE TRAP IN THE FIELD, tune in the station on which the interference is observed. Tune the cores for maximum rejection of interference in the picture. Keep the stud extensions of the cores approximately the same by visual inspection. If this does not completely eliminate the interference, turn one core one half turn clockwise and readjust L82 for minimum interference in the picture. If this adjustment reduced the interference still further, continue until the greatest rejection is obtained. If, however, the interference becomes worse, then turn on counter-clockwise one half turn and readjust the other. Continue until maximum rejection is obtained.

In making the above adjustments, several precautions must be observed. For the case of channel 10 or 6, when the interference is light or when the trap has been adjusted so that the interference has been almost completely eliminated, the interference is somewhat dependent upon the fine tuning adjustment. The interference is most noticeable when the fine tuning adjustment is such as to cause the beat to appear as vertical bars in the picture. When the bars are at a considerable angle across the picture, the interference is least noticeable. It is therefore necessary when making trap adjustments while observing the picture to adjust the fine tuning control so that the interference bars are vertical in the picture. If this is not done, and the trap is adjusted with the bars at a considerable angle, the interference will reappear when the fine tuning is changed and the bars line up vertically. The adjustment of the trap may pull the oscillator slightly and will require that the fine tuning control be reset to keep the bars vertical while the trap is being adjusted. This variation of the fine tuning control is very slight and occurs well within the tolerance of the correct setting for clear sound.

In the case of channel 10 on 6, interference, if channel 10 is on the air and six is off, the channel 10 picture will appear on 6. If the trap is adjusted for minimum channel 10 picture on 6 with the picture control in the maximum clockwise position, it may be found that the picture will reappear as the picture control is turned counter-clockwise unless the R-F amplifier grid bias has been removed. In other words, the proper adjustment of the trap is dependent on the setting of the picture control unless the R-F bias is removed as described later.

Since the channel 7 on 5 interference is caused by the channel 7 sound carrier the channel 5 picture suffers from an FM type of interference. In this case, the interference is somewhat less subject to fine tuning variations but is still subject to the picture control setting as above.

WHEN A RECEIVER WITH A TRAP IS ALIGNED IN THE SHOP, the antenna trap should be adjusted to reject the type of interference encountered at the customers home. It can be adjusted by actual observation of the interfering condition or by rejection of a signal fed in from a signal generator. Two methods of adjustment are possible if a signal generator is employed. Select the method and the frequency to suit the test equipment available and the channel on which interference is obtained. Method 1 is the most direct, but is subject to difficulty if the adjustment is made in a location where the signal from the station (5 or 6 as the case may be) is on and very strong at the time the adjustment is made. Method 2 may also be subject to difficulty if a very strong signal is received on the channel to which the receiver channel switch is set. Between the two methods, however, one method will undoubtably be workable.

METHOD 1 FOR CHANNEL 6-10 INTERFERENCE. Switch the receiver to channel 6 and tune the receiver oscillator to 109 mc. by frequency meter or by tuning in the channel 6 station. Connect the "VoltOhmyst" to the pix detector and set it on the 3 volt scale. Connect the signal generator to the receiver antenna terminals and feed in a channel 10 picture carrier frequency signal (193.25). Set the picture control for the maximum gain possible without overloading the receiver. Adjust traps for minimum reading on the "VoltOhmyst" keeping both core stud extensions about the same by visual inspection. For final touches, adjust one core one half turn clockwise and readjust the other for maximum rejection. Repeat as described above for maximum rejection.

METHOD 2 FOR CHANNEL 6-10 INTERFERENCE. With the same setup as described in method 1 switch the receiver to channel 3 and tune the receiver oscillator to 87 mc. Feed in a signal of 109 mc. from the signal generator and adjust the trap as before for minimum reading on the "VoltOhmyst".

METHOD 1 FOR CHANNEL 5-7 INTERFERENCE. With the same setup as above, set the receiver on channel 5 and tune the receiver oscillator to 103 mc. Feed in a channel 7 sound carrier frequency signal (179.75 mc.) and adjust the trap as before.

METHOD 2 FOR CHANNEL 5-7 INTERFERENCE. With the same setup as before set the receiver on channel 2 and tune the receiver oscillator to 81 mc. Feed in a 103 mc. signal from the generator and adjust trap as before.

METHOD FOR FM IMAGE INTERFERENCE. With the same setup as above, switch the receiver to channel 2 and tune the receiver oscillator to 81 mc. Feed in a signal of the frequency of the interfering FM station and adjust the trap as before.

In case of severe interference, it may be necessary to retouch these adjustments when the receiver is installed in the customers home.

When a receiver with an antenna trap is aligned in the shop, it may be necessary to detune the trap by screwing the cores all the way counter-clockwise to prevent the trap from adversely affecting the channel 6 response shape. After the receiver has been completely aligned, the trap should then be retuned.

REMOVAL OF R-F BIAS

Basically this change is to remove the bias from the R-F amplifier and permit it to operate at maximum gain. This condition also results in minimum conversion on the r-f amplifier due to the fact that the tube is operating on the most linear portion of its grid characteristics. Double conversion interferences, 10 on 6, 7 on 5 or FM and 7 on 5 are thereby reduced. At the same time, maximum r-f gain and consequent high-level direct signal input to the converter stage result in maximum supression of oscillator harmonic conversions such as 10 on 3, 13 on 4, etc.

The above mentioned change is performed by unsoldering the green lead coming from the r-f unit and resoldering the lead to ground as shown in figure 2.

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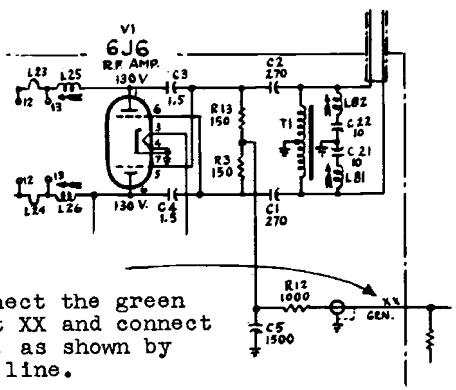
WIRING CHANGE TO REMOVE R-F AMPLIFIER BIAS

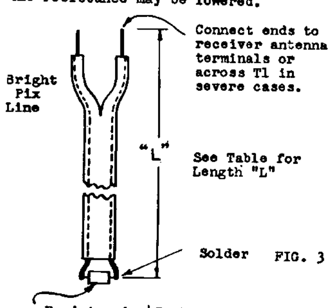
FIGURE 2



Disconnect the green lead at XX and connect to Gnd. as shown by dotted line.

ADDITIONAL TRAP. A stub may be connected across the transmission line to reduce the strength of the interfering signal. Care should be taken, however, that the stub does not upset the line and cause reflections or picture degradation on any channel. Figure 3 shows a practical stub which will provide approximately a 2.5 to 1 reduction of the interfering signal. If this stub is added to a receiver employing an antenna trap, it will be necessary to retune the trap.

The table of Figure 3 gives the length of a half-wave stub for each channel. The length given is sufficiently accurate so that resistor-terminated stubs may be made up in the shop for installation in the field. If more attenuation is desired than is provided by the stub as shown, the value of the resistance may be lowered.



Channel To Be Attenuated	Length "L" in Inches
2 Pix	88-1/2"
3 Pix	80"
4 Pix	72-7/8"
5 Pix	63-1/2"
6 Pix	58-7/8"
7 Snd	27-1/4"
8 Pix	27"
9 Pix	26-1/4"
10 Pix	25-3/8"
11 Pix	24-5/8"
12 Pix	23-7/8"
13 Pix	23-1/4"

FIG. 3 TRANSMISSION LINE STUB FOR ATTENUATING SPECIFIC SIGNALS

Resistor is 47 ohms composition type to give 2.5 to 1 reduction. Smaller value resistor will greater attenuation. With end shorted maximum attenuation of 8 to 1 on high channels can be obtained.

If still more attenuation is desired in order to reduce interference, the end of the stub can be shorted. However, the length of the shorted stub becomes extremely critical and it will be necessary to cut the line in the field. The stub should be cut approximately one inch longer than shown then pared down in 1/8 inch increments. The correct length can be quickly determined by observing the picture while cutting into the line with a pair of diagonals. The cut should be deep enough to contact both wires in the line but not deep enough to cut the line in two.

Since the sharpness of the <u>shorted stub</u> causes degradation of the picture on the channel for which it was cut, it may be necessary to provide a switch to disconnect the stub when viewing the stubbed channel.

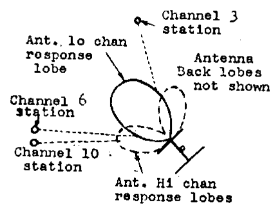
The location of the stubs, especially the shorted stub, becomes critical. The stub should be kept away from the chassis, the metal back of the cabinet, or the transmission lines. To firmly fix the location of the stub it should be tacked to the inside of the cabinet with short tacks.

ANTENNA ORIENTATION

In certain cases antenna orientation is extremely important in the suppression on interchannel interference. In some instances, the interference cannot be suppressed by any means unless the antenna orientation is correct. Fundamentally this orientation is a matter of obtaining a favorable ratio of signal strengths from the stations involved. For instance, if the signal from channel 10 is much greater than the channel 6 signal, the 10 on 6 interference may be excessive and practically incurable. In many instances considerable control of relative signal strength can be obtained by antenna orientation.

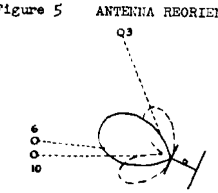
In some instances where a high frequency channel is interfering with a low channel such as 10 on 6, advantage can be taken of the difference in the antenna pattern for the two channels. Figure 3 shows a typical installation which is conducive to excessive 10 on 6 interference. Figure 4 shows a reorientation to minimize 10 on 6 interference. In case it becomes necessary to install a separate antenna for channel 3, it should be installed as shown in Figure 5 in order to prevent channel 10-3 interference. A switch should be provided at the receiver to permit the receiver to be switched from one antenna to the other.

FIGURE 4 ANTENNA ORIENTATION CONDUCIVE TO INTERCHANNEL INTERFERENCE



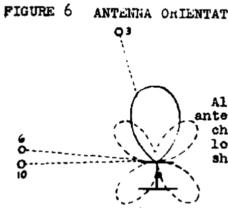
The antenna orientation shown is for a compromise for equal signal strength from channel 6 and 3. As a result both channel 6 and 3 signals arrive considerably off the peak of the antenna low-channel response lobe and are correspondingly attenuated. Unfortunately the peak of the antenna high-channel response lobe points in the direction of channel 10 station thus providing a stronger signal at the receiver on channel 10 than from either channel 6 or channel 3.

Figure 5 ANTENNA REORIENTED TO REDUCE 10 ON 6 INTERFERENCE



The illustration shows the antenna reoriented by turning it more toward the channel 6 station thus increasing the channel 6 signal. At the same time the antenna high-channel lobe is moved off the direction of the channel 10 station thus reducing the channel 10 signal. The channel 3 signal is also reduced, but in many instances this will cause no difficulty.

FIGURE 6 ANTENNA ORIENTATION TO REDUCE 10 ON 3 INTERFERENCE



If in the above reorientation the channel 3 signal became too weak, or if channel 10 on 3 interference appeared, it may be necessary to install a separate antenna for channel 3. The illustration shows the antenna oriented for minimum channel 10 signal by turning its end towards the channel 10 station. A switch should be provided at the set to swtich the receiver from one antenna to the other.

The above case was used to show the possibilities of antenna orientation in the cure of interchannel interference. Each field case will undoubtedly exhibit individual problems. However, Figures 4 and 5 illustrate a method of approach to the solution. Of course the reflection problem must not be forgotten when making antenna reorientations.

INSTALLATION ADJUSTMENTS - MODEL 77 ONLY

The Freed Eisemann Television Receiver is shipped complete with Kinescope tube pretested and ready for operation. It is advisable to check adjustments before setting up in customer's home. The adjustments should be carried out in the following order, using a test pattern only.

1. <u>Ion Trap Magnet Adjustment</u>

The ion trap rear magnet poles should be approximately over the ion trap flags of the Kinescope. Starting in this position, adjust the magnet by moving it slightly back or forward at the same time rotating it slightly to obtain the brightest raster on the screen. Reduce the brightness control until the raster is barely visible. Adjust the focus control for clearest indication and readjust the ion trap for maximum brightness. The final adjustment should be made with the brightness control at the maximum position at which good line focus can be maintained.

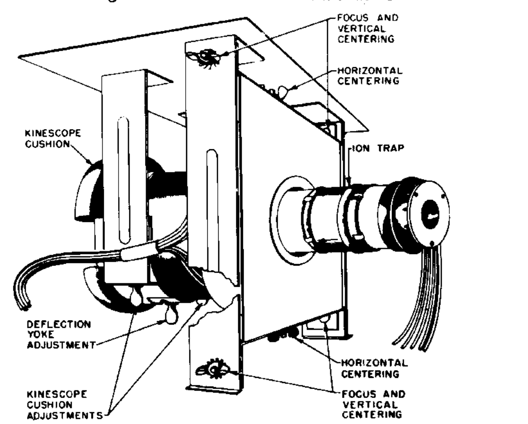


FIGURE 7 - Yoke and Focus Adjustments

2. <u>Width and Horizontal Linearity Adjustments.</u>

The setting of the Horizontal Drive is extremely important since it controls the horizontal linearity of the picture and regulates the high voltage.

The correct setting of the Horizontal Drive involves adjustment of the Horizontal Peaking control and is a simple operation but should be carefully checked. Too little drive will allow the 6BG6 tube to draw too much current and so shorten its life.

Turn the Horizontal Drive control in a clockwise direction until one or two white vertical lines appear on the left hand side of the picture.

Adjust the Horizontal Peaking control as you would a tuning control so that the vertical white lines are reduced to a minimum.

Reduce Horizontal Drive by turning carefully in a counter-clockwise direction until vertical white lines just disappear.

These adjustments provide the correct operating conditions for the 6BG6 tube and for maximum high voltage.

3. <u>Focus Coil Adjustments</u> (See Figure 7)

Loosen wing nuts on Focus Coil saddle, and center focus coil about neck of tube. Check vertical and horizontal positioning controls for setting at mid point of travel. Readjust focus coil to properly center raster and prevent shadows on the screen; maintaining at the same time the maximum possible distance between focus coil and deflection yoke within the limits of the above settings. Adjust focus control for best line definition at normal brightness.

WARNING:

WHEN CARRYING OUT THIS ADJUSTMENT, EXTREME CARE SHOULD BE EXERCISED SO THAT NO ABNORMAL PRESSURE IS EXERTED ON THE NECK OF THE PICTURE TUBE.

4. <u>Deflection Yoke Adjustment</u> (See Fig. 7)

Loosen deflection yoke wing screw, rotate deflection yoke until lines of raster are horizontal in picture mask.

5. <u>Vertical Height and Linearity Adjustments</u> (See Fig. 8)

Adjust vertical height and linearity controls, until picture is vertically symmetrical from top to bottom and fills mask (10-1/4"). Adjustment of either control will require a readjustment of the other.

6. <u>Final Focus Adjustments</u> (See Fig. 8)

Tune in pattern. Adjust focus control for maximum definition in test pattern wedges.

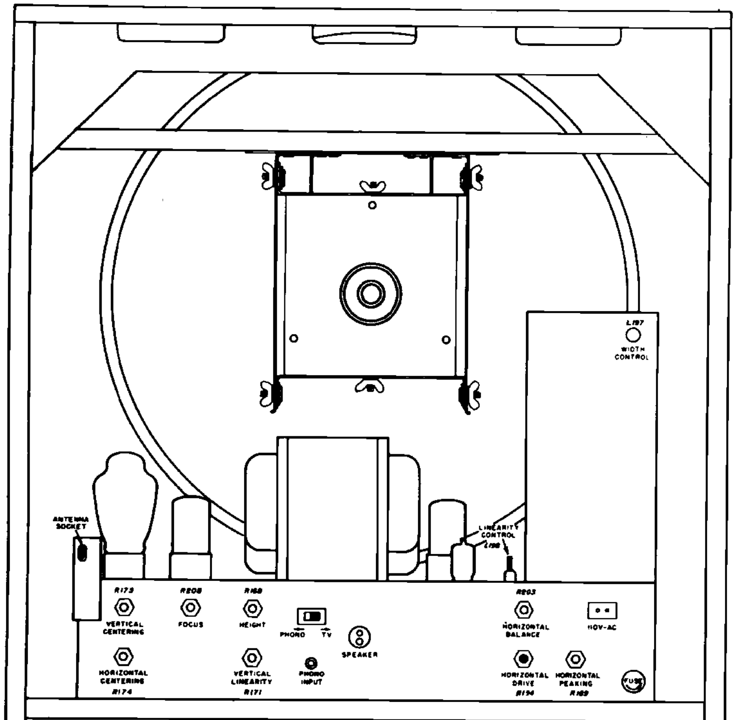


FIGURE 8-REAR CHASSIS ADJUSTMENTS, MODEL 77

7. Check of Horizontal Sync. Alignment (See Fig. 10)

Tune in television station. Set picture control so picture is barely visible. Receiver should remain in horizontal sync. Repeat check for all stations. If receiver passes above check, horizontal oscillator is properly aligned. If receiver fails to pass above check, turn horizontal frequency adjustment on top rear of chassis until picture falls into sync. Repeat above checks. If receiver fails to lock properly or locks with black vertical bar in picture, refer to horizontal phase adjustment.

8. Horizontal Phase Adjustment (See Fig. 11)

This adjustment is not necessary if receiver passed horizontal sync. check.

Reduce horizontal size until both edges of raster are clearly visible on the screen.

Turn up brightness control and reduce contrast so that normally blanked borders of raster are clearly visible. Readjust Phase Control (under chassis, rear) so that normally blanked borders are equal on both sides.

9. Horizontal Balance (See Fig. 8)

The setting for horizontal balance, which is in effect, a horizontal linearity adjustment, will be correct when the test pattern is centered on the tube face horizontally.

10. Final Inspection

Check all thumb screws on yoke and focus adjustments to see that they are tight. Replace back.

INSTALLATION ADJUSTMENTS (MODEL 55-56)

(Use Test Pattern Only)

1. Ion Trap Magnet Adjustment (See Fig. 7)

The ion trap rear magnet poles should be approximately over the ion trap flags of the Kinescope. Starting in this position adjust the magnet by moving it slightly back or forward at the same time rotating it slightly to obtain the brightest raster on the screen. Reduce brightness control until the raster is barely visible. Adjust the focus control for clearest indication and readjust the ion trap for maximum brightness. The final adjustment should be made with the brightness control at the maximum position at which good line focus can be maintained.

2. Width and Horizontal Linearity Adjustments

Adjust the width control (L 213) on rear chassis until the picture just fills the mask horizontally (13-3/4 inches). Adjust the horizontal linearity control (L 214) until the test pattern is symmetrical left to right.

3. Focus Coil Adjustments (See Fig. 7.)

Loosen wing nuts on focus coil saddle, and center Focus coil about neck of tube. Check vertical positioning control for centering at mid point of travel. Readjust focus coil to properly center raster and prevent shadows on the screen, maintaining at the same time the maximum possible distance between focus coil and deflection yoke within the limits of the above settings. Adjust focus control for best line definition at maximum brightness.

WARNING!

WHEN CARRYING OUT THIS ADJUSTMENT, EXTREME CARE SHOULD BE EXERCISED SO THAT NO ABNORMAL PRESSURE IS EXERTED ON THE NECK OF THE PICTURE TUBE.

4. Deflection Yoke Adjustment (See Fig. 7)

Loosen deflection yoke wing screw, rotate deflection yoke until lines of raster are horizontal in picture mask.

5. Vertical Height and Linearity Adjustments (See Fig. 9)

Adjust the height control (R 168 on rear apron) until the picture fills the mask (10-1/4"). Adjust vertical linearity (R171 on rear apron) until test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust vertical centering to align the picture with the mask.

6. Final Focus Adjustments (See Fig. 9)

Tune is test pattern. Adjust focus control for maximum definition in test pattern wedges.

7. Check of Horizontal Sync. Alignment (See Fig. 12)

Tune in television station. Set picture control so picture is barely visible. Receiver should remain in horizontal sync. Repeat check for all stations. If receiver passes above check horizontal oscillator is properly aligned. If receiver fails to pass above check, turn horizontal frequency adjustment on top rear of chassis until picture falls into sync. Repeat above checks. If receiver fails to lock properly or locks with black vertical bar in picture refer to horizontal phase adjustment.

8. Horizontal Phase Adjustment (See Fig. 13)

This adjustment is not necessary if receiver passed horizontal sync. check.

Reduce horizontal size until both edges of raster are clearly visible on the screen. Turn up brightness control and reduce contrast so that normally blanked borders of raster are clearly visible. Readjust phase control (Under chassis, rear) so that normally blanked borders are equal on both sides.

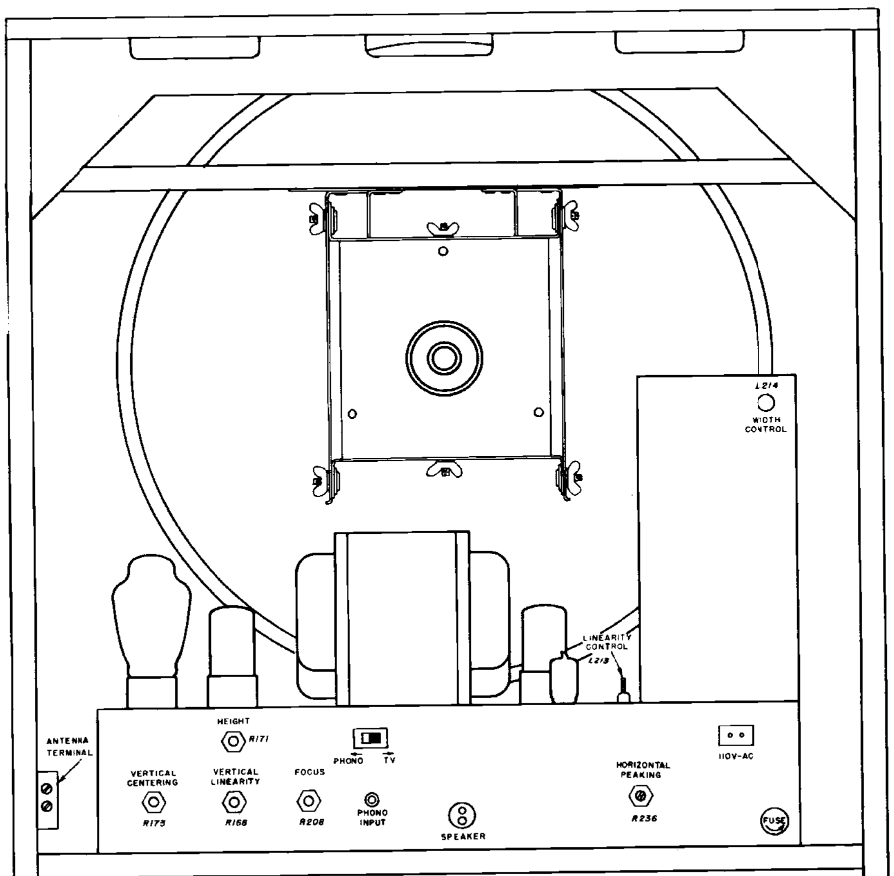


FIGURE 9-REAR CHASSIS ADJUSTMENTS, MODEL 55-56

9. Horizontal Peaking Adjustment (See Fig. 9)

Adjust for minimum fold-over on left hand side of raster.

10. Final Inspection (See Fig. 7)

Check all thumb screws on yoke and focus adjustments to see that they are tight. Replace back.

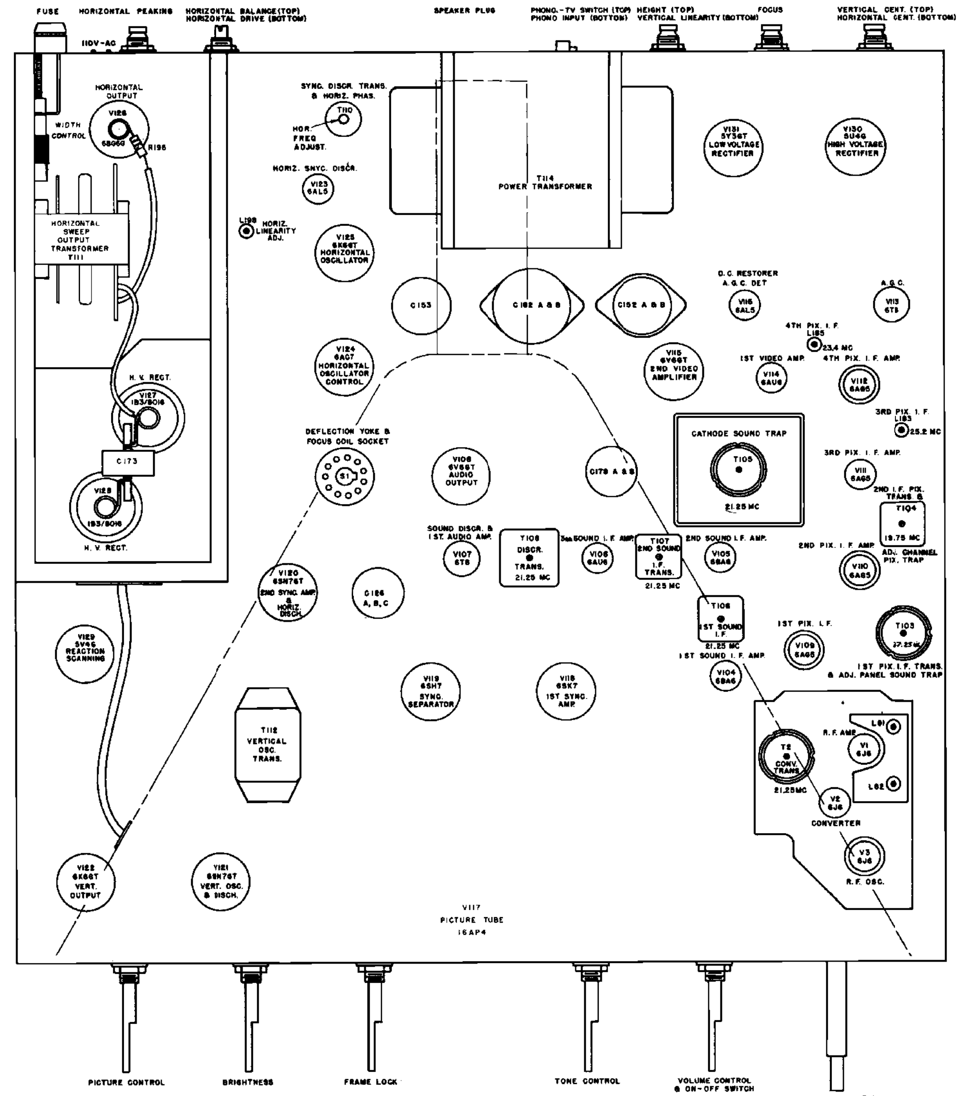


FIGURE 10- CHASSIS TOP VIEW MODEL 77

MODELS 55, 56, Ch. 1620; 77, Ch. 1610

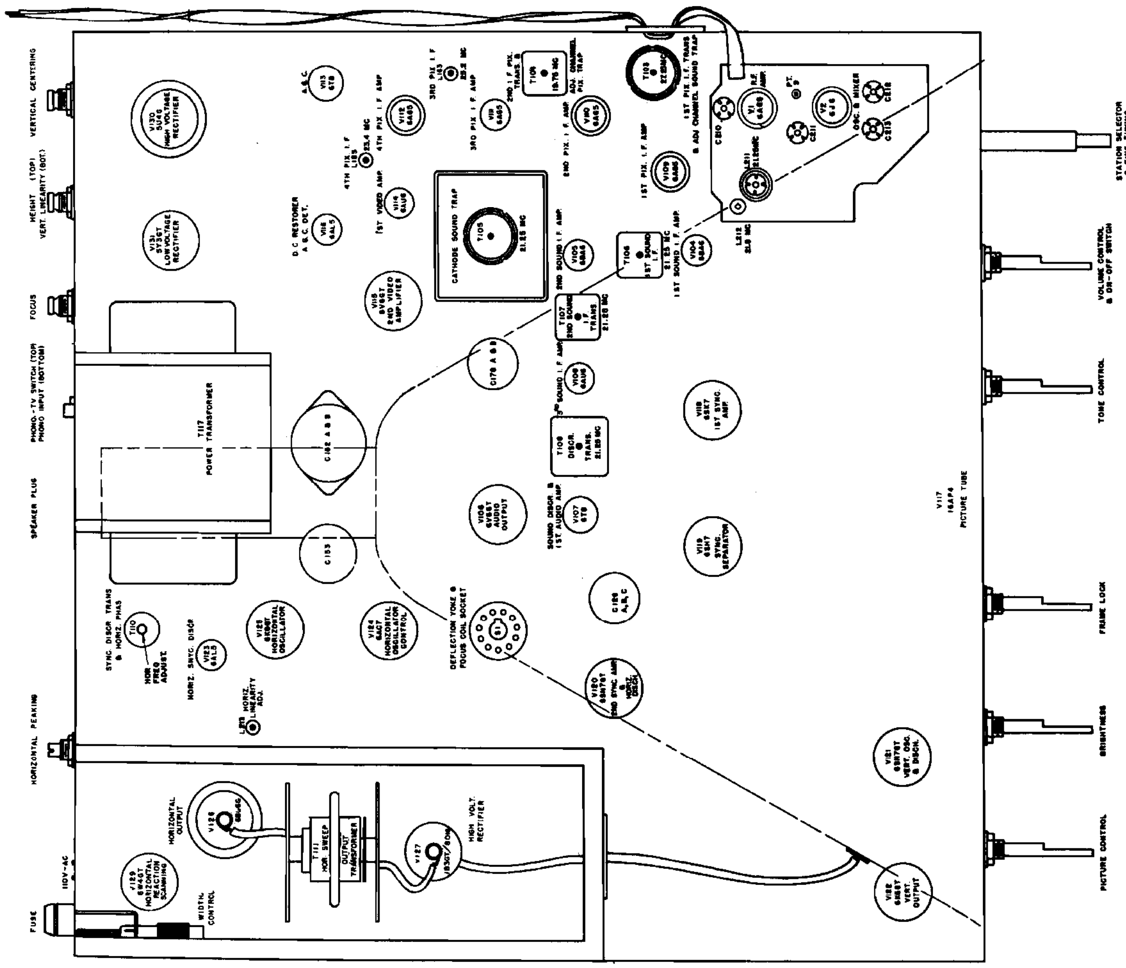


FIGURE 12- CHASSIS TOP VIEW MODEL 55,56

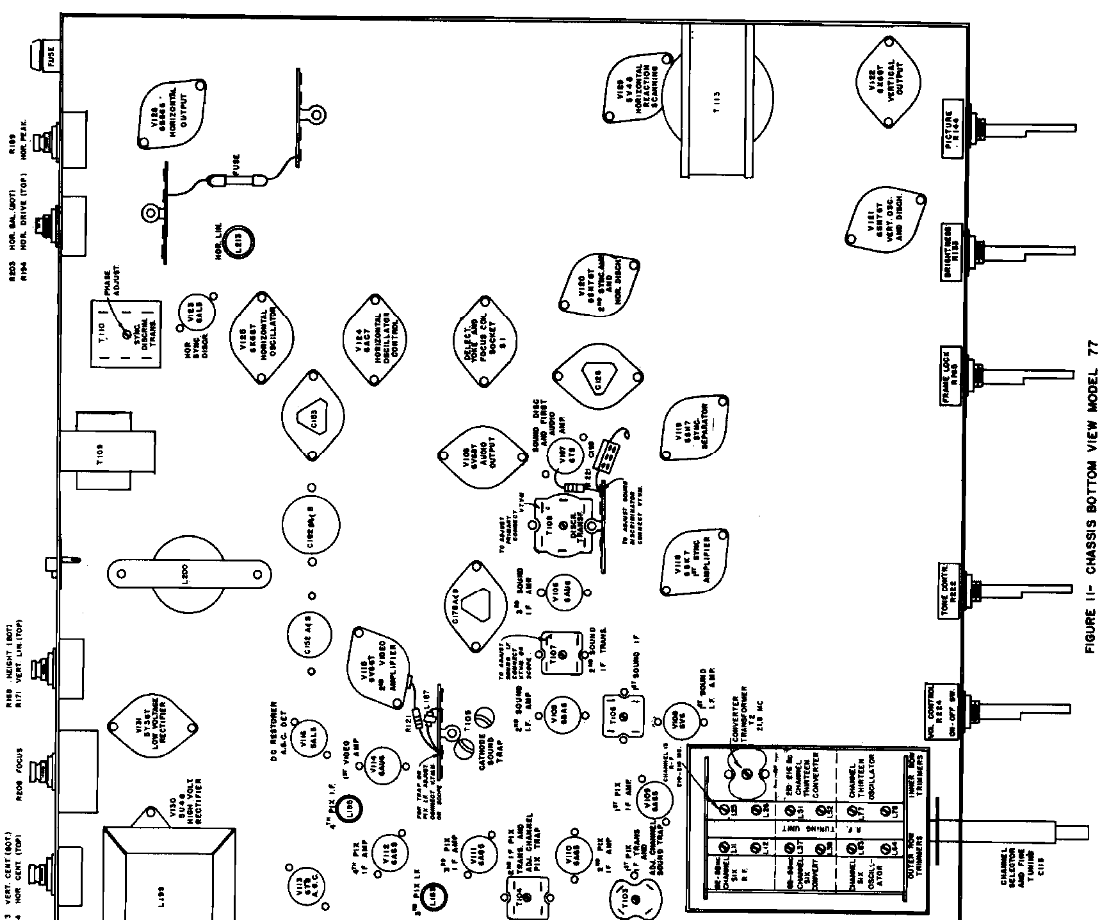


FIGURE 11- CHASSIS BOTTOM VIEW MODEL 77

Section 5 - ALIGNMENT

A. TEST EQUIPMENT

The following is a list of test equipment used in aligning a television receiver.

SIGNAL GENERATOR - 10 MC to 225 MC frequency range (minimum). Low impedance output. Calibrated output attenuator.

MARKER GENERATOR - 10 MC to 30 MC and 45.25 to 215.75 MC frequency ranges. Extreme accuracy or crystal calibrator. Low impedance output. Output attenuator.

SWEEP GENERATOR - 10 MC to 30 MC and 44 MC to 216 MC. (Sweep IF's and channels 2 to 13) frequency range. 300 ohms balanced output. Output attenuator.

VACUUM TUBE VOLTMETER - 3 volt DC, low range desirable.

OSCILLOSCOPE - Essentially flat vertical amplifier frequency response up to at least 100 KC. Calibrator or step attenuator on input of vertical amplifier.

B. ADJUSTMENTS REQUIRED

Normally only the RF oscillator line will require the attention of the service technician. All other circuits are either broad or very stable and hence will seldom require readjustment.

Due to the high frequencies at which the RF oscillator operates, the oscillator tuning adjustment is critical. A tube change will effect the tuning. Tuning can be adjusted for any 6J6 on Channel 13, but it may not then be possible to adjust channels 7, 8, 9, 10, 11, and 12. For a tube to be satisfactory it should be possible to adjust the tuning with the fine tuning control in the middle third of its range. If this cannot be done, select a tube for the oscillator which will match the old one. If the above method does not work, it will be necessary to realign the oscillator coils.

C. ORDER OF ALIGNMENT

When complete receiver alignment is necessary, proceed as outlined below:

a. Sound Discriminator
b. Sound IF Transformers
c. Picture IF Traps
d. Picture IF Transformers
e. R-F and Converter
f. R-F Oscillator
g. Retouch picture IF Transformers

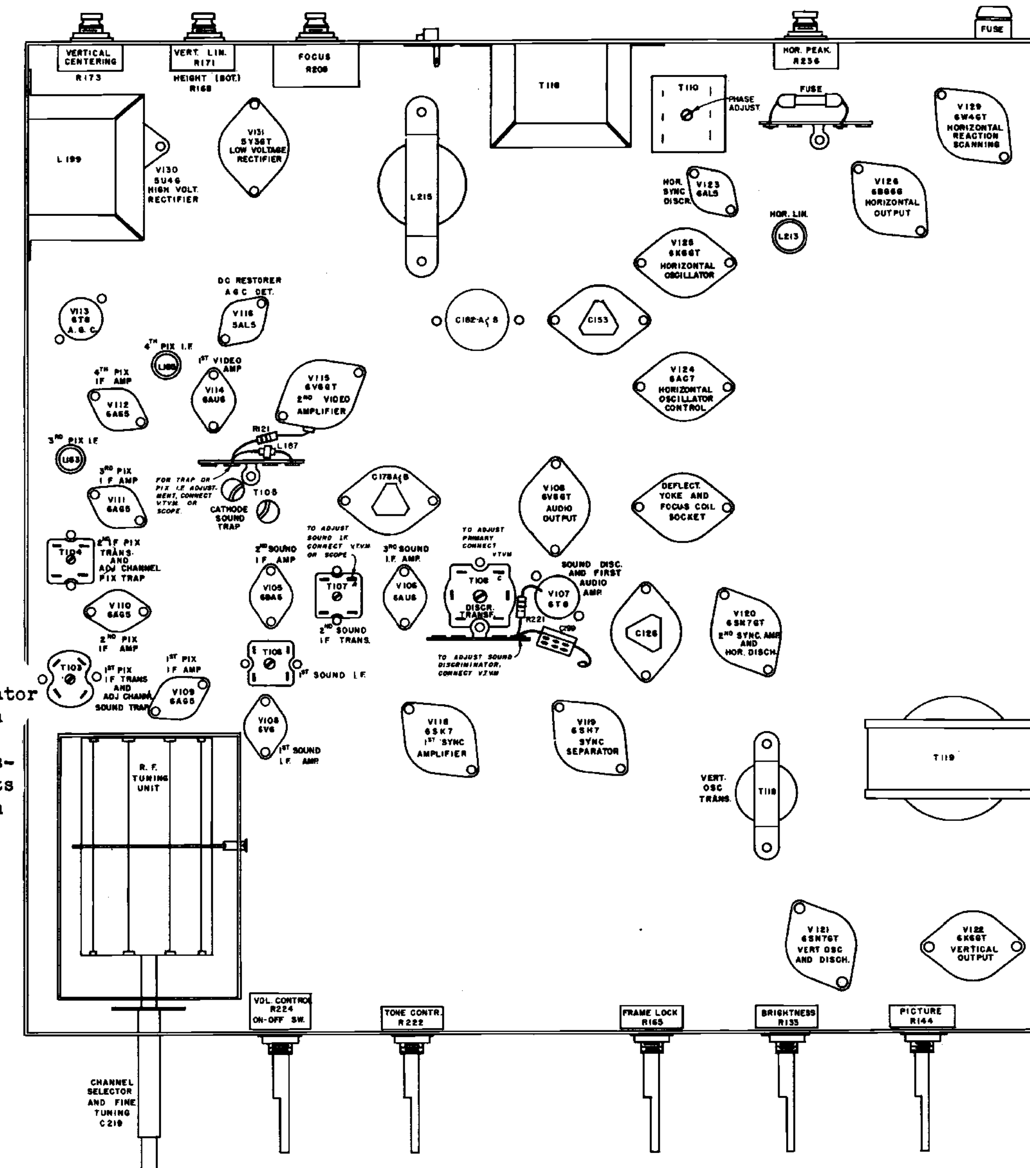


FIGURE 13- CHASSIS BOTTOM VIEW MODEL 55,56

MODELS 55, 56, Ch. 1620; 77, Ch. 1610

IF and Trap Alignment for Models 77, 55 and 56

Alignment adjustment locations are show in Figure 10 and Figure 11 for Model 77, Figure 12 and Figure 13 for Models 55 and 56. Response curves in Figures 14 and 15.

Step	Signal Gen. Freq. MC.	Connect VTVM to	Test Connections and Instructions	Adjust
1.	21.25	One Meg. Ohm resistor in series with probe to junction of R213 & R219 10 Volt scale.	Detune T106 (Sec.) bottom. Signal gen. to V106 pin #1 max. output.	T103 (top) primary for max. output.
2.	21.25	Junction of R221 and C199		T103 (bottom) sec. for zero between max. negative and max. positive voltage.
3.	21.25	Terminal "A" of T107	Signal Generator to Pin #1 V104. Reduce output. Use 4 volt negative as standard output level.	T106 & T107 (top & bottom) for maximum output.
4.			Remove V113 and conn. Bias control to Pin #3 V113. Adjust for 3 volts.	For Bias control refer to Fig. 6
5.	21.25	Junction of L187 & R121 -3 volt scale.	Sig. Generator output max. Connect output to un-grounded shield can on V2.	T105 (top) for minimum.
6.	21.25	Junction of L187 & R121 -3 volt scale.	Sig. Generator output max. Connect output to un-grounded shield can on V2.	T2 (top) for minimum.
7.	27.25	Junction of L187 & R121 -3 volt scale.	Sig. Generator output max. Connect output to un-grounded shield can on V2.	T103 (top) for minimum.
8.	19.75	Junction of L187 & R121 -3 volt scale.	Sig. Generator output max. Connect output to un-grounded shield can on V2.	T104 (top) for minimum.
9.	21.8	Junction of L187 & R121 -3 volt scale.	Reduce output as required.	T2 (bottom) for maximum.
10.	25.3	Junction of L187 & R121 -3 volt scale.	Reduce output as required.	T103 (bottom) for maximum.
11.	22.3	Junction of L187 & R121 -3 volt scale.	Reduce output as required.	T104 (bottom) for maximum.
12.	25.2	Junction of L187 & R121 -3 volt scale.	Reduce output as required.	L183 (top chassis) for maximum.
13.	23.4	Junction of L187 & R121 -3 volt scale.	Reduce output as required.	L185 (top chassis) for maximum.

Note: If T104 (bottom required adjustment in step 11, repeat step 8).

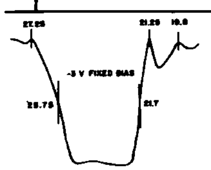


FIGURE 14- VIDEO I-F RESPONSE

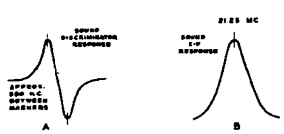


FIGURE 15- SOUND DISCRIMINATOR & I-F RESPONSE

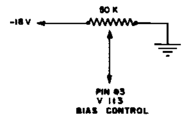


FIGURE 16- BIAS CONTROL

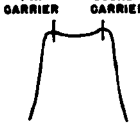


FIGURE 17 R-F RESPONSE

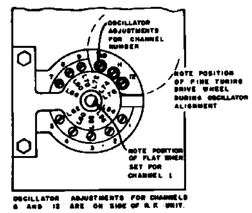


FIGURE 18- R-F OSCILLATOR ADJUSTMENTS

RF and Converter Alignment. (Model 77 only).

Sweep generator to antenna terminal. Marker generator to sweep generator. Adjustment locations show in Figure 11, RF response in Figure 17.

Step	Marker Gen. Freq. (MC)	Sweep Gen. Freq.	Connect Oscilloscope to	Test Connections and Instructions	Adjust
1.	175.25 179.75	Sweeping Channel 7	Through 10,000 ohms to junction of R6 & L60	Gnd. grid of 1st IF V109 with 1000 MMFD. Rec. on Channel 7	L25, L26, L51 & L52 for approx. flat response between markers. Markers above 70%.
2	181.25 185.75	8	"	"	*Check response as above.
3.	187.25 191.75	9	"	"	"
4.	193.25 197.75	10	"	"	"
5.	199.25 203.75	11	"	"	"
6.	205.25 209.75	12	"	"	"
7.	211.25 215.75	13	"	"	"
8.	83.75 87.75	6	"	"	L11, L12, L37, & L38 for response as above.
9.	77.25	5	"	"	*Check to see that response is as above.
10.	67.25 71.75	4	"	"	"
11.	61.25 65.75	3	"	"	"
12.	55.25 59.75	2	"	"	"

*Do not make adjustments unless better reception is desired on a specific high or low band channel. Adjustment on a specific channel can then be made.

High-Frequency Oscillator Alignment. (Model 77 only)

Connect signal generator to antenna terminal. VTVM to junction of R221 and C199. Center fine tuning control on receiver. Zero-center VTVM. Proceed as follows. See Figure 18.

Step	Channel	Generator Frequency (MC)	Adjust
1	13	215.75	**L77 & L78 for zero on meter
2	12	209.75	L76 as above
3	11	203.75	L74 as above
4	10	197.75	L72 as above
5	9	191.75	L70 as above
6	8	185.75	L68 as above
7	7	179.75	L66 as above
8	6	87.75	L63 & L64 as above **
9	5	81.75	L62 as above
10	4	71.75	L60 as above
11	3	65.75	L58 as above
12	2	59.75	L56 as above

Note** These slug adjustment screws should protrude approximately the same distance out of the coil forms.

ALIGNMENT PROCEDURE

Standard TV Tuner - Model 55 and 56 - (See Figures 12 and 13)

IF and Trap Alignment

Connect VTVM in series with 10,000 ohm resistor to junction of L187 and R121 crystal detector output on main chassis. Remove tube shield on 6J6 on tuner. Capacity couple A.M. Signal Generator to 6J6 by slipping tight fitting ungrounded shield over 6J6 and connect generator to ungrounded shield. Set frequency of generator to ungrounded shield. Set frequency of generator to 21.25 MC. Tune L212 for minimum voltage on VTVM. Set generator to 21.8 MC and tune L211 for maximum voltage on VTVM. Use high output on signal generator at 21.25 MC. and low output on 21.8 MC for above alignment procedure.

R.F. and Mixer Alignment

1. Set station selector switch to Channel 12.
2. Connect oscilloscope through 10,000 ohms to test point 9 (wire loop on top of tune - Figure 12).
3. Set bias to 1.5 volts. Set sharp tuning control at approximately midpoint of its tuning range.
4. Feed sweep generator into antenna terminals, sweeping Channel 12.
5. Adjust C210, C211, C212 (Figure 12) for flat top response curve. Check markers on all channels. They should fall in automatically on all channels.

Oscillator Alignment

1. Turn station selector switch to Channel 12.
2. Connect signal generator to one antenna terminal and ground. Set to sound carrier frequency 209.75 MC.
3. Connect vacuum tube voltmeter to DC output of discriminator in main chassis (R221 and C199 - Figure 13).
4. Adjust C213 for zero reading on VTVM between positive and negative peak.
5. Check all channels for zero reading on VTVM. It is usually not necessary to make any further adjustments. If necessary to touch up the oscillator coils, the following procedure is recommended.

Oscillator Re-check (Not usually necessary)

a. Center sharp tuning control.
b. Place a non-metallic screwdriver through opening on front of tuner and adjust coil on Channel 14.
c. This adjustment can be repeated for all channels, or if necessary, on any single channel.

TROUBLE SHOOTING CHART

Symptoms	Check	Remarks
Dead Receiver No sound or picture Raster O.K.	A.C. Power line or line fuse 1. Tubes V_1, V_2 and V131 2. R-F Tuner 3. Picture control circuit	
No sound Weak video (Insufficient contrast)	1. R-F tuner alignment	Oscillator V3 alignment most probable cause
No sound Weak Sound Noisy Sound Intermittent Sound	1. Audio Section tubes (V104 to V108) 2. Audio I-F alignment 3. Discriminator alignment 4. Speaker	
No raster Sound O.K.	1. Tubes V117, V120, V125, V126, V127, V128, V129, V130. 2. Ion trap adjustment. 3. High voltage power supply (V130) 4. 13KV. Power supply V127, V128 5. Horizontal Oscillator V125 6. Horizontal Output V126 7. Reaction Scanning V129 8. Focus coil open 9. Picture tube V117 10. R201 open in H.V. circuit	Failure of horizontal oscillator (V125) or horizontal discharge (V120) will result in loss of drive to horizontal output stage (V126) and the 6BG6 will show color due to excessive plate dissipation.
Intermittent raster Sound O.K.	Check circuits as above in No raster.	Check for arc-over or corona discharge in 13KV power supply. V127, V128
Insufficient Brilliance	Ion trap adjustment Tubes (V117, V127, V128) 13KV power supply (V127, V128)	
Rounded corners on raster Brilliance O.K.	1. Deflection yoke (too far back on picture tube neck) 2. Ion trap adjustment	
Raster not centered	1. position adjustment of focus coil	
Excessive raster size (Too large a picture for the picture tube mask.)	1. Height and width adjustments. (R168, L197) 2. Horizontal width open (L197) 3. 13KV power supply	Low second anode potential increases the deflection sensitivity of picture tube. (V117). Check V127, V128, by substitution
Insufficient raster width	1. Width adjustment (L197) 2. Tubes (V120, V126) 3. Horizontal discharge (V120B) 4. Horizontal output (V126)	
Insufficient raster height	1. Height adjustment (R168) 2. Vertical oscillator (V121) 3. Vertical output (V122)	
Bright Horizontal line. No vertical deflection, no raster	1. Vertical oscillator (V121) 2. Vertical output V122	
Bright Vertical line. No horizontal deflection, no raster	1. T111, T115. Secondary circuit	
Excessive raster brilliance. Brightness control has no effect.	1. Picture tube (V117) 2. Brightness control circuit 3. Negative supply	
Bunching of several trace lines appearing as a white band across raster.	1. Vertical amplifier tube (V122)	Replace tube (V122 and V125) can be switched to correct this difficulty

TROUBLE SHOOTING CHART (Cont'd)

SYMPTOMS	CHECK	REMARKS
Vertical lines or "wrinkles" on left side of raster	1. Spurious oscillations in horizontal output (V126) 2. Deflection yoke 3. Horizontal drive setting	If trouble is "1" replace tube V126. 56mmf. cond. defective
Light and dark vertical bars. Bad horizontal linearity	Damper tube (V129)	Replace tube (V129)
Heavy black horizontal bars covering picture tube screen	1. High voltage power supply (V130) for open filter C182A or B	
No picture. Raster and sound OK.	1. Video Section V109 to V115. 2. Video I-F's (V109 to V112) 3. Video Detector 1N34 4. Video amplifier (V114, V115)	
Intermittent Video sound and raster OK.	Check above tubes and circuits	
Intermittent Video and sound. Raster OK	1. R-F tuner V1, V2, V3 2. Low voltage power supply (V131) 3. Picture control circuit	
Weak Video (Insufficient Contrast) Sound and Raster OK.	1. Video I-F alignment 2. Video I-F's (V109 to V112) 3. Video Detector (1N34) 4. Video amplifier (V114, V115)	
"Snow" in picture background	1. For weak signal input 2. Noisy tubes in RF tuner 3. 13KV. power supply for corona discharge	Weak signal from station. receiver antenna and/or transmission line difficulties.
No vertical sync. Horizontal sync. OK.	1. Integrator network	
No Horizontal sync. Vertical sync. OK.	1. Horizontal sync. discriminator circuit (V123) 2. Horizontal oscillator control circuit (V124)	
No horizontal or vertical sync.	1. D.C. restorer (V116a) 2. Sync. amplifier (V118) 3. Sync. separator (V119)	
Picture jitter	1. Horizontal hold and/or phase adjustment. 2. Check horizontal output, (V126) if regular sections of the picture are displaced. 3. For noisy tube(s) in R-F, video and sweep sections of the receiver.	
Horizontal non-linearity.	1. Horizontal drive control (R194) 2. Horizontal linearity control setting (L198) 3. Horizontal discharge (V120B) 4. Horizontal output. (V126) 5. Reaction scanning (V129)	
Vertical non-linearity	1. Vertical linearity control setting (R170) 2. Vertical oscillator (V121) 3. Vertical output (V122)	

TROUBLE SHOOTING CHART (Cont'd)

Improper focus (best at extreme control position)	1. Focus coil (L192) 2. Focus control circuit 3. For circuit defect causing either excessive or low current drain from power supply.	
Improper focus (control has no effect)	1. Focus coil (L192) 2. Focus control circuit 3. Picture tube (V117)	If "1" check for open shorted turns or incorrect position adjustment. If trouble is "3" picture tube (V117) may be gassy.
Engraved or bass relief effect in picture	1. Video output amplifier (V115) 2. First Video amplifier (V114) 3. Video Detector (1N34) 4. Peaking chokes	Output load and coupling circuit is common source of this difficulty.
Smeared effect in picture (poor low frequency video response)	1. Video detector (1N34) 2. First video amplifier (V114) 3. Video outputamplifier (V115) 4. Peaking chokes (open)	
Poor picture detail (poor definition)	1. R-F and video I-F band pass 2. Video amplifier high frequency response.	
Vertical bars on right side of picture	Horizontal oscillator tube (V125)	
Sound bars in picture	1. Alignment of video I-F sound traps. 2. Alignment of T_2 secondary 3. Oscillator alignment V_3	
Herringbone pattern superimposed on picture.	FM, diathermy or other forms of R-F interference.	
Brown or yellowish brown spot on picture tube screen	Picture tube (V117) by substitution	Burned phosphor on picture tube screen. Replace tube if objectionable.

Replacing Picture Tube 16AP4 (V117)

Remove the defective tube in the following manner.

a. Remove back cover
b. Remove control knobs from chassis
c. Remove four chassis bolts
d. Disconnect speaker and pilot indicator
e. Remove antenna terminals from side of cabinet
f. Slide chassis back and disconnect high voltage lead from picture tube socket and deflection assemble socket,
g. Remove ion trap
h. Remove deflection assembly by taking out two front screws and loosen two rear screws. Slide assembly off tube.

CAUTION DO NOT ALLOW WEIGHT OF ASSEMBLY ON TUBE NECK

1. Remove four screws holding lower half of picture tube rim support, and remove tube.

To install a new picture tube the above procedure should be reversed, Remove plastic ring and plastic shield from defective tube and place on new tube making sure high voltage connector is on side next to high voltage lead and compartment.

Distortion Due to Magnetization of Metal Cone

If a strong magnetic field is brought near the 16AP4 Kinescope, the metal cone can be sufficiently magnetized to cause objectionable distortion in the image. The principal indication of distortion is a kink in the edge of the raster. The most likely cause of cone magnetization is contact of the metal with the frame of a permanent-magnet loudspeaker. Magnetized sections near the middle and small end of the cone produce the most disturbance. The magnetism, however, is usually localized and can readily be detected with a pocket compass.

MODELS 55, 56, Ch. 1620; 77, Ch. 1610

In the event the cone should become magnetized, it can easily be demagnetized by the use of the AC. magnetic field produced by a simple coil. A suitable coil consists of approximately 1250 turns of No. 24 copper wire wound on a diameter of seven inches and protected by an insulating covering. Because this coil takes about 1 ampere at 117 volts and will overheat on continuous duty, it should be used only intermittently. To demagnetize the metal cone, energize the coil and move its flat side over the magnetized area. The coil should not be de-energized until it is moved away from the cone, since the current may not cut off at zero field strength.

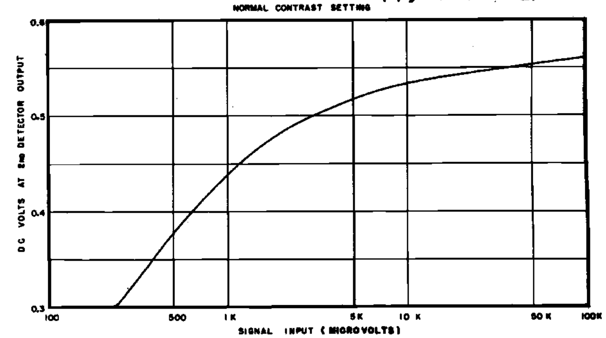


FIGURE 21 - BIAS VERSUS SIGNAL INPUT

TUBE CHART FOR CHT 1620 (MODELS 55 AND 56)

* READINGS TAKEN WITH VACUUM TUBE VOLTMETER. ALL OTHERS AT 20,000 OHMS PER VOLT

TUBE NO	TUBE TYPE	FUNCTION	OPERATING CONDITION	PIN #1		PIN #2		PIN #3		PIN #4		PIN #5		PIN #6		PIN #7		PIN #8		PIN #9	
				RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT
V1	6AG5	RF AMP	PIX MIN																		
			PIX MAX																		
V2	6J6	MIXER AND OSC.	PIX MIN																		
			PIX MAX																		
V104	6BA6	AUDIO IF	PIX MIN	0	0	0	0	1	6.3	0	0	—	130	—	130	100	1.9				
			PIX MAX	0	0	0	0	1	6.3	0	0	—	110	—	110	100	1.6				
V105	6BA6	AUDIO IF	PIX MIN	470 K	0	0	0	1	6.3	0	0	—	135	—	130	100	1.8				
			PIX MAX	470 K	0	0	0	1	6.3	0	0	—	115	—	110	100	1.5				
V106	6AU6	LIMITER	PIX MIN	22 K	.3 *	0	0	0	0	1	6.3	10 K	60	10 K	55	0	0				
			PIX MAX	22 K	.3 *	0	0	0	0	1	6.3	10 K	55	10 K	45	0	0				
V107	6T8	1ST AUDIO DISCRIMINATOR	PIX MIN	100 K	-.5 *	100 K	-.5 *	200 K	0	0	0	1	6.3	—	—	18	0	500 K	-1.7 *	—	115
			PIX MAX	100 K	-.5 *	100 K	-.5 *	200 K	0	0	0	1	6.3	—	—	18	0	500 K	-1.7 *	—	116
V108	6V6	AUDIO OUTPUT	PIX MIN	—	—	1	6.3	—	285	—	295	510 K		—	—	0	0	330	16		
			PIX MAX	—	—	1	6.3	—	285	—	295	510 K		—	—	0	0	330	16		
V109	6AG5	1ST PIX IF	PIX MIN	—	-8 *	39	0 *	0	0	1	6.3	—	142	—	142	39	0 *				
			PIX MAX	—	0 *	39	.5 *	0	0	1	6.3	—	115	—	115	39	.5 *				
V110	6AG5	2ND PIX IF	PIX MIN	—	-8 *	39	0 *	1	6.3	0	0	—	145	—	145	39	0 *				
			PIX MAX	—	0 *	39	.6 *	1	6.3	0	0	—	100	—	100	39	.6 *				
V111	6AG5	3RD PIX IF	PIX MIN	0	0	39	0	1	6.3	0	0	—	145	—	145	39	0				
			PIX MAX	0	0	39	.5	1	6.3	0	0	—	75	—	110	39	.5				
V112	6AG5	4TH PIX IF	PIX MIN	0	0	130	1.5	1	6.3	0	0	—	90	—	135	130	1.5				
			PIX MAX	0	0	130	1.2	1	6.3	0	0	—	75	—	115	130	1.25				
V113	6T8	AGC AMP	PIX MIN	80 K	-105	40 K	-8.3	120 K	-6.4	0	0	1	6.3	190 K	-105	125	-105	600 K	-105	100 K	-41.5
			PIX MAX	80 K	-110	40 K	-2.3	120 K	0	0	0	1	6.3	190 K	-100	200	-100	600 K	-100	100 K	0
V114	6AU6	1ST VIDEO	PIX MIN	470 K	1.7 *	0	0	0	0	1	6.3	—	160	—	145	0	0				
			PIX MAX	470 K	1.7 *	0	0	0	0	1	6.3	—	200	—	125	0	0				
V115	6V6 GT	VIDEO OUTPUT	PIX MIN	—	—	0	0	—	220	—	145	1 MEG	-3.6 *	150	-16	0	0	240	4.25		
			PIX MAX	—	—	0	0	—	235	—	125	1 MEG	-3.6 *	150	-16	0	0	240	3.6		
V116	6AL5	DC RESTORER AGC DET	BRIGHT MIN	80 K	-110	220 K	-105	1	6.3	0	0	1 MEG	-100	0	0	10 K	-110				
			BRIGHT MAX	80 K	-105	220 K	0	1	6.3	0	0	1 MEG	0	0	0	10 K	-105				
V117	16AP4	CRT	PIX MIN																		
			PIX MAX																		
V118	6SK7	SYNC AMP	PIX MIN	0	0	0	0	0	0	1 MEG	-3.4 *	0	0	—	135	1	6.3	—	150		
			PIX MAX	0	0	0	0	0	0	1 MEG	-3.4 *	0	0	—	115	1	6.3	—	199		
V119	6SH7	SYNC SEP	PIX MIN	0	0	0	0	0	0	1 MEG	-4	0	0	—	150	1	6.3	—	140		
			PIX MAX	0	0	0	0	0	0	1 MEG	-15	0	0	—	125	1	6.3	—	125		
V120	6SN7 GT	SYNC AMP HOR DISCH.	PIX MIN	1 MEG	-5 *	—	95	0	0	220 K	-135	—	75	900	-105	1	6.3	*0	0		
			PIX MAX	1 MEG	-2.5 *	—	85	0	0	220 K	-135	—	75	900	-105	1	6.3	0	0		
V121	6SN7 GT	VERT OSC AND DISCH	PIX MIN	1.5 MEG	-300	—	300	1000	-105	—	-300	—	65	1000	-105	1	6.3	0	0		
			PIX MAX	1.5 MEG	-300.	—	300	1000	-105	—	-300	—	65	1000	-105	1	6.3	0	0		
V122	6K6 GT	VERT OUTPUT	PIX MIN	—	-100	0	0	—	180	—	180	—	-100	—	-75	1	6.3	—	-60		
			PIX MAX	—	-100	0	0	—	180	—	180	—	-100	—	-75	1	6.3	—	-60		
V123	6AL5	HOR SYNC DISCRIM.	PIX MIN	1 MEG	-.6 *	1.5 MEG	-8 *	1	6.3	0	0	15	-1.7	0	0	1.5 MEG	-8 *				
			PIX MAX	1 MEG	-.6 *	1.5 MEG	-8 *	1	6.3	0	0	15	-1.7	0	0	1.5 MEG	-8 *				
V124	6AC7	HORIZONTAL CONTROL	PIX MIN	0	0	0	0	0	0	1.5 MEG	-1	10	.05	—	90	1	6.3	—	135		
			PIX MAX	0	0	0	0	0	0	1.5 MEG	-1	10	.05	—	90	1	6.3	—	135		
V125	6K6 GT	HOR OSC	PIX MIN	—	—	0	0	—	190	—	200	51 K	-35	—	0	1	6.3	10	.3		
			PIX MAX	—	—	0	0	—	190	—	200	51 K	-35	—	0	1	6.3	10	.3		
V126	6BG6G	HORIZ OUTPUT	PIX MIN	—	—	1	6.3	1100	-100	1 MEG	-135	1 MEG	-135	900	-105	0	0	—	200		
			PIX MAX	—	—	1	6.3	1100	-100	1 MEG	-135	1 MEG	-135	900	-105	0	0	—	200		
V127	1B3GT 8016	H V RECT	PIX MIN																		
			PIX MAX																		
V129	6W4GT	HORIZ. DAMP.	PIX MIN						430				270				6.3				
			PIX MAX						430				270				6.3				
V130	5U4G	H.V. RECTIFIER	PIX MIN				285				395 AC				395 AC				285		
			PIX MAX				285				395 AC				395 AC				285		
V131	5Y3GT	LOW VOLT RECTIFIER	PIX MIN				145				165 AC				165 AC				145		
			PIX MAX				125				165 AC				165 AC				125		

TUBE CHART FOR CHT 1610 (MODEL 77)

* READINGS TAKEN WITH VACUUM TUBE VOLTMETER. ALL OTHERS AT 20,000 OHMS PER VOLT

TUBE NO	TUBE TYPE	FUNCTION	OPERATING CONDITION	PIN #1		PIN #2		PIN #3		PIN #4		PIN #5		PIN #6		PIN #7		PIN #8		PIN #9	
				RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT	RESIST	VOLT
V1	6J6	R.F. AMP.	PIX MIN																		
			PIX MAX																		
V2	6J6	MIXER	PIX MIN																		
			PIX MAX																		
V3	6J6	OSC	PIX MIN																		
			PIX MAX																		
V104	6BA6	AUDIO I.F.	PIX MIN	0	0	0	0	1	6.3	0	0	—	135	—	135	100	2.2				
			PIX MAX	0	0	0	0	1	6.3	0	0	—	120	—	120	100	2.2				
V105	6BA6	AUDIO I.F.	PIX MIN	470 K	0	0	0	1	6.3	0	0	—	135	—	135	100	2.2				
			PIX MAX	470 K	0	0	0	1	6.3	0	0	—	120	—	120	100	2				
V106	6AU6	LIMITER	PIX MIN	22 K	.75 *	0	0	0	0	1	6.3	10 K	60	10 K	60	0	0				
			PIX MAX	22 K	.75 *	0	0	0	0	1	6.3	10 K	55	10 K	55	0	0				
V107	6T8	1ST AUDIO DISCRIMINATOR	PIX MIN	100 K	-.5 *	100 K	-.75 *	200 K	.1 *	0	0	1	6.3	0	0	18	0	500 K	-2.8 *	—	160
			PIX MAX	100 K	-.6 *	100 K	-.75 *	200 K	.1 *	0	0	1	6.3	0	0	18	0	500 K	-2.8 *	—	160
V108	6V6	AUDIO OUTPUT	PIX MIN	—	—	1	6.3	—	270	—	280	100 K	-12 *	—	—	0	0	0	0		
			PIX MAX	—	—	1	6.3	—	270	—	280	100 K	-12 *	—	—	0	0	0	0		
V109	6AG5	1ST PIX I.F.	PIX MIN	13 K	-8	39	0	0	0	1	6.3	—	148	—	148	39	0				
			PIX MAX	13 K	-5	39	.3	0	0	1	6.3	—	110	—	110	39	.3				
V110	6AG5	2ND PIX I.F.	PIX MIN	13 K	-8	39	0	1	6.3	0	0	—	150	—	150	39	0				
			PIX MAX	13 K	-5	39	.4	1	6.3	0	0	—	115	—	115	39	.4				
V111	6AG5	3RD PIX I.F.	PIX MIN	13 K	—	39	0	1	6.3	0	0	—	150	—	150	39	0				
			PIX MAX	13 K	—	39	.5	1	6.3	0	0	—	95	—	117	39	.6				
V112	6AG5	4TH PIX I.F.	PIX MIN	0	0	150	1.25	1	6.3	0	0	—	110	—	145	150	1.25				
			PIX MAX	0	0	150	1.5	1	6.3	0	0	—	80	—	130	150	1.25				
V113	6T8	AGC AMP.	PIX MIN	90 K	-106	40 K	-8 *	125 K	-8 *	0	0	1	6.3	200 K	-106	1200	-105	700 K	-105	100 K	-13 *
			PIX MAX	90 K	-104	40 K	-8 *	125 K	-.25 *	0	0	1	6.3	200 K	-104	2200	-100	700 K	-100	100 K	-.3 *
V114	6AU6	1ST VIDEO	PIX MIN	500 K	-2.25 *	0	0	0	0	1	6.3	—	240	—	155	0	0				
			PIX MAX	500 K	-2.25 *	0	0	0	0	1	6.3	—	253	—	135	0	0				
V115	6V6 GT	VIDEO OUTPUT	PIX MIN	—	—	0	0	—	215	—	155	1 MEG	-12 *	155	-19	0	0	240	4.5		
			PIX MAX	—	—	0	0	—	215	—	135	1 MEG	-12 *	155	-19	0	0	240	3.9		
V116	6AL5	DC RESTORER AGC DET.	BRIGHT MIN	90 K	-105	200 K	-105	1	6.3	0	0	1.5 MEG	-90	0	0	10 K	-107				
			BRIGHT MAX	90 K	-105	200 K	-3	1	6.3	0	0	1.5 MEG	-90	0	0	10 K	-107				
V117	16AP4	CRT	PIX MIN																		
			PIX MAX																		
V118	6SK7	SYNC AMP	PIX MIN	0	0	0	0	0	0	1 MEG	-3.4 *	0	0	—	145	1	6.3	—	140		
			PIX MAX	0	0	0	0	0	0	1 MEG	-3.4 *	0	0	—	130	1	6.3	—	167		
V119	6SH7	SYNC SEP.	PIX MIN	0	0	0	0	0	0	1 MEG	-4 *	0	0	—	150	1	6.3	—	150		
			PIX MAX	0	0	0	0	0	0	1 MEG	-15 *	0	0	—	135	1	6.3	—	130		
V120	6SN7 GT	SYNC AMP HOR. DISCH.	PIX MIN	1 MEG	-4 *	—	80	0	0	220 K	-120	—	-8	—	-110	1	6.3	0	0		
			PIX MAX	1 MEG	-4 *	—	80	0	0	220 K	-120	—	-8	—	-110	1	6.3	0	0		
V121	6SN7 GT	VERT OSC. AND DISCH.	PIX MIN	1.5 MEG	-220	—	160	900	-115	1.5 MEG	-220	—	80	900	-115	1	6.3	0	0		
			PIX MAX	1.5 MEG	-220	—	160	900	-115	1.5 MEG	-220	—	80	900	-115	1	6.3	0	0		
V122	6K6 GT	VERT OUTPUT	PIX MIN	—	-75	0	0	—	160	—	160	2.2 MEG	-85	—	-6	1	6.3	—	-60		
			PIX MAX	—	-75	0	0	—	160	—	160	2.2 MEG	-85	—	-6	1	6.3	—	-60		
V123	6AL5	HOR SYNC DISCRIM.	PIX MIN	1 MEG	-.3 *	1.5 MEG	-6.5 *	1	6.3	0	0	20	-2.6	0	0	1.5 MEG	-9 *				
			PIX MAX	1 MEG	-.3 *	1.5 MEG	-6.5 *	1	6.3	0	0	20	-2.6	0	0	1.5 MEG	-9 *				
V124	6AC7	HORIZONTAL CONTROL	PIX MIN	0	0	0	0	0	0	1.5 MEG	-1 *	10	.05	—	115	1	6.3	—	230		
			PIX MAX	0	0	0	0	0	0	1.5 MEG	-1 *	10	.05	—	115	1	6.3	—	230		
V125	6K6 GT	HOR. OSC.	PIX MIN	—	—	0	0	—	200	—	200	51 K	-33	—	0	—	6.3	10	.3		
			PIX MAX	—	—	0	0	—	200	—	200	51 K	-33	—	0	—	6.3	10	.3		
V126	6BG6G	HORIZ. OUTPUT	PIX MIN	—	—	—	6.3	900	-108	330 K	-148	330 K	-148	900	-115	0	0	—	175		
			PIX MAX	—	—	—	6.3	900	-108	330 K	-148	330 K	-148	900	-115	0	0	—	175		
V127	1B3GT 8016	H.V. RECT.	PIX MIN																		
			PIX MAX																		
V128	1B3GT 8016	H.V. RECT.	PIX MIN																		
			PIX MAX																		
V129	5V4G	HORIZ. DAMP.	PIX MIN				390				290				290				390		
			PIX MAX				390				290				290				390		
V130	5U4G	RECTIFIER	PIX MIN				300				405 AC				405 AC				300		
			PIX MAX				300				405 AC				405 AC				300		
V131	5Y3GT	LOW VOLT RECTIFIER	PIX MIN				155				165 AC				165 AC				155		
			PIX MAX				140				165 AC				165 AC				140		

MODEL 77, Ch. 1610

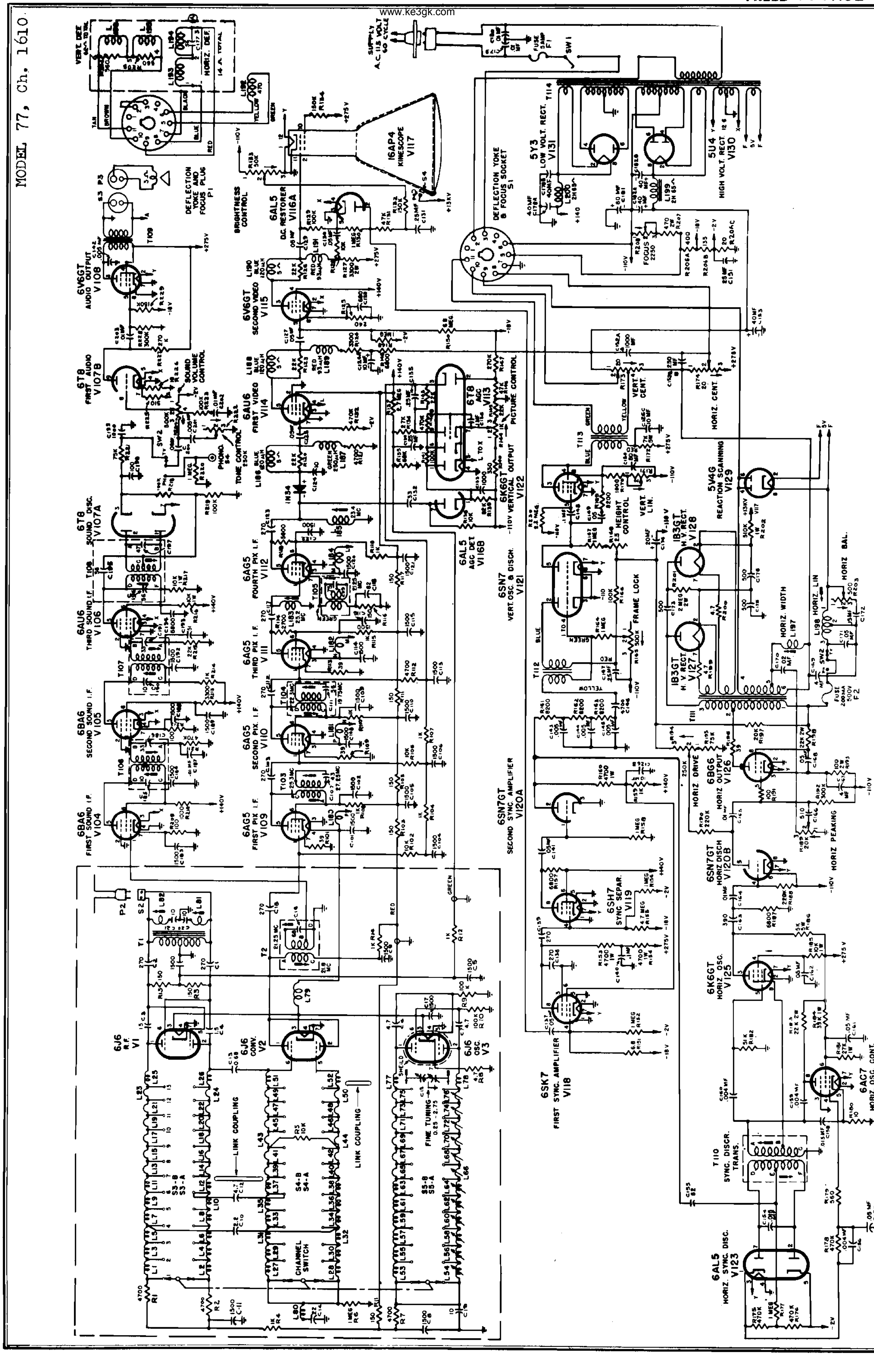


FIGURE 19 - MODEL 77 SCHEMATIC (CH 1610)

MODELS 55, 56; Ch. 1620

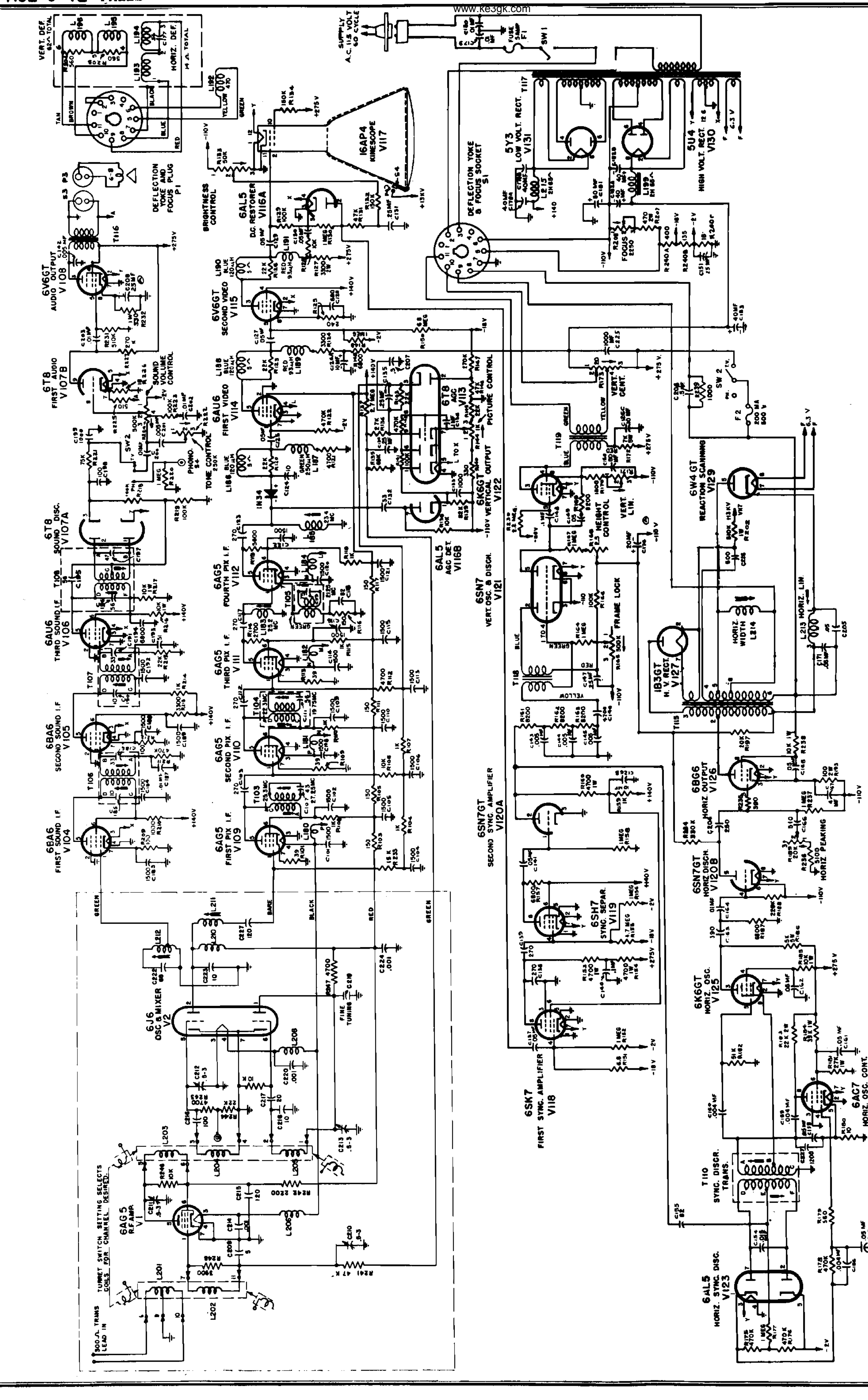


FIGURE 20 - MODELS 55 & 56 SCHEMATIC (CH1620)

SECTION 7 - REPLACEMENT PARTS

Stock No.	Description
A-A237	*Bearing - Bearing for RF unit shaft.
CM-A19	Capacitor - Mica 10 MMF (C124).
CC-A19	Capacitor - Ceramic 33 MMF (C132).
CC-A1	Capacitor - Ceramic 51 MMF (C193).
CM-A12	Capacitor - Mica 56 MMF (C177).
CM-A13	Capacitor - Mica 82 MMF (C118, C155).
CM-A1	Capacitor - Mica 100 MMF (C198).
CM-A14	Capacitor - Mica 270 MMF (C103, C112, C117, C123, C138, C139).
CM-A15	Capacitor - Mica 390 MMF (C163).
CM-A5	Capacitor - Mica 510 MMF (C166).
CM-A16	Capacitor - Mica 680 MMF (C128).
CM-A3	Capacitor - Mica 1000 MMF (C199, C133).
CC-A9	Capacitor - Ceramic 1500 MMF (C101, C102, C104, C105, C106, C108, C109, C110, C113, C114, C115, C116, C120, C121, C122, C183, C184, C188, C189, C192.)
CM-A17	Capacitor - Mica 4700 MMF (C146).
CC-A18	* Capacitor - Ceramic 500 MMF. (C173) Hi-Voltage Filter.
CVC-A6	*Capacitor - Ceramic 500 MMF. (C175) Hi-Voltage Filter.
CVC-A7	*Capacitor - Ceramic 500 MMF. (C176) Hi-Voltage Filter.
CC-A16	Capacitor - Ceramic 6800 MMF (C194).
CM-A1	Capacitor - Mica .01 MF (C187).
CN-A15	Capacitor - Paper .004 MFD - 400 V (C156, C159).
CN-A16	Capacitor - Paper .004 MFD - 1000 V (C160).
CN-A17	Capacitor - Paper .005 MFD - 400 V (C142, C143, C144, C145, C201).
CN-A18	Capacitor - Paper .01 MFD - 400 V (C164, C200, C202, C203).
CN-A27	*Capacitor - Paper .01 MF 1000 V (C165).
CN-A25	Capacitor - Moulded Paper .01 MF 600 V (C179, C180).
CN-A19	Capacitor - Paper .015 MF 400 V (C154, C158).
CN-A28	*Capacitor - Paper .02 MF 1000 V (C170).
CN-A2	Capacitor - Paper .05 MF 400 V (C137, C141, C149, C157, C161, C162, C168, C171, C205).
CN-A31	Capacitor - Paper .05 MF 400 V (small) (C125, C127, C129, C130).
CN-A26	Capacitor - Paper .1 MF 200 V (C136).
CN-A23	Capacitor - Paper .1 MF 400 V (C140, C148).
CN-A29	*Capacitor - Paper .15 MF 200 V (C172).
CN-A24	Capacitor - Paper .25 MF 200 V (small) (C134, C135).
CN-A82	Capacitor - Paper .25 MF 200 V (C131).
CN-A30	Capacitor - Paper .25 MF 600 V (C147).
CE-A17	Capacitor - Electrolytic 4 MF 150 V (C167, C169*).
CE-A14	Capacitor.- Electrolytic 10-10-10 MF 450 V, (C126a, C126b, C126c).
CE-A18	Capacitor.- Electrolytic 20 MF 500 V (C174).
CE-A1	Capacitor - Electrolytic 25 MF 50 V (C151, C208).
CE-A15	Capacitor - Electrolytic 40 MF 450 V (C153).
CE-A19	Capacitor - Electrolytic 40-40 MF 240 V (C173a, C178b).
CE-A20	Capacitor - Electrolytic 40-40 MF 450 V (C182a, C182b).
CE-A16	Capacitor - Electrolytic 50 MF 50 V (C150).
CE-A21	Capacitor - Electrolytic 80 MF 150 V (C131).
CE-A10	*Capacitor - Electrolytic 1000 MF 6 V/250 MF 10 V (C152a, C152b).
TC-A5	Choke. Filter (L199, L200*).
LC-A9	Coil - Third or fourth picture IF coil (L183, L185).
LC-A10	Coil - Choke coil (L180, L181, L132, L184).
LC-A20	*Coil - Horizontal linearity control coil (L198).
LC-A14	Coil - Peaking coil 120 uh blue (L186, L188, L190, R120, R123, R126)
LC-A13	Coil - Peaking coil 93 uh red (L189, L191).
LC-A16	Coil - Peaking coil 250 uh green (L187).
LC-A19	Coil - Focus (L192).
LC-A21	*Coil - Width control (L197).

Stock No.	Description
RC-A4	Resistor - 5100 ohm 1/2 watt (R236).
RC-A33	Resistor - 15,000 ohm 1/2 watt (R233).
RC-A61	Resistor - 330,000 ohm 1/2 watt (R234).
RC-A10	Resistor - 510,000 ohm 1/2 watt (R231).
RW-A24A	Resistor - wire wound 400 ohm, 135 ohm, 150 ohm, interchangeable with RW-A24 (R240A, R240B, R240C).
LC-A23	Coil - horizontal linearity and width control (L213, L214).
TC-A7	Choke, filter (L215).
TA-B7	Transformer - audio output (T116).
TR-A37	Transformer - horizontal output & high voltage (T115).
TA-B9	Transformer - vertical oscillator (T118).
TA-B8	Transformer - vertical output (T119).
TP-B11C2	Transformer - power 115 volt 60 cycle (T117).
QSD-A23	Speaker - 12 inch P.M. 6-8 ohm voice coil.
RC-A55	Resistor - 5600 ohms 1/2 watt (R119).
RC-A56	Resistor - 6300 ohms 1/2 watt (R148, R157, R187).
RC-A26	Resistor - 8200 ohms 1/2 watt (R161, R162, R163, R169).
RC-A13	Resistor - 10,000 ohms 1/2 watt (R102*, R106, R128, R138).
RC-A82	Resistor - 10,000 ohms 1 watt (R185, R216, R217, R238).
RC-A38	Resistor - 20,000 ohms 1/2 watt (R197).
RC-A23	Resistor - 22,000 ohms 1/2 watt (R143, R145, R215).
RC-A79	Resistor - 22,000 ohms 2 watt (R183, R198*).
RC-A22	Resistor - 27,000 ohms 1/2 watt (R136).
RC-A77	Resistor - 27,000 ohms 1 watt (R181).
RC-A16	Resistor - 39,000 ohms 1 watt (R184).
RC-A66	Resistor - 47,000 ohms 1/2 watt (R131, R146).
RC-A7	Resistor - 51,000 ohms 1/2 watt (R182).
RC-A21	Resistor - 68,000 ohms 1/2 watt (R135).
RC-A12	Resistor - 75,000 ohms 1/2 watt (R221, R195*).
RC-A91	Resistor - 82,000 ohms 1/2 watt (R139).
RC-A8	Resistor - 100,000 ohms 1/2 watt (R129, R141, R166, R213, R219, R223).
RC-A59	Resistor - 150,000 ohms 1/2 watt (R182, R229*, R134).
RC-A9	Resistor - 220,000 ohms 1/2 watt (R188, R190*).
RC-A24	Resistor - 270,000 ohms 1/2 watt (R147, R227).
RC-A104	*Resistor - 300,000 ohms 1/2 watt (R192*, R228).
RC-A62	Resistor - 470,000 ohms 1/2 watt (R122, R142, R175, R176, R178, R211).
RC-A107	Resistor - 510,000 ohms 1 watt (R202).
RC-A18	Resistor - 1 megohm 1/2 watt (R130, R149, R152, R158, R164, R167, R177, R220, R237).
RC-A93	*Resistor - 2 meg, 2 watt, High voltage (R201).
RC-A19	Resistor - 2.2 megohm 1/2 watt (R230).
RC-A90	Resistor - 2.7 megohm 1/2 watt (R137).
RC-A88	Resistor - 4.7 megohm 1/2 watt (R155).
RC-A89	Resistor - 6.8 megohm 1/2 watt (R150, R151).
RC-A1	Resistor - 510 ohms 1/2 watt (R225).
RC-A30	Resistor -18 ohms 1/2 watt (R226).
RW-A24	*Resistor - Wire Wound Resistor 400 ohm, 135 ohm, 20 ohm (R206a, R206b, R206c).
RW-A23	Resistor - 7000 ohm wire wound 5 watt (R172).
RW-A21	Resistor - 5000 ohm wire wound 5 watt (R186).
X-A53	Socket - Kinescope.
X-A24	Socket, tube, octal 8 contact.
X-A55	Socket, tube, miniature 7 contact.
X-A54	Socket, tube 9 contact.
TR-A27	Transformer - sound discriminator (T108, C195).(C196, C197).
TA-B6	*Transformer - audio output (T109).
TR-A28	Transformer - first or second sound IF (T107, T106, C185, C186, C190, C191).

Stock No.	Description
RVC-A13A	Control - Brightness (R133).
RVC-A12A	Control - Picture Control (R144).
RWV-A15	Control - Focus (R208).
RVC-A20	*Control - Horizontal Driver (R194).
RVC-A22	Control - Frame Lock (R165).
RWV-A16	Control - Vertical or Horizontal Centering (R173, R174*).
RVC-A103	Control - Volume On-Off (R224) (SW-1).
RVC-A11B	Control Tone - (R222).
RVC-A14	Control Height (R168).
RVC-A15	Control - Vertical Linearity (R170).
RVC-A21	*Control - Horizontal Balance (R203).
RVC-A16	Control - Horizontal Peaking (R189).
PL-A17	Plug deflection (P1).
PL-A3	Plug speaker (P3).
PL-A16	*Plug antenna (P2).
RC-A94	*Resistor - 4.7 ohms 1/2 watt (R199, R200).
RC-A43	Resistor - 10 ohms 1/2 watt (R180).
RC-A44	Resistor - 39 ohms 1/2 watt (R101, R109, R113, R196*).
RC-A11	Resistor - 100 ohms 1/2 watt (R209, R212, R191*).
RC-A70	Resistor - 100 ohms 1/2 watt (R193).
RC-A46	Resistor - 150 ohms 1/2 watt (R103, R105, R111, R116, R117).
RC-A85	Resistor - 240 ohms 1/2 watt (R125).
TV-A47	Resistor - 330 ohms 1/2 watt (R140).
RC-A105	Resistor - 470 ohms 2 watt (R207).
RC-A48	Resistor - 560 ohms 1/2 watt (R204, R205, R179).
RC-A2	Resistor - 1000 ohms 1/2 watt (R104, R107, R108, R110, R115, R118, R159, R210, R214, R239).
RC-A50	Resistor - 1800 ohms 1/2 watt (R170).
RC-A81	Resistor - 2700 ohms 1/2 watt (R114).
RC-A52	Resistor - 3300 ohms 1/2 watt (R124, R213).
RC-A101	Resistor - 3300 ohms 2 watt (R127).
RC-A54	Resistor - 4700 ohms 1/2 watt (R112, R121).
RC-A74	Resistor - 4700 ohms 1 watt (R153, R154, R160).
TR-A29	Transformer - first picture IF (T103, C107).
TR-A30	Transformer - second picture IF (T104, C111).
TR-A36*	Transformer - Horizontal output and high voltage (T111).
TP-C11A	*Transformer - power 115 volt, 60 cycle (T114).
TR-A32	Transformer - sync discriminator (T110).
TA-B4	*Transformer - vertical oscillator (T112).
TA-B5	*Transformer - vertical output (T113).
TR-A31	Trap - cathode (T105, C119).
A-A241	Trap - ion
TR-A34	Yoke - deflection (L193, L194, L195, L196, R204, R205, C177).
QSD-A22	*Speaker - 8 inch P.M. 3.2 ohm voice coil.

Note: Parts marked with* are not used on Model 55 - 56.

Replacement Parts for Model 55 - 56 Not common to Model 77

Stock No.	Description
CM-A23	Capacitor - Mica 250 MMF 1000 V (C204).
CN-A34	Capacitor - Paper .5 MF 200 volt (C207)
CN-A33	Capacitor - Paper .5 MF 200 V (C206).
CC-A20	Capacitor - Ceramic 500 MMF 20 KV Hi-voltage filter, (C226).
CC-A17	Capacitor - 1200 MMF (C227).
CE-A22	Capacitor - Electrolytic 1000 MF 6 V (C225).
RC-A96	Resistor - 330 ohm 1 watt (R232).
RC-A32	Resistor - 390 ohm 1/2 watt (R235).