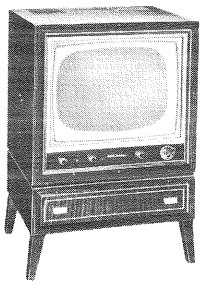
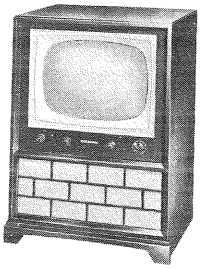
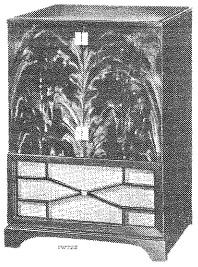


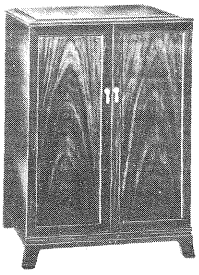
Models 21T159, 21T159DE, "Selfridge" Walnut, Mahogany, Limed Oak



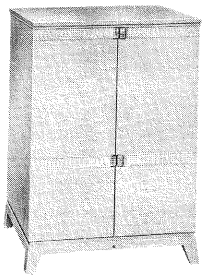
Model 21T165 "Meredith" Walnut, Mahogany, Limed Oak



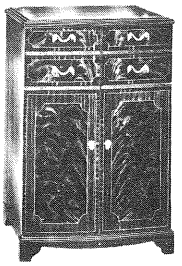
Model 21T174DE "Bancroft" Walnut, Mahogany, Limed Oak



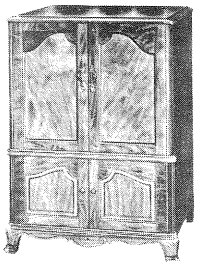
Model 21T176 "Suffolk" Walnut, Mahogany, Limed Oak



Model 21T177 "Donley" Walnut, Mahogany, Limed Oak



Models 21T178, 21T178DE, "Rockingham" Walnut, Mahogany



Models 21T179, 21T179DE "Clarendon" Walnut, Mahogany, Maple

RCA VICTOR TELEVISION RECEIVERS MODELS 21T159, 21T159DE, 21T165, 21T174DE, 21T176, 21T177, 21T178, 21T178DE, 21T179, 21T179DE

Chassis Nos. KCS68C, KCS68E or KCS68F

— Mfr. No. 274 —

SERVICE DATA

— 1951 No. T8 —

PREPARED BY RCA SERVICE CO., INC.

FOR

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION

CAMDEN, N. J., U. S. A.

GENERAL DESCRIPTION

Features of these receivers are: full twelve channel coverage; "totem" r-f amplifier; intercarrier FM sound system; ratio detector; 40 mc picture i-f; improved picture brilliance; pulsed picture A-G-C; A-F-C horizontal hold; stabilized vertical hold; compensated video gain control; noise saturation circuits; improved sync separator and clipper; four mc. band width for picture channel and reduced hazard high voltage supply. An auxiliary audio input jack is provided to permit the use of an external record playing attachment.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE ..... 227 square inches on a 21AP4 Kinescope

TELEVISION R-F FREQUENCY RANGE

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.

Picture I-F Carrier Frequency ..... 45.75 mc.

Sound I-F Carrier Frequency ..... 41.25 mc. and 4.5 mc.

POWER SUPPLY RATING ..... 115 volts, 60 cycles, 300 watts

AUDIO POWER OUTPUT RATING ..... 5.0 watts max.

CHASSIS DESIGNATIONS

KCS68C ..... In Models 21T176, 21T177, 21T178, 21T179

KCS68E ..... In Models 21T159, 21T165

KCS68F ..... In Models 21T159DE, 21T174DE, 21T178DE, 21T179DE

LOUDSPEAKERS

Models 21T159, 21T159DE (971490-2) 8" PM dynamic, 3.2 ohms

Models 21T165, 21T174DE, 21T178DE, 21T179DE (92569-14W) 12" PM Dynamic, 3.2 ohms

Models 21T176, 177, 178 and 179 (971494-1W) 12" PM Dynamic, 3.2 ohms

Model	Chassis with Tubes in Cabinet Weight	Shipping Weight
21T159, 21T159DE	107	128
21T165	111	149
21T174DE	140	172
21T176	128	159
21T177	143	174
21T178, 21T178DE	134	164
21T179, 21T179DE	142	173

RECEIVER ANTENNA INPUT IMPEDANCE

Choice: 300 ohms balanced or 72 ohms unbalanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6BQ7	R-F Amplifier
(2) RCA 6X8	R-F Oscillator and Mixer
(3) RCA 6AU6	1st Picture I-F Amplifier
(4) RCA 6CB6	2nd Picture I-F Amplifier
(5) RCA 6CB6	3rd Picture I-F Amplifier
(6) RCA 6CB6	4th Picture I-F Amplifier
(7) RCA 6AG7	Video Amplifier
(8) RCA 6AU6	1st Sound I-F Amplifier
(9) RCA 6AU6	2nd Sound I-F Amplifier
(10) RCA 6AL5	Ratio Detector
(11) RCA 6AV6	1st Audio Amplifier
(12) RCA 6AQ5	Audio Output
(13) RCA 6CB6	AGC Amplifier
(14) RCA 6SN7GT	Sync Separator
(15) RCA 6SN7GT	Vert Sync Amplifier and Vert Sweep Osc.
(16) RCA 6AQ5	Vertical Sweep Output
(17) RCA 6SN7GT	Horizontal Sync Amplifier
(18) RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(19) RCA 6CD6G	Horizontal Sweep Output
(20) RCA 6W4GT (2 tubes)	Dampers
(21) RCA 1B3-GT/8016	High Voltage Rectifier
(22) RCA 5U4G (2 tubes)	Rectifiers
(23) RCA 21AP4	Kinescope

Third Edition—First Printing 8-22-52

Printed in U. S. A.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

(Continued)

PICTURE INTERMEDIATE FREQUENCIES

Picture Carrier Frequency ..... 45.75 mc.
Adjacent Channel Sound Trap ..... 47.25 mc.
Accompanying Sound Traps ..... 41.25 mc.
Adjacent Channel Picture Carrier Trap ..... 39.25 mc.

SOUND INTERMEDIATE FREQUENCIES

Sound Carrier Frequency ..... 41.25 mc. and 4.5 mc.

VIDEO RESPONSE ..... To 4 mc.

FOCUS ..... Magnetic

SWEEP DEFLECTION ..... Magnetic

SCANNING ..... Interlaced, 525 line

HORIZONTAL SWEEP FREQUENCY ..... 15,750 cps

VERTICAL SWEEP FREQUENCY ..... 60 cps

FRAME FREQUENCY (Picture Repetition Rate) ..... 30 cps

OPERATING CONTROLS (front Panel)

Channel Selector, Fine Tuning ..... Dual Control Knobs
Picture, Brightness ..... Dual Control Knobs
Picture Horizontal Hold, Picture Vertical Hold ..... Dual Control Knobs
Sound Volume and On-Off Switch, Tone Control and Phono Switch ..... Dual Control Knobs

NON-OPERATING CONTROLS (not including r-f and i-f adjustments)

Picture Centering ..... top chassis adjustment
Width ..... rear chassis adjustment
Height ..... rear chassis adjustment
Horizontal Linearity ..... rear chassis screwdriver adjustment
Vertical Linearity ..... rear chassis adjustment
Vertical Peaking Control ..... rear chassis adjustment
Horizontal Drive ..... rear chassis screwdriver adjustment
Horizontal Oscillator Frequency ..... rear chassis adjustment
Horizontal Oscillator Waveform ..... bottom chassis adjustment
Horizontal Locking Range ..... rear chassis adjustment
Focus ..... top chassis adjustment
Ion Trap Magnet ..... top chassis adjustment
Deflection Coil ..... top chassis wing nut adjustment
AGC Control ..... rear chassis adjustment

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER OUTSIDE THE CABINET OR WITH THE COVERS REMOVED, INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED.

KINESCOPE HANDLING PRECAUTIONS

DO NOT REMOVE THE RECEIVER CHASSIS, INSTALL, REMOVE OR HANDLE THE KINESCOPE IN ANY MANNER UNLESS SHATTERPROOF GOGGLES, AND HEAVY GLOVES ARE WORN. PEOPLE NOT SO EQUIPPED SHOULD BE KEPT AWAY WHILE HANDLING KINESCOPES. KEEP THE KINESCOPE AWAY FROM THE BODY WHILE HANDLING.

The kinescope bulb encloses a high vacuum and, due to its large surface area, is subjected to considerable air pressure. For this reason, the kinescope must be handled with more care than ordinary receiving tubes.

The large end of the kinescope bulb—particularly that part at the rim of the viewing surface—must not be struck, scratched or subjected to more than moderate pressure at any time. During service if the tube sticks or fails to slip smoothly into its socket, or deflecting yoke, investigate and remove the cause of the trouble. Do not force the tube. Refer to the Receiver Installation section for detailed instructions on kinescope installation. All RCA replacement kinescopes are shipped in special cartons and should be left in the cartons until ready for installation in the receiver.

OPERATING INSTRUCTIONS

The following adjustments are necessary when turning the receiver on for the first time.

1. See that the TV-PH switch is in the "TV" position.

2. Turn the receiver "ON" and advance the SOUND VOLUME control to approximately mid-position.

3. Set the STATION SELECTOR to the desired channel.

4. Adjust the FINE TUNING control for best pix and the SOUND VOLUME control for suitable volume.

5. Turn the BRIGHTNESS control fully counter-clockwise, then clockwise until a light pattern appears on the screen.

6. Adjust the VERTICAL hold control until the pattern stops vertical movement.

7. Adjust the HORIZONTAL hold control until a picture is obtained and centered.

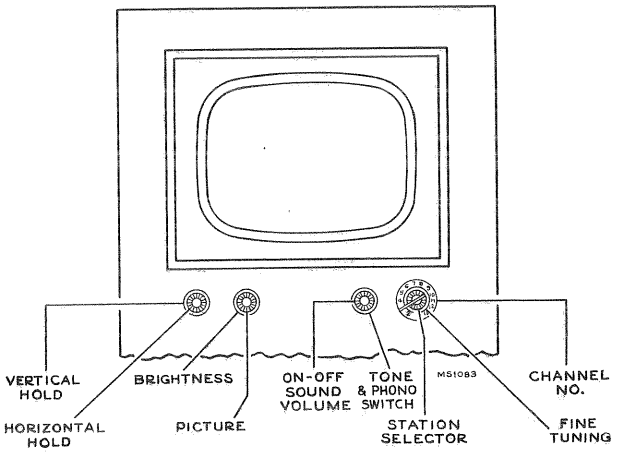


Figure 1—Receiver Operating Controls

8. Adjust the PICTURE and BRIGHTNESS controls for suitable picture contrast and brightness.

9. In switching from one channel to another, it may be necessary to repeat steps 4 and 8.

10. When the set is turned on again after an idle period it should not be necessary to repeat the adjustment if the positions of the controls have not been changed. If any adjustment is necessary, step number 4 is generally sufficient.

11. If the positions of the controls have been changed, it may be necessary to repeat steps 2 through 8.

12. To use a record player, plug the record-player output cable into the PHONO jack on the rear apron, and set the TV-PH switch to "PH."

INSTALLATION INSTRUCTIONS

UNPACKING.—These receivers are shipped complete in cardboard cartons. The kinescope is shipped in place in the receiver.

Take the receiver out of the carton and remove all packing material.

Install the control knobs on the proper control shafts.

Make sure that all tubes are in place and are firmly seated in their sockets.

Check to see that the kinescope high voltage lead clip is in place.

Plug a power cord into the 115 volt a-c power source and into the receiver interlock receptacle.

Turn the receiver power switch to the "on" position, the brightness control fully clockwise, and the picture control counter-clockwise.

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 2. Starting from this position immediately adjust the magnet by moving it forward or backward at the same time rotating it slightly around the neck of the kinescope for the brightest raster on the screen.

DEFLECTION YOKE ADJUSTMENT.—If the lines of the raster are not horizontal or squared with the picture mask, rotate the deflection yoke until this condition is obtained. Tighten the yoke adjustment wing screw.

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern picture in order to make further adjustments. Connect the antenna transmission line to the receiver.

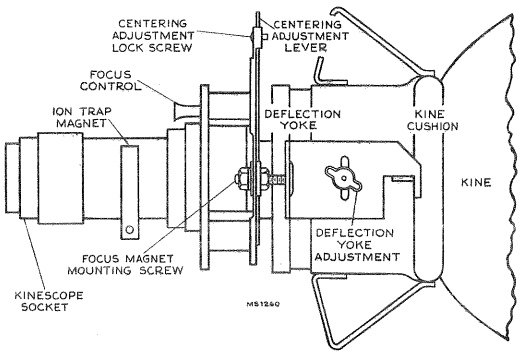


Figure 2—Ion Trap and Centering Magnet Adjustments

If the Horizontal Oscillator and AGC System are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R175 on the rear apron (see Figure 3) counter-clockwise until the set operates normally and the picture can be synchronized.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 120 degrees from the extreme counter-clockwise position. The picture should remain in sync for approximately 90 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

If the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned. Skip "Alignment of Horizontal Oscillator" and proceed with "Centering Adjustment."

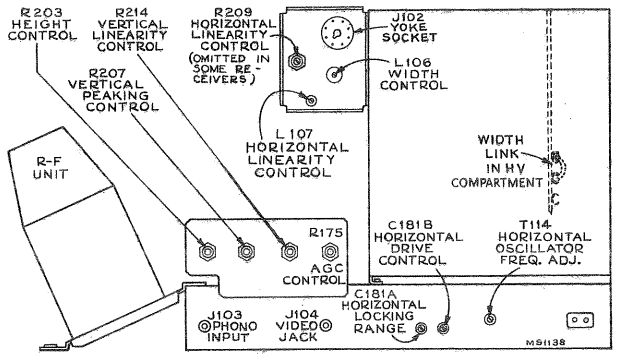


Figure 3—Rear Chassis Adjustments

INSTALLATION INSTRUCTIONS

ALIGNMENT OF HORIZONTAL OSCILLATOR.—If in the above check the receiver failed to hold sync with the hold control at the extreme counter-clockwise position or failed to hold sync over 90 degrees of clockwise rotation of the control from the pull-in point, it will be necessary to make the following adjustments.

Horizontal Frequency Adjustment.—Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and adjust the T114 horizontal frequency adjustment at the rear of the chassis until the picture is just out of sync and the horizontal blanking appears as a vertical or diagonal black bar in the raster. Then turn the T114 core until the bar moves out of the picture leaving it in sync.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 rear core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 2 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C181A slightly clockwise. If less than 2 bars are present, adjust C181A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 bars are present.

Repeat the adjustments under "Horizontal Frequency Adjustment" and "Horizontal Locking Range Adjustment" until the conditions specified under each are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If it is impossible to sync the picture at this point and the AGC system is in proper adjustment it will be necessary to adjust the Horizontal Oscillator by the method outlined in the alignment procedure on Page 11. For field purposes paragraph "B" under Horizontal Oscillator Waveform Adjustment may be omitted.

FOCUS MAGNET ADJUSTMENTS.—The focus magnet should be adjusted so that there is approximately three-eighths inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus magnet. This spacing gives best average focus over the face of the tube.

The axis of the hole through the magnet should be parallel with the axis of the kinescope neck with the kinescope neck through the middle.

CENTERING ADJUSTMENT.—No electrical centering controls are provided. Centering is accomplished by means of a separate plate on the focus magnet. The centering plate includes a locking screw which must be loosened before centering. Up and down adjustment of the plate moves the picture side to side and sidewise adjustment moves the picture up and down.

If a corner of the raster is shadowed, check the position of the ion trap magnet. Reposition the magnet within the range of maximum raster brightness to eliminate the shadow and recenter the picture by adjustment of the focus magnet plate. In no case should the ion trap magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In some cases it may be necessary to shift the position of the focus magnet in order to eliminate a corner shadow.

WIDTH, DRIVE AND HORIZONTAL LINEARITY ADJUSTMENTS.—Adjustment of the horizontal drive control affects the high voltage applied to the kinescope. In order to obtain the highest possible voltage hence the brightest and best focused picture, adjust horizontal drive trimmer C181B for maximum drive (minimum capacity) consistent with a linear raster. Compression of the raster due to excessive drive can be seen as a white vertical bar or bars in the right half of the picture. Besides compression caused by excessive drive, another item to watch for is the change in linearity at the extreme left with changes of brightness control setting. By proper adjustment of the linearity coil, the changes in linearity with changes in brightness can be made negligible. In general, to achieve this condition, the linearity coil should be set slightly on the high inductance side (core slightly clockwise) of the optimum position and the linearity rheostat R209 should be as far clockwise as possible.

Note: In late production receivers, R209 has been omitted since it normally was operated at zero resistance.

Preset the following adjustments as directed:

A.—Place the width plug (P105) in the minimum width position (top).

B.—Set the width control coil L106 in approximately mid position.

C.—Set the linearity control coil L107 near minimum inductance (counter-clockwise).

D.—Set the linearity control rheostat near zero resistance (clockwise).

E.—Set the drive capacitor C181B in the maximum drive position (counter-clockwise).

If the raster is cramped or shows compression bars on the right half of the picture turn C181B clockwise until this condition is just eliminated.

Adjust the linearity control coil L107 clockwise until best linearity and maximum deflection or best compromise are obtained then turn one quarter turn clockwise from this position.

Retouch the drive trimmer C181B if necessary to obtain best linearity and maximum width.

Check the horizontal linearity at various settings of the brightness control R218. There should be no compression of the right half and no appreciable change of linearity especially at the extreme left of the picture. If objectional change does occur, turn linearity coil L107 slightly clockwise and repeat the test.

Adjust the width control L106 to fill the mask.

If the left side of the picture appears stretched, turn the linearity control rheostat R209 counter-clockwise. If the left side of the picture is cramped, turn R209 clockwise. Whenever possible, correct nonlinearity by adjustment of R209 rather than by reduction of drive.

If the line voltage is low and it becomes impossible to fill the mask, move the width plug P105 to the bottom position. The width coil L106 is inoperative in this position.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R203 on chassis rear apron) until the picture fills the mask vertically. Adjust vertical linearity (R214 on rear apron), until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. If the top few lines of the picture are stretched or squeezed, adjust the vertical peaking control R207 until this condition is corrected.

FOCUS.—Adjust the focus magnet for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

Recheck the position of the ion trap magnet to make sure that maximum brightness is obtained.

If necessary readjust centering to align the picture with the mask.

CHECK OF R-F OSCILLATOR ADJUSTMENTS.—Tune in all available stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. If adjustments are required, these should be made by the method outlined in the alignment procedure on page 7. The adjustments for channels 2 through 12 are available from the front of the cabinet by removing the station selector escutcheon as shown in Figure 4. Adjustment for channel 13 is on top of the chassis.

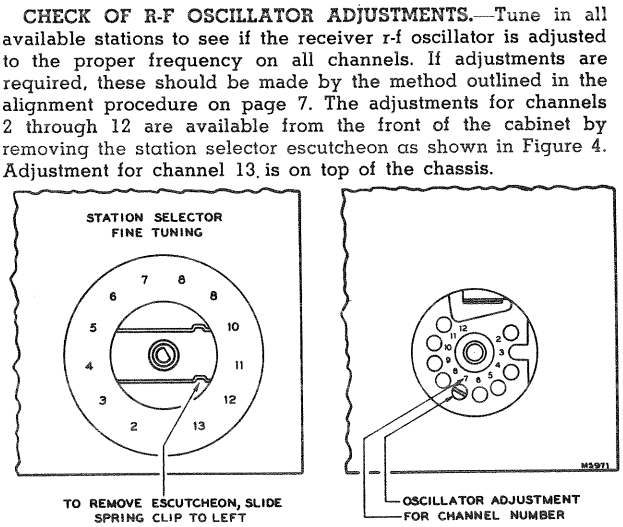


Figure 4—R-F Oscillator Adjustments

INSTALLATION INSTRUCTIONS

AGC THRESHOLD CONTROL.—The AGC threshold control R175 is adjusted at the factory and normally should not require readjustment in the field.

To check the adjustment of the AGC Threshold Control, tune in a strong signal and sync the picture. Momentarily remove the signal by switching off channel and then back. If the picture reappears immediately, the receiver is not overloading due to improper setting of R175. If the picture requires an appreciable portion of a second to reappear, or bends excessively, R175 should be readjusted

Turn R175 fully counter-clockwise. The raster may be bent slightly. This should be disregarded. Turn R175 clockwise until there is a very, very slight bend or change of bend in the picture. Then turn R175 counter-clockwise just sufficiently to remove this bend or change of bend.

If the signal is weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R175 clockwise until the snow in the picture becomes more pronounced, then counter-clockwise until the best signal to noise ratio is obtained.

The AGC control adjustment should be made on a strong signal if possible. If the control is set too far clockwise on a weak signal, then the receiver may overload when a strong signal is received.

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the L58 core on top of the antenna matching transformer for minimum interference in the picture.

CAUTION.—In some receivers, the FM trap L58 will tune down into channel 6 or even into channel 5. Needless to say, such an adjustment will cause greatly reduced sensitivity on these channels. If channels 5 or 6 are to be received, check L58 to make sure that it does not affect sensitivity on these two channels.

Replace the cabinet back and connect the receiver antenna leads to the cabinet back. Make sure that the screws holding it are up tight, otherwise it may rattle or buzz when the receiver is operated at high volume.

CABINET ANTENNA.—A cabinet antenna is provided in these receivers and the leads are brought out near the antenna terminal board. The cabinet antenna may be employed in place of the outdoor antenna in areas where the signals are strong and no reflections are experienced.

KINESCOPE HANDLING PRECAUTION.—Do not install, remove, or handle the kinescope in any manner, unless shatterproof goggles and heavy gloves are worn. People not so equipped should be kept away while handling the kinescope. Keep the kinescope away from the body while handling.

Handle this tube by the metal rim at the edge of the screen. Do not cover the glass bell of the tube with fingermarks as it will produce leakage paths which may interfere with reception. If this portion of the tube has inadvertently been handled, wipe it clean with a soft cloth moistened with "dry" carbon tetrachloride.

To remove the kinescope from the cabinet, loosen the two nuts and disengage the rods alongside the kinescope. Remove the wing screw which holds the yoke frame to the cabinet. Remove the kinescope, the yoke frame with yoke and focus or centering magnet as an assembly.

INSTALLATION OF KINESCOPE.—Handle this tube by the metal rim at the edge of the screen. Do not cover the glass bell of the tube with fingermarks as it will produce leakage paths which may interfere with reception. If this portion of the tube has inadvertently been handled, wipe it clean with a soft cloth moistened with "'dry" carbon tetrachloride.

Wipe the kinescope screen surface and front panel safety glass clean of all dust and fingermarks with a soft cloth moistened with "Windex" or similar cleaning agent.

Turn the tube so that the key on the base of the tube will be down and insert the neck of the kinescope through the deflection coil and focus magnet. If the tube sticks, or fails to slip into place smoothly, investigate and remove the cause of the trouble. Do not force the tube.

Replace the kinescope and yoke frame assembly in the cabinet. Insert the wing screw and tighten. Engage the two side rods into the yoke frame and tighten the two nuts. Slide the deflection yoke as far forward as possible. If this is not done, difficulty will be encountered in adjusting the ion trap and focus magnet because of shadows on the corner of the raster.

Slide the chassis into the cabinet, then insert and tighten the four chassis bolts.

Slip the ion trap magnet over the neck of the kinescope.

Connect the kinescope socket to the tube base and connect the high voltage lead from the rim of the kinescope into the high voltage bushing on the high voltage compartment.

Reconnect all other cables. Do not forget to replace the yoke frame grounding strap. Perform the entire set-up procedure beginning with the Ion Trap Magnet Adjustment.

ANTENNAS.—The finest television receiver built may be said to be only as good as the antenna design and installation. It is therefore important to select the proper antenna to suit the particular local conditions, to install it properly and orient it correctly.

If two or more stations are available and the two stations are in different directions, it may be possible to make a compromise orientation which will provide a satisfactory signal on all such channels.

If it is impossible to obtain satisfactory results on one or more channels, it may become necessary either to provide means for turning the antenna when switching channels or to install a separate antenna for one or more channels and to switch antennas when switching channels.

In some cases, the antenna should not be installed permanently until the quality of the picture reception has been observed on a television receiver. A temporary transmission line can be run between receiver and the antenna, allowing sufficient slack to permit moving the antenna. Then, with a telephone system connecting an observer at the receiver and an assistant at the antenna, the antenna can be positioned to give the most satisfactory results on the received signal. A shift of direction or a few feet in antenna position may effect a tremendous difference in picture reception.

REFLECTIONS.—Multiple images sometimes known as echoes or ghosts, are caused by the signal arriving at the antenna by two or more routes. The second or subsequent image occurs when a signal arrives at the antenna after being reflected off a building, a hill or other object. In severe cases of reflections, even the sound may be distorted. In less severe cases, reflections may occur that are not noticeable as reflections but that will instead cause a loss of definition in the picture.

Under certain extremely unusual conditions, it may be possible to rotate or position the antenna so that it receives the cleanest picture over a reflected path. If such is the case, the antenna should be so positioned. However, such a position may give variable results as the nature of reflecting surfaces may vary with weather conditions. Wet surfaces have been known to have different reflecting characteristics than dry surfaces.

Depending upon the circumstances, it may be possible to eliminate the reflections by rotating the antenna or by moving it to a new location. In extreme cases, it may be impossible to eliminate the reflection.

INTERFERENCE.—Auto ignition, street cars, electrical machinery and diathermy apparatus may cause interference which spoils the picture. Whenever possible, the antenna location should be removed as far as possible from highways, hospitals, doctors' offices and similar sources of interference. In mounting the antenna, care must be taken to keep the antenna rods at least ¼ wave length (at least 6 feet) away from other antennas, metal roofs, gutters or other metal objects.

Short-wave radio transmitting and receiving equipment may cause interference in the picture in the form of moving ripples. In some instances it may be possible to eliminate the interference by the use of a trap in the antenna transmission line. However, if the interfering signal is on the same frequency as the television station, a trap will provide no improvement.

WEAK PICTURE.—When the installation is near the limit of the area served by the transmitting station, the picture may be speckled, having a "snow" effect, and may not hold steady on the screen. This condition is due to lack of signal strength from the transmitter.

CHASSIS TOP VIEW

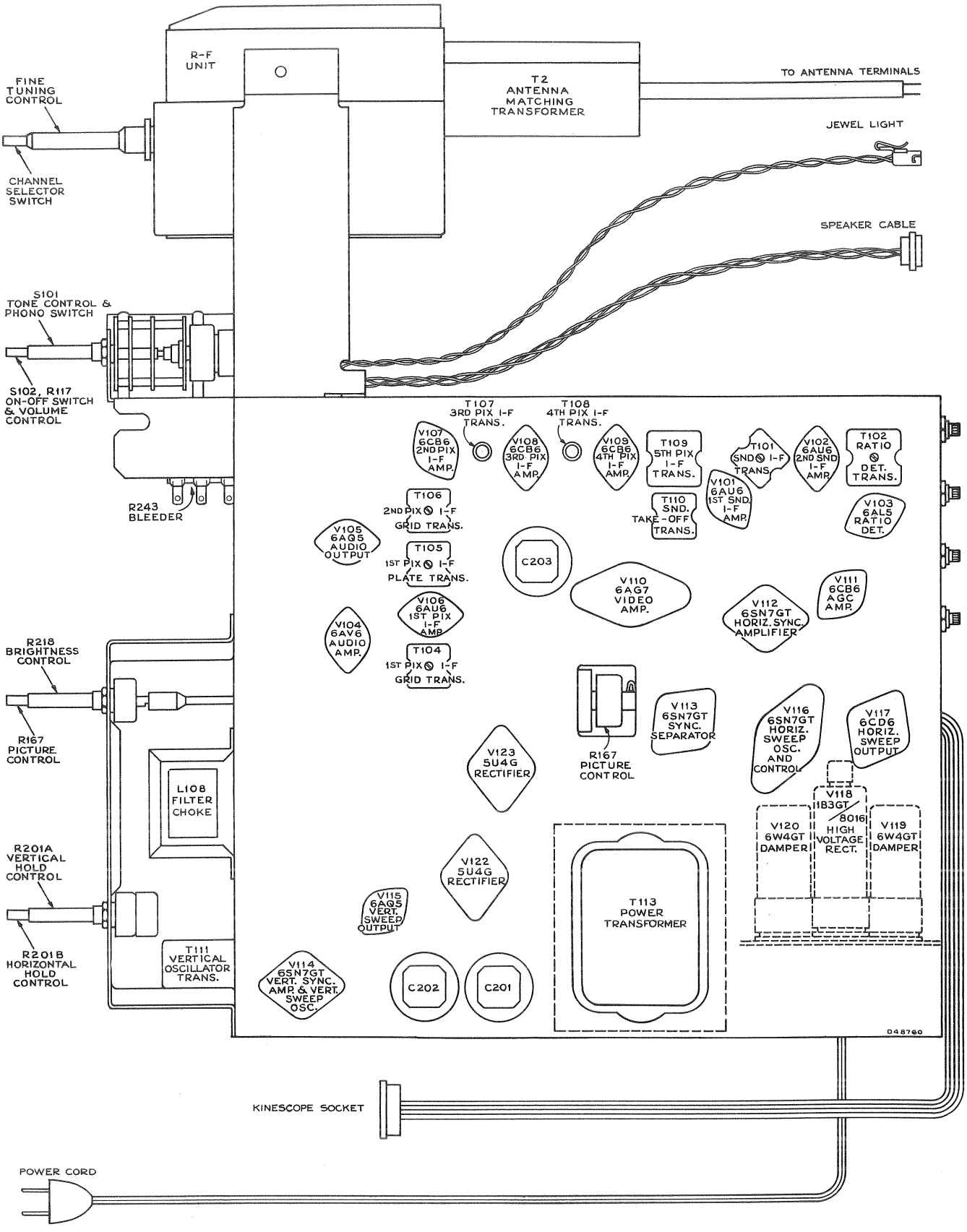


Figure 5—Chassis Top View

CHASSIS BOTTOM VIEW

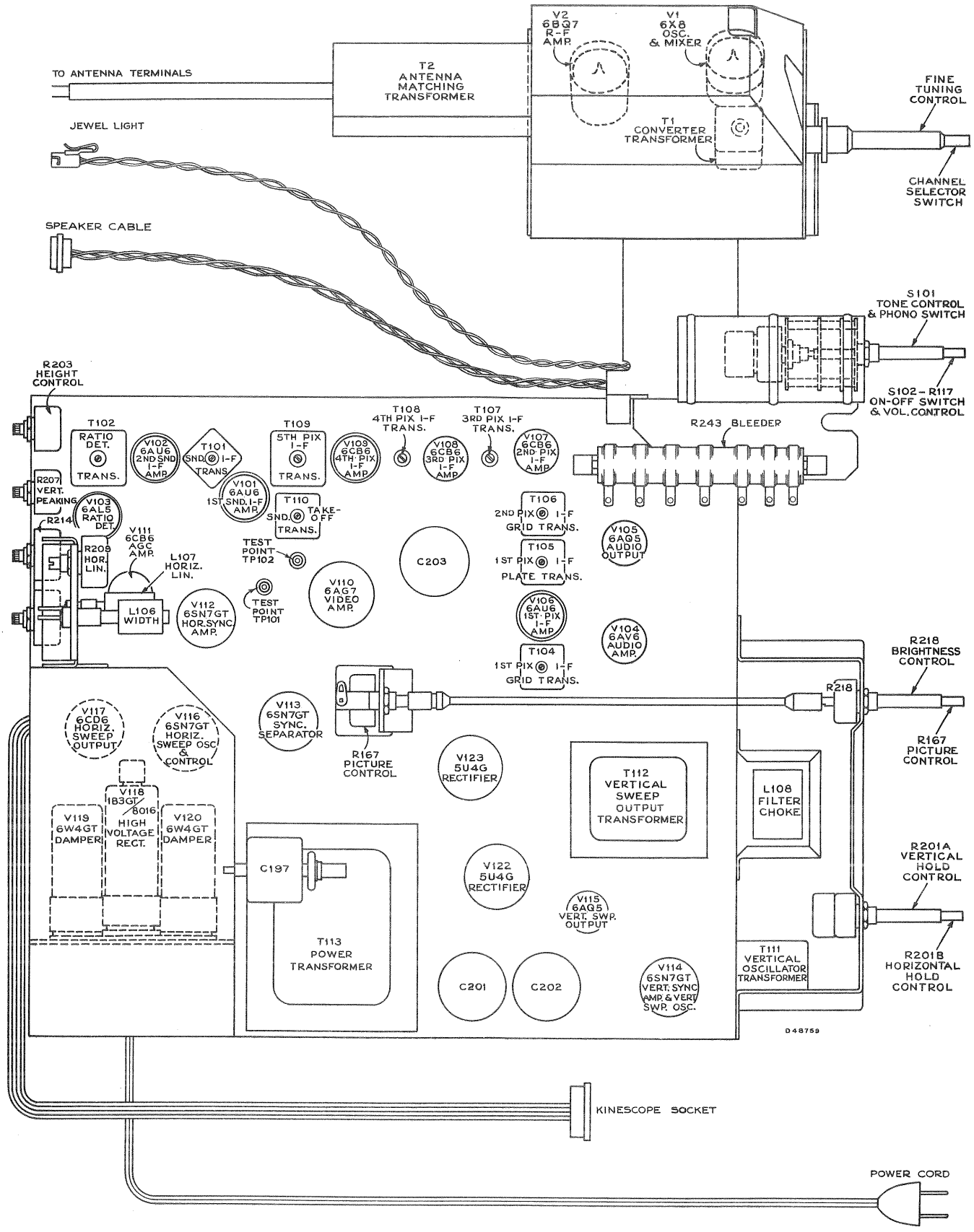


Figure 6—Chassis Bottom View

ALIGNMENT PROCEDURE

TEST EQUIPMENT.—To properly service the television chassis of this receiver, it is recommended that the following test equipment be available:

R-F Sweep Generator meeting the following requirements:

(a) Frequency Ranges
35 to 90 mc., 1 mc. to 12 mc. sweep width
170 to 225 mc., 12 mc. sweep width

(b) Output adjustable with at least .1 volt maximum.

(c) Output constant on all ranges.

(d) "Flat" output on all attenuator positions.

Cathode-Ray Oscilloscope. — For alignment purposes, the oscilloscope employed must have excellent low frequency and phase response.

For video and sync waveform observations, the oscilloscope must have excellent frequency and phase response from 10 cycles to at least two megacycles in all positions of the gain control.

Signal Generator to provide the following frequencies with crystal accuracy.

(a) Intermediate frequencies
4.5 mc., 39.25 mc., 41.25 mc., 45.75 mc., 47.25 mc.

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.25	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

(c) Output of these ranges should be adjustable and at least .1 volt maximum.

Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

Electronic Voltmeter of Junior or Senior "VoltOhmyst" type and a high voltage multiplier probe for use with this meter to permit measurements up to 20 kv.

ORDER OF ALIGNMENT.—When a complete receiver alignment is necessary, it can be most conveniently performed in the following order:

(1) Ant. Matching Unit
(2) R-F Unit
(3) Ratio Detector
(4) Sound I-F Trans.
(5) Sound Take-Off Trans.
(6) Picture I-F Traps
(7) Picture I-F Trans.
(8) Sweep Alignment of I-F
(9) Horizontal Oscillator
(10) Sensitivity Check

ANTENNA MATCHING UNIT ALIGNMENT. — The antenna matching unit is accurately aligned at the factory. Adjustment of this unit should not be attempted in the customer's home since even slight misalignment may cause serious attenuation of the signal especially on channel 2. The r-f unit is aligned with a particular antenna matching transformer in place. If for any reason, a new antenna matching transformer is installed, the r-f unit should be realigned.

The F-M Trap which is mounted in the antenna matching unit may be adjusted without adversely affecting the alignment of the unit.

To align the antenna matching unit disconnect the lead from the F-M trap L58 to the channel selector switch S5.

With a short jumper, connect the output of the matching unit through a 1000 mmf. capacitor to the grid of the second pix i-f amplifier, pin 1 of V107.

Replace the cover on the matching unit while making all adjustments.

Remove the first pix i-f amplifier tube V106.

Connect the positive terminal of a bias box to the chassis and the potentiometer arm to the junction of R143 and R144. Set the potentiometer to produce approximately —6.0 volts of bias at the junction of R143 and R144.

Connect an oscilloscope to the video test point TP102 or pin 2, V110 and set the oscilloscope gain to maximum.

Connect a signal generator to the antenna input terminals. Modulate the signal generator 30% with an audio signal.

Tune the signal generator to 45.75 mc. and adjust the generator output to give an indication on the oscilloscope. Adjust L59 in the antenna matching unit for minimum audio indication on the oscilloscope.

Tune the signal generator to 41.25 mc. and adjust L60 for minimum audio indication on the oscilloscope.

Remove the jumper from the output of the matching unit.

Connect a 300 ohm ½ watt composition resistor from L58 to ground, keeping the leads as short as possible.

Connect an oscilloscope low capacity crystal probe from L58 to ground. The sensitivity of the oscilloscope should be approximately 0.03 volts per inch. Set the oscilloscope gain to maximum.

Connect the r-f sweep generator to the matching unit antenna input terminals. In order to prevent coupling reactance from the sweep generator into the matching unit, it is advisable to employ a resistance pad at the matching unit terminals. Figure 11 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohms co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep employed.

Connect the signal generator loosely to the matching unit antenna terminals.

Set the sweep generator to sweep from 45 mc. to 54 mc. With RCA type WR59A sweep generators, this may be accomplished by retuning channel number 1 to cover this range. With WR59B sweep generators this may be accomplished by retuning channel number 2 to cover the range. In making these adjustments on the generator, be sure not to turn the core too far clockwise so that it becomes lost beyond the core retaining spring.

Adjust L61 and L62 to obtain the response shown in figure 12. L61 is most effective in locating the position of the shoulder of the curve at 52 mc. and L62 should be adjusted to give maximum amplitude at 53 mc. and above consistent with the specified shape of the response curve. The adjustments in the matching unit interact to some extent. Repeat the above procedure until no further adjustments are necessary.

Remove the 300 ohm resistor and crystal probe connections. Restore the connection between L58 and S5. Replace V106.

R-F UNIT ALIGNMENT.—An r-f unit which is operative and requires only touch up adjustments, requires no presetting of adjustments. For such units, skip the remainder of this paragraph. For units which are completely out of adjustment, preset all adjustments to the approximate center of their range with the following exceptions. Set C18 so that the screw head is approximately three-eighths of an inch above chassis. Set C11 near maximum capacity (one-quarter turn from tight). Do not change any of the adjustments in the antenna matching unit.

Disconnect the link from terminals "A" and "B" of T104 and terminate the link with a 39 ohm composition resistor.

The r-f unit is aligned with zero A-G-C bias. To insure that the bias will remain constant, take a clip lead and short circuit the r-f unit power terminal board terminal 3 to ground.

Connect the oscilloscope to the test point TP1 on top of the r-f unit. Set the oscilloscope gain to maximum.

Turn the receiver channel selector switch to channel 2.

Connect the output of the signal generator to the grid of the r-f amplifier, V2. To do this, remove the tube from the socket and fashion a clip by twisting one end of a small piece of wire around pin number 7. Replace the tube in the socket leaving the end of the wire protruding from under the tube. Connect the signal generator to this wire through a 1,500 mmf. capacitor.

Tune the signal generator to 43.5 mc. and modulate it 30% with a 400 cycle sine wave. Adjust the signal generator for maximum output.

Adjust L65 on top of the r-f unit for minimum 400 cycle indication on the oscilloscope. If necessary, this adjustment can be retouched in the field to provide additional rejection to one specific frequency in the i-f band pass. However, in such cases, care should be taken not to adjust it so as to reduce sensitivity on channel 2.

Remove the wire clip from pin 7 of V2 and replace the tube and tube shield.

Set the channel selector switch to channel 8.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range now and at all times when adjusting the oscillator frequency.

Adjust C1 in KRK11 or C2 in KRK11A for proper oscillator frequency, 227 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this, tune the signal generator to 227 mc. with crystal accuracy. Insert one end of a piece of insulated wire into the r-f unit through the hole provided for the adjustment for C11. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the r-f unit oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust C1 in KRK11 or C2 in KRK11A to obtain an audio beat with the signal generator.

Note—If, on some KRK11A units, it is not possible to reach the proper channel 8 oscillator frequency by adjustment of C2, switch to channel 13 and adjust L46 to obtain proper channel 13 oscillator frequency as indicated in the table on page 10. Then switch to channel 12 and adjust L11 to obtain proper channel 12 oscillator frequency. Continue down to channel 8 adjusting the appropriate oscillator trimmer to obtain the proper frequency on each channel. Then again on channel 8 adjust C2 to obtain proper channel 8 oscillator frequency. Switch back to channel 13 and adjust L46 and back to channel 8 and adjust C2.

Set the T1 core for maximum inductance (core turned counter-clockwise).

Connect the sweep generator through a suitable attenuator as shown in Figure 11 to the input terminals of the antenna matching unit.

Connect the signal generator loosely to the antenna terminals.

Set the sweep generator to cover channel 8.

Set the cscilloscope to maximum gain and use the minimum input signal which will produce a usable pattern on the oscilloscope. Excessive input can change oscillator injection during alignment and produce consequent misalignment even though the pattern on the oscilloscope may look normal.

Insert markers of channel 8 picture carrier and sound carrier, 181.25 mc. and 185.75 mc.

Adjust C9, C11, C15 and C18 for approximately correct curve shape, frequency, and band width as shown in Figure 13.

The correct adjustment of C18 is indicated by maximum amplitude of the curve midway between the markers. C15 tunes the r-f amplifier plate circuit and affects the frequency of the pass band most noticeably. C9 tunes the mixer grid circuit and affects the tilt of the curve most noticeably (assuming that C18 has been properly adjusted). C11 is the coupling adjustment and hence primarily affects the response band width.

Set the receiver channel switch to channel 6.

Adjust the signal generator to the channel 6 oscillator frequency 129 mc.

Turn the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L5 for an audible beat with the signal generator as before.

Set the sweep generator to channel 6.

From the signal generator, insert channel 6 sound and picture carrier markers, 83.25 mc. and 87.75 mc.

Adjust L48, L50 and L53 for proper response as shown in Figure 13.

L50 tunes the r-f amplifier plate circuit and primarily affects the frequency of the pass band. L53 tunes the r-f amplifier grid and is adjusted to give maximum amplitude of the curve between the markers. L48 affects the tilt of the curve but not quite the same as C9 adjustment. When the circuits are correctly adjusted and L48 is rocked on either side of its proper setting, the high frequency (sound carrier) end of the curve appears to remain nearly fixed in amplitude while the picture carrier end tilts above or below this point.

Turn off the sweep and signal generators.

Connect the "VoltOhmyst" to the r-f unit test point TP1.

Adjust the oscillator injection trimmer C8 for —3.5 volts or at maximum if —3.5 volts cannot be reached. This voltage should fall between —2.5 and —5.5 volts on all channels when the alignment of all circuits is completed.

Turn the sweep generator and signal generator back on and recheck channel 6 response. Readjust L48, L50 and L53 if necessary.

Set the receiver channel selector switch to channel 8 and readjust C1 in KRK11 or C2 in KRK11A for proper oscillator frequency, 227 mc.

Set the sweep generator and signal generator to channel 8.

Readjust C9, C11, C15 and C18 for correct curve shape, frequency and band width.

Turn off the sweep and signal generators, switch back to channel 6 and check the oscillator injection voltage at TP1 if C9 was adjusted in the recheck of channel 8 response.

If the initial setting of oscillator injection trimmer C8 was far off, it may be necessary to adjust the oscillator frequency and response on channel 8, adjust the oscillator injection on channel 6 and repeat the procedure several times before the proper setting is obtained.

Turn off the sweep generator and switch the receiver to channel 13.

Adjust the signal generator to the channel 13 oscillator frequency 257 mc.

Set the fine tuning control 30 degrees clockwise from the center of its mechanical range.

Adjust L46 to obtain an audible beat. Slightly overshoot the adjustment of L46 by turning the slug a little more in the same direction from the original setting, then reset the oscillator to proper frequency by adjusting C1 in KRK11 or C2 in KRK11A to again obtain the beat.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep generator and marker oscillator to each of these channels and observing the response and oscillator injection obtained. See Figure 12 for typical response curves. It should be found that all these channels have the proper shaped response with the markers above 80% response.

If the markers do not fall within this requirement, switch to channel 8 and readjust C9, C11, C15 and C18 as necessary.

Turn off the sweep generator and check the channel 8 oscillator frequency. If C1 has to be readjusted for channel 8, the principle of overshooting the adjustment and then correcting by adjusting L46 should be followed in order to establish the L/C ratio for the desired oscillator tracking.

Turn off the sweep generator and check the channel 6 oscillator frequency. Adjust L5 for correct oscillator frequency, 129 mc.

Turn the sweep generator on and to channel 6 and observe the response curve. If necessary readjust L48, L50 and L53.

For KRK11A units switch to channel 2 and tune T1 clockwise to a point where there is no change in the channel 2 response as T1 is turned.

Switch the receiver through channel 6 down through channel 2 and check for normal response curve shapes and oscillator injection voltage.

If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt, then switch to channel 6 and adjust L53 for maximum amplitude of curve between carrier markers. This adjustment should produce "flat" response on the low channels if the other adjustments, especially L48, are correct.

Likewise check r-f response and oscillator injection on channels 7 through 13, stopping on 13 for the next step.

With the receiver on channel 13, check the receiver oscillator frequency. Correct by adjustment of C1 in KRK11 or C2 in KRK11A if necessary.

Adjust the oscillator to frequency on all channels by switching the receiver and the frequency standard to each channel and adjusting the appropriate oscillator trimmer to obtain the audible beat. It should be possible to adjust the oscillator to the correct frequency on all channels with the fine tuning control in the middle third of its range. When employing WR39 calibrators to adjust the receiver oscillator, tune the calibrator to one half the receiver oscillator frequency on channels 4, 5 and 6 and to one fourth the receiver oscillator frequency on channels 11, 12 and 13.

ALIGNMENT PROCEDURE

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.	Channel Oscillator Adjustment
2	55.25	59.75	101	L1
3	61.25	65.75	107	L2
4	67.25	71.75	113	L3
5	77.25	81.75	123	L4
6	83.25	87.75	129	L5
7	175.25	179.75	221	L6
8	181.25	185.75	227	L7
9	187.25	191.75	233	L8
10	193.25	197.75	239	L9
11	199.25	203.75	245	L10
12	205.25	209.75	251	L11
13	211.25	215.75	257	C1

Remove the 39 ohm resistor from the link and reconnect the link to terminals "A" and "B" of T104.

RATIO DETECTOR ALIGNMENT.—In order to obtain good ratio detector alignment an AM modulated signal generator that is exceptionally free from FM modulation must be employed. Set the signal generator at 4.5 mc. and connect it to the second sound i-f grid, pin 1 of V102. Set the generator for 30% 400 cycle modulation.

As an alternate source of signal, the RCA WR39B or WR39C calibrator may be employed. If used, connect it to the grid of the 4th pix i-f amplifier, pin 1, V109. Set the frequency of the calibrator to 45.75 (pix carrier) and modulate with 4.5 mc. crystal. Also turn on the internal AM audio modulation. The 4.5 mc. signal will be picked off at T110A and amplified through the Sound i-f amplifier.

Connect the "VoltOhmyst" to the junction of R110 and R114.

Connect the oscilloscope across the speaker voice coil and turn the volume control for maximum output.

Adjust C226 on the bottom of the V103 socket for minimum capacity.

Tune the ratio detector primary, T102 top core for maximum DC output on the "VoltOhmyst." Adjust the signal level from the signal generator for minus 10 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

Connect the "VoltOhmyst" to the junction of R112 and C113.

Adjust the T102 bottom core for zero d-c on the meter. Then, turn the core to the nearest minimum AM output on the oscilloscope.

Repeat adjustments of T102 top for maximum DC and T102 bottom for minimum output on the oscilloscope making final adjustment with the 4.5 mc. input level adjusted to produce 10 volts d-c on the "VoltOhmyst" at the junction of R110 and R114.

Connect the "VoltOhmyst" to the junction of R112 and C113 and note the amount of d-c present. If this voltage exceeds ±1.5 volts, adjust C226 by turning it in until zero d-c is obtained. Readjust the T102 bottom core for minimum output on the oscilloscope. Repeat adjustments of C226 and T102 bottom core until the voltage at R112 and C113 is less than ±1.5 volts when T102 bottom core is set for minimum output on the oscilloscope.

Connect the "VoltOhmyst" to the junction of R110 and R114 and repeak T102 top core for maximum d-c on the meter and again reset the generator so as to have —10 volts on the meter.

Repeat the adjustments in the above two paragraphs until the voltage at R112 and C113 is less than ±1.5 volts when the T102 top core is set for maximum d-c at the junction of R110 and R114 and the T102 bottom core is set for minimum indication on the oscilloscope.

SOUND I-F ALIGNMENT.—Connect the sweep generator to the first sound i-f amplifier grid, pin 1 of V101. Adjust the generator for a sweep width of 1 mc. at a center frequency of 4.5 mc.

Insert a 4.5 mc. marker signal from the signal generator into the first sound i-f grid. With the WR39B or WR39C calibrators the 4.5 mc. crystal signal may be obtained at the R-F out terminal by turning the variable osc. switch off, the calibrate switch to 4.5 mc. and the volume control with mod. off.

Connect the oscilloscope in series with a 10,000 ohm resistor to terminal A of T101.

Adjust T101 top and bottom cores for maximum gain and symmetry about the 4.5 mc. marker on the i-f response. The pattern obtained should be similar to that shown in Figure 14.

The output level from the sweep should be set to produce approximately 2.0 volt peak-to-peak at terminal A of T101 when the final touches on the above adjustment are made. It is necessary that the sweep output voltage should not exceed the specified values otherwise the response curve will be broadened, permitting slight misadjustment to pass unnoticed and possibly causing distortion on weak signals.

Connect the oscilloscope to the junction of R112 and C113 and check the linearity of the response. The pattern obtained should be similar to that shown in Figure 15.

SOUND TAKE-OFF ALIGNMENT.—Connect the 4.5 mc. generator in series with a 1000 ohm resistor to terminal "C" of T110. The input signal should be approximately 0.5 volt.

Short the fourth pix i-f grid to ground, pin 1 V109, to prevent noise from masking the output indication.

As an alternate source of signal the RCA WR39B or WR39C calibrator may be used. In such a case, disregard the above two paragraphs. Connect calibrator across link circuit, T104 A, B, and modulate 45.75 with 4.5 mc. crystal.

Connect the crystal diode probe of a "VoltOhmyst" to the plate of the video amplifier, pin 8 of V110.

Adjust the core of T110 for minimum output on the meter.

Remove the short from pin 1 V109 to ground, if used.

PICTURE I-F TRAP ADJUSTMENT.—Connect the i-f signal generator across the link circuit on terminals A and B of T104.

Connect the "VoltOhmyst" to the junction of R143 and R144.

Obtain a 7.5 volt battery capable of withstanding appreciable current drain and connect the ends of a 1,000 ohm potentiometer across it. Connect the battery positive terminal to chassis and the potentiometer arm to the junction of R143 and R144.

Set the bias to produce approximately —1.0 volt of bias at the junction of R143 and R144.

Connect the "VoltOhmyst" to pin 2 of V110, the 6AG7 video amplifier.

Set the signal generator to each of the following frequencies and adjust the corresponding circuit for minimum d-c output at pin 2 of V110. Use sufficient signal input to produce 1.0 volt of d-c on the meter when the final adjustment is made.

39.25 mc.	T104 top core
41.25 mc.	T105 bottom core
47.25 mc.	T106 bottom core

PICTURE I-F TRANSFORMER ADJUSTMENTS.—Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst." During alignment, reduce the input signal if necessary in order to produce 1.0 volt of d-c at pin 2 of V110 with —1.0 volt of i-f bias at the junction of R143 and R144.

43.7 mc.	T109
45.5 mc.	T108
41.8 mc.	T107

To align T105 and T106, connect the sweep generator to the first picture i-f grid, pin 1 of V106 through a 1000 mmf. ceramic capacitor. Shunt R141, R149 and terminals "A" and "F" of T109 with 330 ohm composition resistors. Set the i-f bias to —1.0 volt at the junction of R143 and R144.

Connect the oscilloscope to pin 2 of V110.

Adjust T105 and T106 top cores for maximum gain and curve shape as shown in Figure 16. For final adjustment set the output of the sweep generator to produce 0.5 volt peak-to-peak at the oscilloscope terminals.

To align T1 and T104, connect the sweep generator to the mixer grid test point TP2. Use the shortest leads possible, with not more than one inch of unshielded lead at the end of the sweep cable.

Set the channel selector switch to channel 4.

Connect a 180 ohm composition resistor from terminal B of T105 to the junction of R135 and C132. Connect the oscilloscope diode probe to terminal B of T105 and to ground.

Couple the signal generator loosely to the diode probe in order to obtain markers.

In some receivers, C221 is variable and is provided as a bandwidth adjustment. Preset C221 to minimum capacity.

Adjust T1 (top) and T104 (bottom) for maximum gain at 43.5 mc. and with 45.75 mc. at 70% of maximum response.

Adjust C221 until 41.25 mc. is at 85% response with respect to the low frequency shoulder at approximately 41.9 mc. as shown in Figure 17.

In receivers in which C221 is fixed, adjust T1 (top) and T104 (bottom) for maximum gain and the response shown in Figure 17.

Disconnect the diode probe, the 180 ohm and three 330 ohm resistors.

SWEEP ALIGNMENT OF PIX I-F.—Connect the oscilloscope to pin 2 of V110.

Adjust the bias potentiometer to obtain —6.0 volts of bias as measured by a "VoltOhmyst" at the junction of R143 and R144.

Leave the sweep generator connected to the mixer grid test point TP2 with the shortest leads possible and with not more than one inch of unshielded lead at the end of the sweep cable. If these precautions are not observed, the receiver may be unstable and the response curves obtained may be unreliable.

Adjust the output of the sweep generator to obtain 3.0 volts peak-to-peak on the oscilloscope.

Couple the signal generator loosely to the grid of the first pix i-f amplifier. Adjust the output of the signal generator to produce small markers on the response curve.

Retouch T108 and T109 to obtain the response shown in Figure 18. Do not adjust T107 unless absolutely necessary. If T107 is adjusted too low in frequency it will raise the level of the 41.25 mc. sound i-f carrier and may create interference in the picture. It will also cause poor adjacent channel picture rejection. If T107 is tuned too high in frequency, the level of the 41.25 mc. sound i-f carrier will be too low and may produce noisy sound in weak signal areas.

Remove the oscilloscope, sweep and signal generator connections.

Remove the bias box employed to provide bias for alignment.

HORIZONTAL OSCILLATOR ADJUSTMENT. — Normally the adjustment of the horizontal oscillator is not considered to be a part of the alignment procedure, but since the oscillator waveform adjustment may require the use of an oscilloscope, it can not be done conveniently in the field. The waveform adjustment is made at the factory and normally should not require readjustment in the field. However, the waveform adjustment should be checked whenever the receiver is aligned or whenever the horizontal oscillator operation is improper.

Horizontal Frequency Adjustment.—Tune in a station and sync the picture. If the picture cannot be synchronized with the horizontal hold control R201B, then adjust the T114 frequency core on the rear apron until the picture will synchronize. If the picture still will not sync, turn the T114 waveform adjustment core (under the chassis) out of the coil several turns from its original position and readjust the T114 frequency core until the picture is synchronized.

Examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C181B, the width control L106 and the linearity control L107 until the picture is correct.

Horizontal Oscillator Waveform Adjustment.—The horizontal oscillator waveform may be adjusted by either of two methods. The method outlined in paragraph A below may be employed in the field when an oscilloscope is not available. The service shop method outlined in paragraph B below requires the use of an oscilloscope.

A.—Turn the horizontal hold control completely clockwise. Place adjustment tools on both cores of T114 and be prepared to make simultaneous adjustments while watching the picture on the screen. First, turn the T114 frequency core (on the rear apron) until the picture falls out of sync and one diagonal black bar sloping down to the right appears on the screen. Then, turn the waveform adjustment core (under the chassis) into the coil while at the same time adjusting the frequency core so as to maintain one diagonal black bar on the screen. Continue this procedure until the oscillator begins to motorboat, then turn the waveform adjustment core out until the motorboating just stops. As a check, turn the T114 frequency core until the picture is synchronized then reverse the direction of rotation of the core until the picture begins to fall out of sync with the diagonal bar sloping down to the right. Continue to turn the frequency core in the same direction. Additional bars should not appear on the screen. Instead, the horizontal oscillator should begin to motorboat. Retouch the adjustment of the T114 waveform adjustment core if necessary until this condition is obtained.

B.—Connect the low capacity probe of an oscilloscope to terminal C of T114. Turn the horizontal hold control one-quarter turn from the clockwise position so that the picture is in sync. The pattern on the oscilloscope should be as shown in Figure 19. Adjust the waveform adjustment core of T114 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator becomes more serious. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is overstabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Horizontal Locking Range Adjustment.—Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the T114 frequency core slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 2 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer C181A slightly clockwise. If less than 2 bars are present, adjust C181A slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point. Repeat this procedure until 2 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the T114 frequency core so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

SENSITIVITY CHECK.—A comparative sensitivity check can be made by operating the receiver on a weak signal from a television station and comparing the picture and sound obtained to that obtained on other receivers under the same conditions. This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad.

RESPONSE CURVES.—The response curves shown on page 14 are typical, though some variations can be expected.

The response curves are shown in the classical manner of presentation, that is with "response up" and low frequency to the left. The manner in which they will be seen in a given test set-up will depend upon the characteristics of the oscilloscope and the sweep generator.

NOTES ON R-F UNIT ALIGNMENT.—Because of the frequency spectrum involved, many of the r-f unit leads are critical in some respects. Even the power supply leads form loops which couple to the tuned circuits, and if resonant at any of the frequencies involved in the performance of the tuner, may cause serious departures from the desired characteristics. In the design of the receiver these undesirable resonant loops have been shifted far enough away in frequency to allow reasonable latitude in physical arrangement without being troublesome. When the r-f unit is aligned in the receiver, no trouble from resonant loops should be experienced. However, if the unit is aligned in a jig separate from the receiver, attention should be paid to insure that unwanted resonance does not exist which might present a faulty representation of alignment.

A resonant circuit exists between the r-f tuner chassis and the outer shield box, which couples into the antenna and r-f plate circuits. The frequency of this resonance depends on the structure of the shield box. This resonance is controlled by using insulating washers of proper thickness in the front plate to tuner chassis mounting. Obviously, if the r-f unit is removed for service, the washers should be replaced in the correct order.

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 8 SHOULD BE READ BEFORE ALIGNMENT BY USE OF THE TABLE IS ATTEMPTED

Step No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
	ANTENNA MATCHING UNIT ALIGNMENT									
1	Do not adjust this unit unless fairly certain that it requires adjustment. Disconnect lead from L58 to S5. Connect output of matching unit through 1000 mmf. to pin 1 of V107. Replace cover on matching unit. Remove V106 from socket. Connect bias box to junction of R143 and R144 and set to produce −6 volts.									
2	Antenna terminals	45.75 mc. 30% mod.	Not used	—	Not used	—	Pin 2, V110 Scope gain to max.	—	L59 for min. audio on scope	Fig. 7
3	"	41.25 mc. 30% mod.	"	—	"	—	"	—	L60 for min. audio on scope	Fig. 7
4	Antenna terminals loosely	—	Antenna terminals through pad	45 to 54 mc.	"	—	Scope a xtal probe to gnd.	Connect 300 ohms from L58 to gnd.	L61 and L62 to obtain response of Fig. 12	Fig. 7 Fig. 11 Fig. 12
	R-F UNIT ALIGNMENT									
5	If unit is completely out of adjustment, preset all adjustments to center of range with following exceptions. Set C18 so that head is 3/8" above chassis. Set C11 1/4 turn from max. clockwise. Disconnect link from T104 and terminate with 39 ohms. Short r-f unit power terminal 3 to ground. Set fine tuning 30 degrees clockwise from mechanical center of its range for all oscillator adjustments.									
6	Grid, pin 7 of V2 through 1500 mmf.	43.5 mc. 30% mod.	Not used	—	Not used	—	TP1. Gain to maximum	Set r-f unit on channel 2	L65 for min. indication on scope	Fig. 7 Fig. 10
7	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C1-KRK11, or C2-KRK-11A for beat on freq. meter	Fig. 7
8	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	R-F unit on channel 8. Set T1 max. counterclockwise	C9, C11, C15 and C18 for response shown in in Fig. 13	Fig. 7 Fig. 13
9	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	R-F unit on channel 6	L5 for beat on het. freq. meter	Fig. 8
10	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	"	L48, L50 and L53 for response shown in Fig. 13	Fig. 7 Fig. 13
11	Not used	—	Not used	—	Not used	—	Not used	On channel 6. Connect "VoltOhmyst" to TP1	C8 for −3.5 volts on meter	Fig. 7
12	Antenna terminals loosely	83.25 and 87.75	Antenna terminals through pad	Channel 6	Not used	—	TP1. Gain to maximum	R-F unit on channel 6	Check response. Readjust L48, L50 and L53 if necessary	Fig. 7 Fig. 13
13	Not used	—	Not used	—	Loosely to r-f unit oscillator	227 mc.	Not used	R-F unit on channel 8	C1-KRK11, or C2-KRK-11A for beat on freq. meter	Fig. 7
14	Antenna terminals loosely	181.25 and 185.75	Antenna terminals through pad	Channel 8	Not used	—	TP1. Gain to maximum	"	Check response adjust C9, C11, C15 and C18 if necessary	Fig. 7
15	If C9 was readjusted in step 14, repeat step 11, step 13 and step 14 until the conditions specified in each step are fulfilled without additional adjustments.									
16	Not used	—	Not used	—	Loosely to r-f unit oscillator	257 mc.	Not used	Rec. on channel 13	L46 for beat on het. freq. meter. Overshoot L46 slightly and adjust C1-KRK11 or C2-KRK-11A for beat	Fig. 7
17	Antenna terminals loosely	211.25 215.75	Antenna terminals through pad	Channel 13	Not used	—	TP1. Gain to maximum	Rec. on channel 13 "VoltOhmyst" on TP1	Check to see that response is correct and −3.0 volts of osc. injection is present	Fig. 13
18	"	205.25 209.75	"	Channel 12	Not used	—	"	Rec. on channel 12	"	Fig. 13
19	"	199.25 203.75	"	Channel 11	"	—	"	Rec. on channel 11	"	Fig. 13
20	"	193.25 197.75	"	Channel 10	"	—	"	Rec. on channel 10	"	Fig. 13
21	"	187.25 191.75	"	Channel 9	"	—	"	Rec. on channel 9	"	Fig. 13
22	"	181.25 185.75	"	Channel 8	"	—	"	Rec. on channel 8	"	Fig. 13
23	"	175.25 179.75	"	Channel 7	"	—	"	Rec. on channel 7	"	Fig. 13
24	If the response of any channel (steps 17 through 23) is below 80% at either marker, adjust C9, C11, C15 and C18 as necessary to pull response up on the low channel yet maintain correct response on channel 8.									
25	Repeat step 13. If the oscillator is off frequency overshoot the adjustment of C1 in KRK11 or C2 in KRK11A and correct by adjusting L46.									
26	Repeat steps 16 through 25 until all adjustments are obtained.									
27	Not used	—	Not used	—	Loosely to r-f unit oscillator	129 mc.	Not used	Rec. on channel 6	L5 for beat on het. freq. meter	Fig. 7
28	Antenna terminals loosely	55.25 59.75	Antenna terminals through pad	Channel 2	Not used	—	TP1. Gain to maximum	Rec. on channel 2	Adjust T1 core clockwise to a point at which channel 2 response does not change	Fig. 7
29	"	83.25 87.75	"	Channel 6	Not used	—	"	Rec. on channel 6. "VoltOhmyst" on TP1	Check to see that response is correct and −3.0 volts of osc. injection is present	Fig. 7 Fig. 13
30	"	77.25 81.75	"	Channel 5	"	—	"	Rec. on channel 5	"	Fig. 13
31	"	67.25 71.75	"	Channel 4	"	—	"	Rec. on channel 4	"	Fig. 13

ALIGNMENT TABLE

Step No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
32	"	61.25 65.75	"	Channel 3	"	—	"	Rec. on channel 3	"	Fig. 13
33	"	55.25 59.75	"	Channel 2	"	—	"	Rec. on channel 2	"	Fig. 13
34	If excessive tilt in the same direction occurs on channels 2, 3 and 4, adjust C18 on channel 2 to overshoot the correction of this tilt then switch to channel 6 and adjust L53 for max. amplitude of response between carrier markers.									
35	Check r-f response and oscillator injection on channels 7 through 13 steps 23 back up through step 17 stopping on channel 13 for the next step.									
36	Not used	—	Not used	—	Loosely coupled to r-f oscillator	257 mc.	TP1. Gain to maximum	Rec. on channel 13	C1-KRK11 or C2-KRK-11A for beat on het. freq. meter	Fig. 7
37	"	—	"	—	"	251 mc.	"	Rec. on channel 12	L11 as above	Fig. 7
38	"	—	"	—	"	245 mc.	"	Rec. on channel 11	L10 as above	Fig. 7
39	"	—	"	—	"	239 mc.	"	Rec. on channel 10	L9 as above	Fig. 7
40	"	—	"	—	"	233 mc.	"	Rec. on channel 9	L8 as above	Fig. 7
41	"	—	"	—	"	227 mc.	"	Rec. on channel 8	L7 as above	Fig. 7
42	"	—	"	—	"	221 mc.	"	Rec. on channel 7	L6 as above	Fig. 7
43	"	—	"	—	"	129 mc.	"	Rec. on channel 6	L5 as above	Fig. 7
44	"	—	"	—	"	123 mc.	"	Rec. on channel 5	L4 as above	Fig. 7
45	"	—	"	—	"	113 mc.	"	Rec. on channel 4	L3 as above	Fig. 7
46	"	—	"	—	"	107 mc.	"	Rec. on channel 3	L2 as above	Fig. 7
47	"	—	"	—	"	101 mc.	"	Rec. on channel 2	L1 as above	Fig. 7
48	Repeat steps 35 through 46 as a check. On completion, remove 39 ohm resistor and reconnect link to terminals A and B of T104.									
	RATIO DETECTOR, SOUND I-F AND SOUND TAKE-OFF ALIGNMENT									
49	Grid. 2nd Snd. I-F (pin 1, V102) or WR39B or C connect to grid 4th pix I-F (pin 1, V109)	4.5 mc. 400 cy. mod. or 45.75 mc. mod. by 4.5 mc. and 400 cy.	Not used	—	Not used	—	Across speaker voice coil. Volume control set for max. volume	"VoltOhmyst" to junction of R110 and R114. Set C226 for min. capacity. Set signal gen. to give −10 V on meter.	T102 top core for max. d-c on meter. T102 bottom core for min. audio on the oscilloscope.	Fig. 9 Fig. 10
50	"	"	"	—	"	—	"	"VoltOhmyst" to junction R112 and C113. If the meter reads more than ±1.5 volts, adjust C226 for zero on the meter and readjust T102 (bot.) for min. output on scope. Repeat steps 49 and 50 until all conditions are satisfied.		Fig. 9 Fig. 10
51	Sig. Gen. to 1st Snd. I-F	4.5 mc.	1st Sound I-F grid (pin 1, V101)	4.5 mc.	"	—	In series with 10,000 ohms to terminal A, of T101	Sweep output reduced to provide 2 v p-p on scope.	T101 top and bot. cores for max. gain and symmetry at 4.5 mc.	Fig. 9 Fig. 10 Fig. 14
52	"	"	"	"	"	—	Junction of R112 and C113	Check for symmetrical response wave-form (positive and negative).		Fig. 15
53	Sig. Gen. in series with 1000 ohms to T110-C or WR39 across T104 A and B	"	Not used	—	"	—		"VoltOhmyst" xtal probe to pin 8, V110. If sig. gen. is used short pin 1, V109 to ground.	Adjust T110 for minimum reading on "VoltOhmyst"	Fig. 9
	PICTURE I-F AND TRAP ADJUSTMENT									
54	Not used	—	Not used	—	Not used	—	Not used	Connect bias box and "VoltOhmyst" to junction of R143 and R144 and to gnd. Adjust bias box to give −1.0 v on "VoltOhmyst".		
55	Sig. Gen. across T104 A and B	39.25 mc.	"	—	"	—	"	"VoltOhmyst" to pin 2, V110. Gen. output to give −1.0 volt d-c.	T104 top core to give min. d-c on meter.	Fig. 9
56	"	41.25 mc.	"	—	"	—	"	"	T105 bot. for min.	Fig. 10
57	"	47.25 mc.	"	—	"	—	"	"	T106 bot. for min.	Fig. 10
58	"	43.7 mc.	"	—	"	—	"	Sig. Gen. output to give −1.0 V dc at Pin 2, V110.	T109 for max.	Fig. 7
59	"	45.5 mc.	"	—	"	—	"	"	T108 for max.	Fig. 9
60	"	41.8 mc.	"	—	"	—	"	"	T107 for max.	Fig. 9
61	First pix i-f grid (pin 1, V106) loosely	Various See Fig. 16	First pix i-f grid pin 1, V106 through 1000 mmf.	40 to 48 mc.	"	—	To pin 2 of V110	Shunt R141, R149 and terminals A and F of T109 with 330 ohms, 0.5 v p-p on scope.	Adjust T105 and T106 top cores for max. gain and response shown in in Fig. 16.	Fig. 9 Fig. 16
62	Connected loosely to diode probe	Various See Fig. 17	Mixer grid test point TP2 with short lead	40 to 48 mc.	"	—	Scope diode probe to T105-B and to gnd.	Rec. on chan. 4. Connect 180 ohms from T105-B to junction R135 and C132. Upon completion disconnect scope and shunting resistors.	Set C221 to min. Adjust T1 top and T104 bot. for max. gain at 43.5 mc. and 45.75 mc. at 70%. Adjust C221 until 41.25 mc. is at 80%.	Fig. 9 Fig. 17
63	Connected loosely to grid of 1st pix i-f	Various See Fig. 18	"	"	"	—	Connect scope to pin 2 of V110	"VoltOhmyst" to pin 2, V110. Set bias box for −6.0 volts on the meter. Set sweep output to produce 3.0 volts p-p on scope.	Retouch T108 and T109 to obtain response shown in Fig. 18. Do not adjust T107 unless absolutely necessary.	Fig. 18

ALIGNMENT DATA

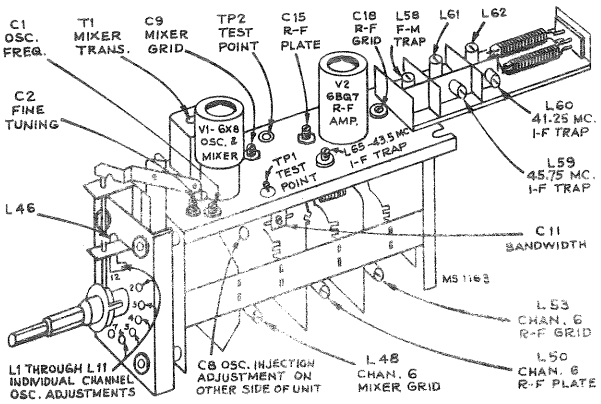


Figure 7—R-F Unit Adjustments

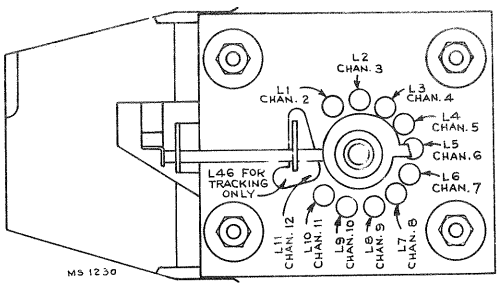


Figure 8—R-F Oscillator Adjustments

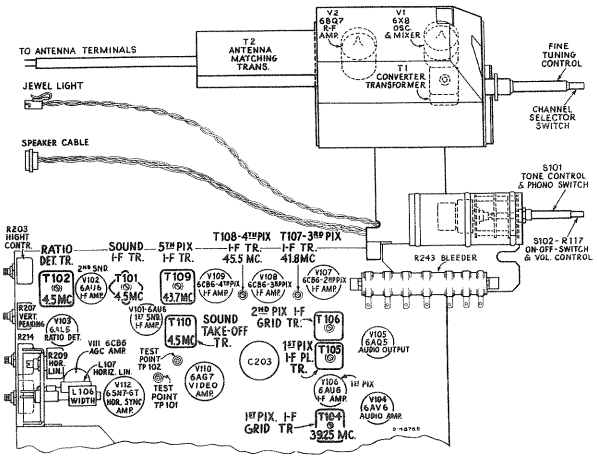


Figure 9—Top Chassis Adjustments

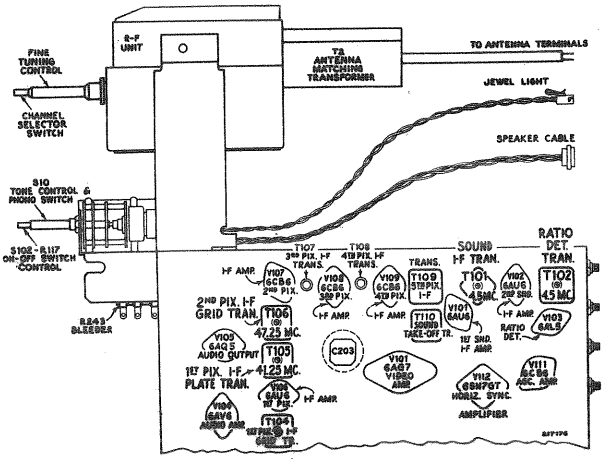


Figure 10—Bottom Chassis Adjustments

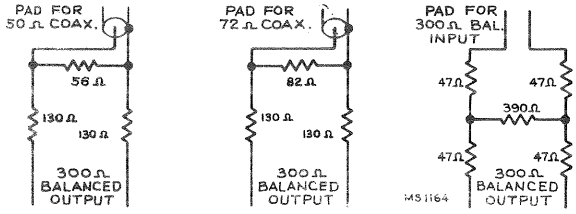


Figure 11—Sweep Attenuator Pads

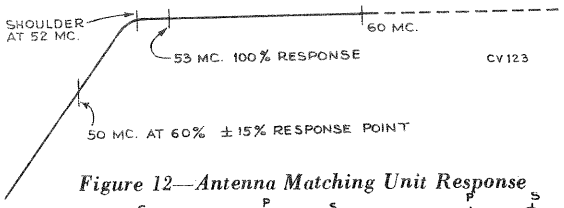


Figure 12—Antenna Matching Unit Response

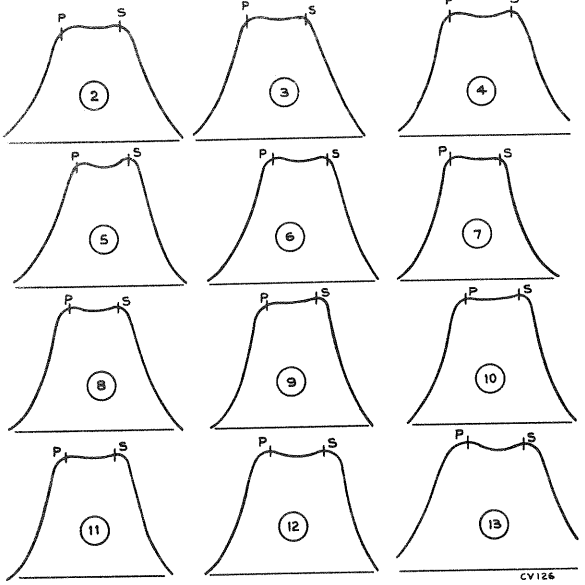


Figure 13—R-F Response

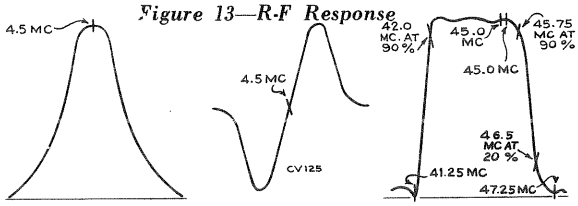


Figure 14 Sound I-F Response

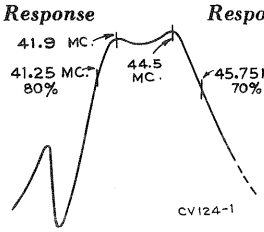


Figure 15 Ratio Det. Response

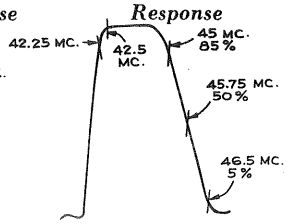


Figure 16 T105 and T106 Response

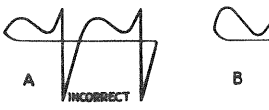


Figure 17 T1 and T104 Response

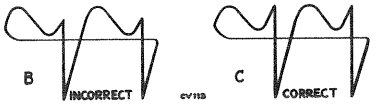


Figure 18 Over-all I-F Response

Figure 19—Horizontal Oscillator Waveforms

SERVICE SUGGESTIONS

Following is a list of symptoms of possible failures and an indication of some of the possible faults:

NO RASTER ON KINESCOPE:

(1) Incorrect adjustment of ion trap magnet. Magnet reversed either front to back or top to bottom.

(2) V116 or V117 inoperative. Check waveforms on grids and plates.

(3) No high voltage—if horizontal deflection is operating as evidenced by the correct waveform on terminal 1 of high voltage transformer, the trouble can be isolated to the 1B3GT circuit. Either the T115 high voltage winding is open, the 1B3GT tube is defective, its filament circuit is open or C197 is shorted.

(4) V110 circuit inoperative—Refer to schematic and waveform chart.

(5) Damper tubes (V119 or V120) inoperative.

(6) Defective kinescope.

(7) R218 open.

(8) No receiver plate voltage—filter capacitor shorted—or filter choke open.

NO VERTICAL DEFLECTION:

(1) V114B or V115 inoperative. Check voltage and waveforms on grids and plates.

(2) T111 or T112 open.

(3) Vertical deflection coils open.

SMALL RASTER:

(1) Low Plus B or low line voltage.

(2) V117 defective.

POOR VERTICAL LINEARITY:

(1) If adjustments cannot correct, change V115.

(2) Vertical output transformer T112 defective.

(3) V114B defective—check voltage and waveforms on grid and plate.

(4) C170, C171, C201D or C202B defective.

(5) Low plate voltage—check rectifiers and capacitors in supply circuits.

(6) If height is insufficient, try changing V114.

POOR HORIZONTAL LINEARITY:

(1) If adjustments do not correct, change V117, V119 or V120.

(2) T115 or L107 defective.

(3) C195 or C219 defective.

WRINKLES ON SIDE OF RASTER:

(1) C193 defective.

(2) Defective yoke.

PICTURE OUT OF SYNC HORIZONTALLY:

(1) T114 incorrectly tuned.

(2) R226, R227 or R201B defective.

TRAPEZOIDAL OR NON SYMMETRICAL RASTER:

(1) Improper adjustment of focus magnet or ion trap magnet.

(2) Defective yoke.

RASTER AND SIGNAL ON KINESCOPE BUT NO SOUND:

(1) T110 defective.

(2) Sound i-f, ratio detector or audio amplifier inoperative—check V101, V102, V103 and their socket voltages.

(3) Audio system defective.

(4) Speaker defective.

SIGNAL AT KINESCOPE GRID BUT NO SYNC:

(1) AGC control control R175 misadjusted.

(2) V111, inoperative. Check voltage and waveforms at its grid and plate.

SIGNAL ON KINESCOPE GRID BUT NO VERTICAL SYNC:

(1) Check V114B and associated circuit—C165, etc.

(2) Integrating network inoperative—Check.

(3) V113 or V114A defective or associated circuit defective.

(4) Gas current grid emission or grid cathode leakage in V114. Replace.

SIGNAL ON KINESCOPE GRID BUT NO HORIZONTAL SYNC:

(1) T114 misadjusted—readjust as instructed on page 11.

(2) V112 or V113 inoperative—check socket voltages and waveforms.

(3) T114 defective.

(4) C215, C157, C181A, C182, C183, C184, C185, C186 or C187 defective.

(5) If horizontal speed is completely off and cannot be adjusted check R226, R227, R201B, R229, R230 and R231.

SOUND AND RASTER BUT NO PICTURE OR SYNC:

(1) Picture, detector or video amplifier defective—check CR101 and V110—check socket voltages.

(2) Bad contact to kinescope cathode.

PICTURE STABLE BUT POOR RESOLUTION:

(1) CR101 or V110 defective.

(2) Peaking coils defective—check resistance.

(3) Make sure that the focus control operates on both sides of proper focus.

(4) R-F and I-F circuits misaligned.

PICTURE SMEAR:

(1) R-F or I-F circuits misaligned.

(2) Open peaking coil.

(3) This trouble can originate at the transmitter—check on another station.

PICTURE JITTER:

(1) AGC control R175 misadjusted.

(2) If regular sections at the left picture are displaced change V117.

TEST PATTERN PHOTOGRAPHS

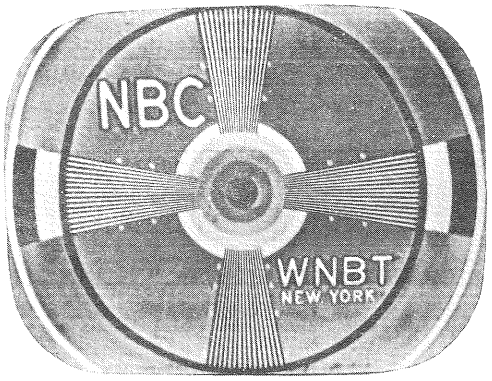


Figure 20—Normal Picture

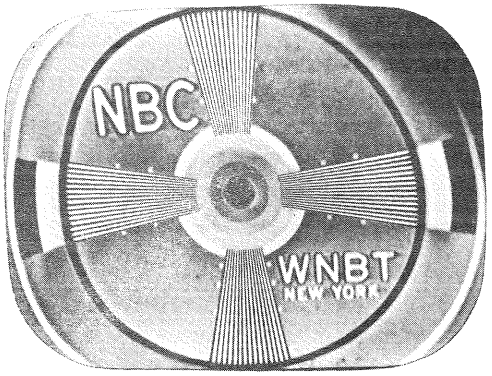


Figure 21—Focus Magnet and Ion Trap Magnet Misadjusted

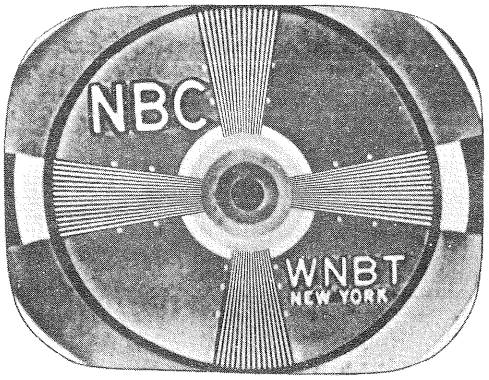


Figure 22—Horizontal Linearity Control Misadjusted (Picture Cramped in Middle)

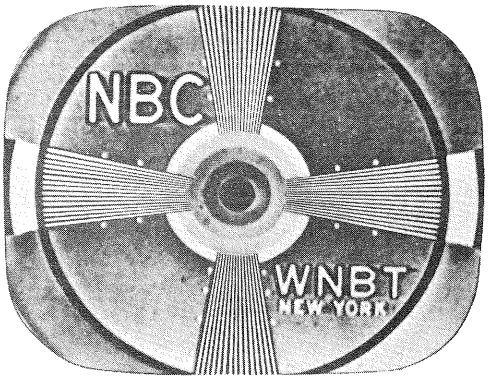


Figure 23—Width Control Misadjusted

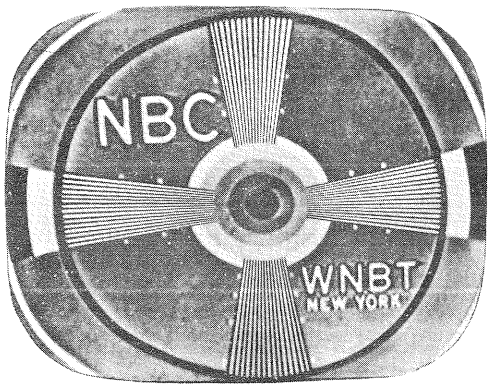


Figure 24—Horizontal Drive Control Misadjusted

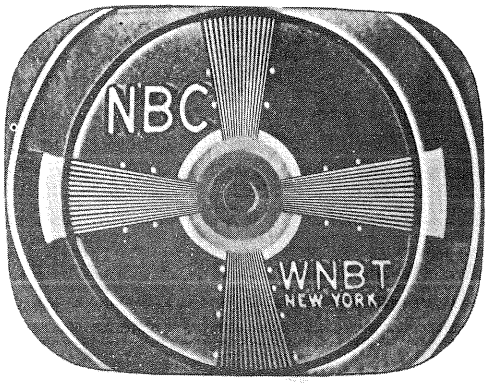


Figure 25—Transients

Figure 26—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is in a Counter-clockwise Position—Just Before Pulling Into Sync

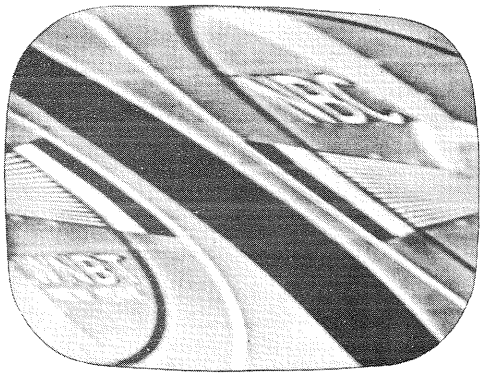


Figure 27—Test Pattern Showing Out of Sync Condition When Horizontal Hold Control Is at the Maximum Clockwise Position

SERVICE SUGGESTIONS

(3) Vertical instability may be due to loose connections or noise.

(4) Horizontal instability may be due to unstable transmitted sync.

RASTER BUT NO SOUND, PICTURE OR SYNC:

(1) Defective antenna or transmission line.

(2) R-F oscillator off frequency.

(3) R-F unit inoperative—check V1, V2.

DARK VERTICAL LINE ON LEFT OF PICTURE:

(1) Reduce horizontal drive and readjust width and horizontal linearity.

(2) Replace V117.

LIGHT VERTICAL LINE ON LEFT OF PICTURE:

(1) C193 defective.

(2) V119 or V120 defective.

PICTURE I-F RESPONSE.—At times it may be desirable to observe the individual i-f stage response. This can be achieved by the following method:

For T107, T108 or T109, shunt all i-f transformers with a 330 ohm carbon resistor except the one whose response is to be observed.

Connect a wide band sweep generator to the second pix i-f grid and adjust it to sweep from 38 mc. to 48 mc.

Connect the oscilloscope to test point TP102 and observe the overall response. The response obtained will be essentially that of the unshunted stage.

To see the response of transformers T1, T104 and T105, T106, follow the instructions given on page 10.

Figures 28 through 36 show the response of the various stages obtained in the above manner. The curves shown are typical although some variation between receivers can be expected. Relative stage gain is not shown.

RESPONSE PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

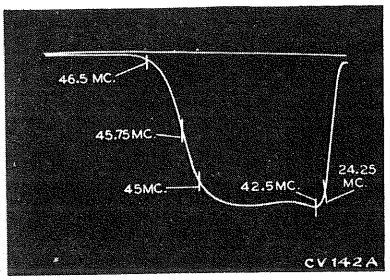


Figure 28—Overall Pix I-F Response

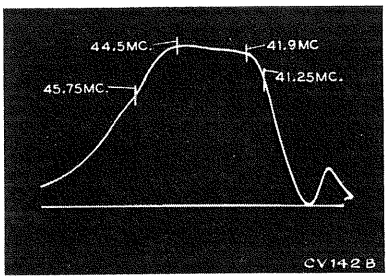


Figure 29—Response of T1-T104 Pix I-F Transformers

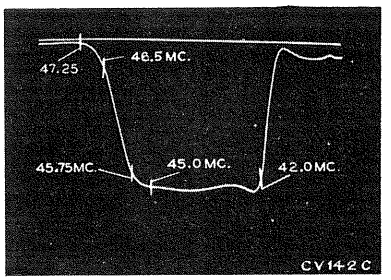


Figure 30—Response of T105-T106 Pix I-F Transformer

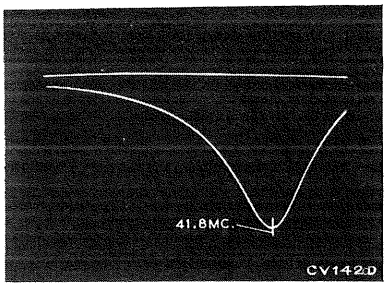


Figure 31—Response of T107 Pix I-F Transformer

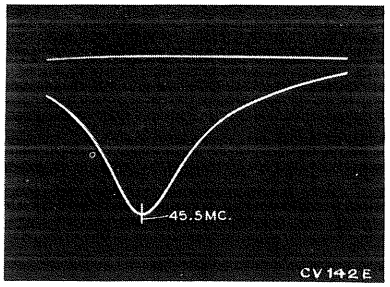


Figure 32—Response of T108 Pix I-F Coil

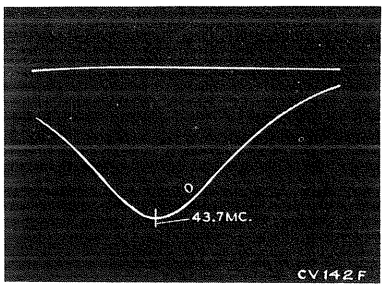


Figure 33—Response of T109 Pix I-F Coil

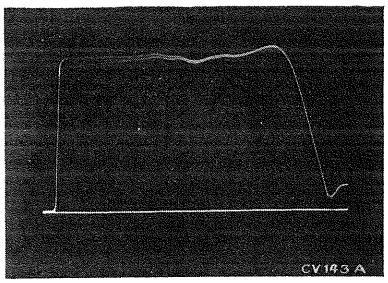


Figure 34—Video Response at Average Contrast

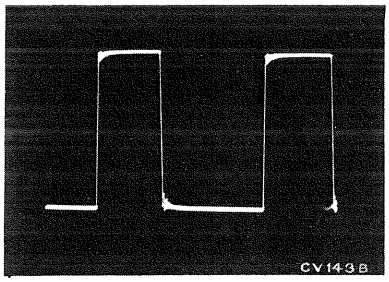


Figure 35—Video Response (100 KC Square Wave)

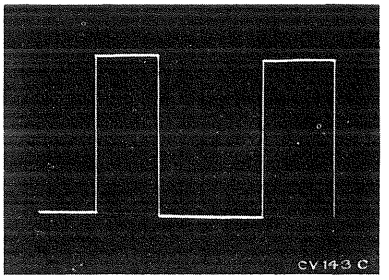
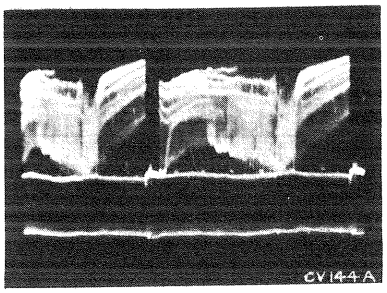


Figure 36—Video Response (60 Cycle Square Wave)

WAVEFORM PHOTOGRAPHS

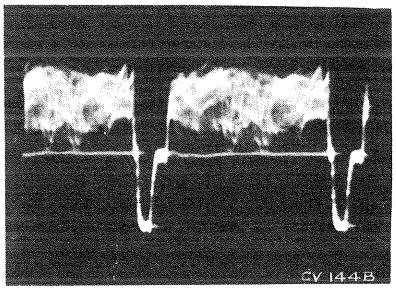
Taken from RCA WO58A Oscilloscope



Grid of 1st Video Amplifier (Pin 4 of V110) (6AG7)

Figure 37—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (5.5 Volts PP)

Figure 38—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (5.5 Volts PP)



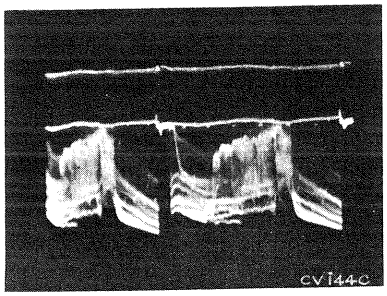
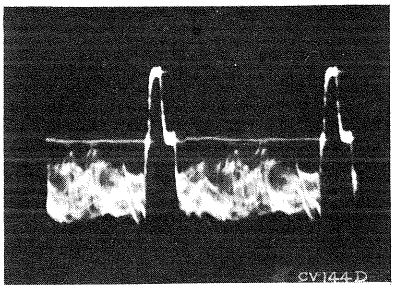


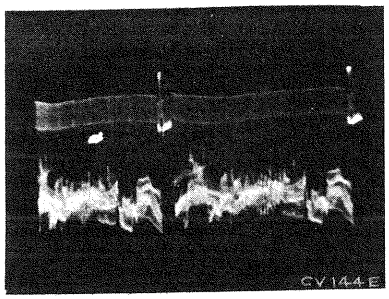
Plate of 1st Video Amplifier (Pin 8 of V110) (6AG7)

Voltage depends on picture

Figure 39—Vertical (110 Volts PP)

Figure 40—Horizontal (110 Volts PP)



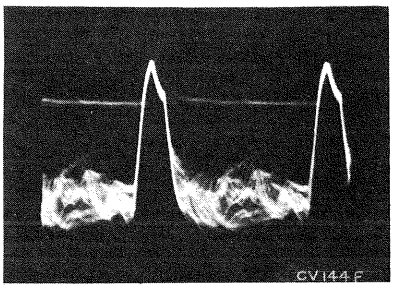


Grid of Sync Separator (Pin 4 of V113) (6SN7)

Voltage depends on picture

Figure 41—Vertical (75 Volts PP)

Figure 42—Horizontal (75 Volts PP)



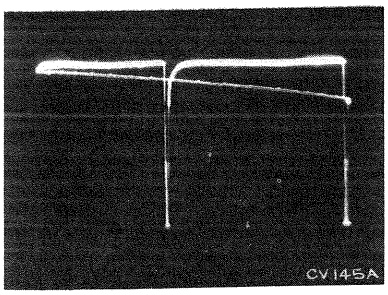
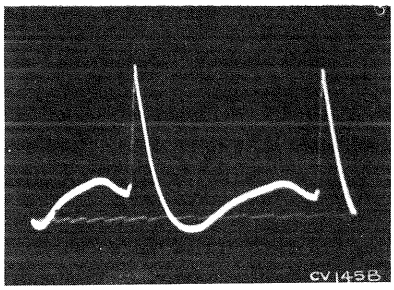


Figure 43—Plate of Sync Separator (Pin 5 of V113) (6SN7) (35 Volts PP)
Voltage depends on picture

Figure 44—Cathode of Sync Separator (Pin 6 of V113) (6SN7) (10 Volts PP)



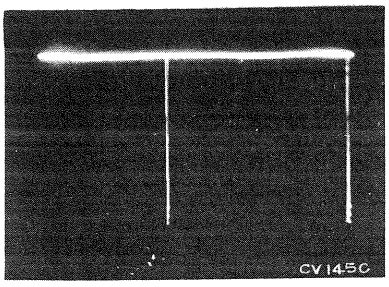
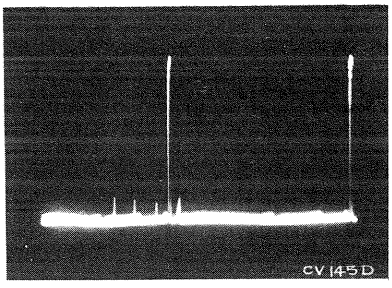


Figure 45—Grid of Vert. Sync Amplifier (Pin 4 of V114A) (6SN7) (12 Volts PP)

Figure 46—Plate of Vert Sync Amplifier (Pin 5 of V114A) (6SN7) (100 Volts PP)



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

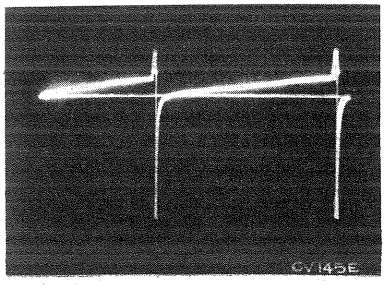


Figure 47—Grid of Vertical Oscillator (Pin 1 of V114B) (6SN7) (135 Volts PP)

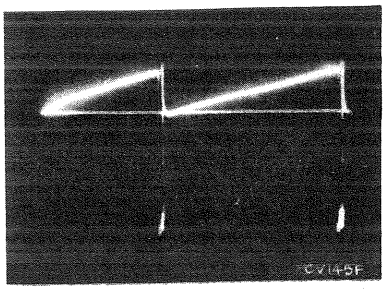


Figure 48—Plate of Vertical Oscillator (Pin 2 of V114B) (6SN7) (105 Volts PP)

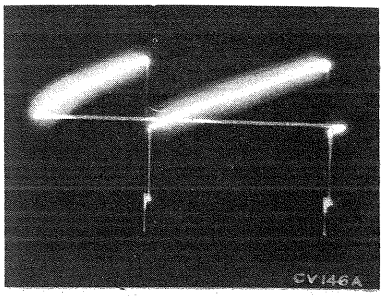


Figure 49—Grid of Vertical Output (105 Volts PP) (Pin 1 of V115) (6AQ5)

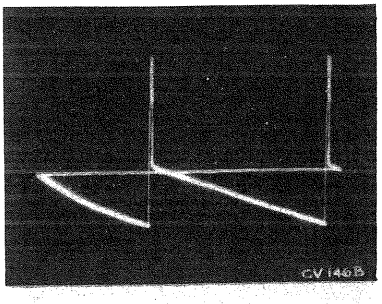


Figure 50—Plate of Vertical Output (900 Volts PP) (Pin 5 of V115) (6AQ5)

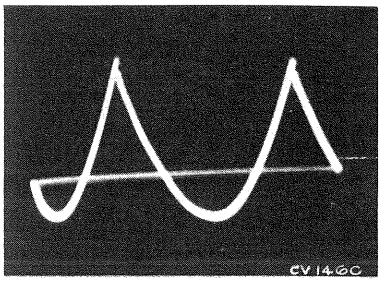


Figure 51—Cathode of Vertical Output (1.0 Volts PP) (Pin 2 of V115) (6AQ5)

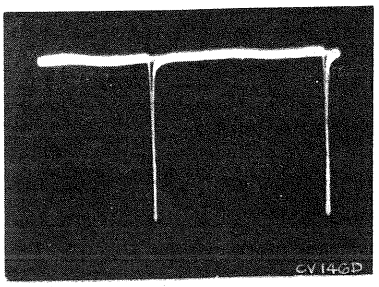
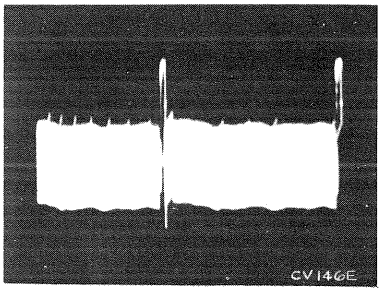


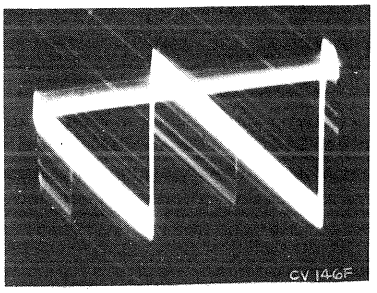
Figure 52—Grid of Kinescope (Pin 2 of V121) (12 Volts PP)

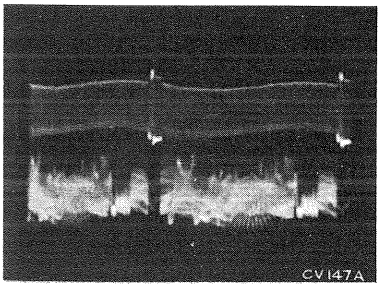


Cathode of Sync Separator (Pin 3 of V113) (6SN7)

Figure 53—Vertical (15 Volts PP)

Figure 54—Horizontal (8 Volts PP)

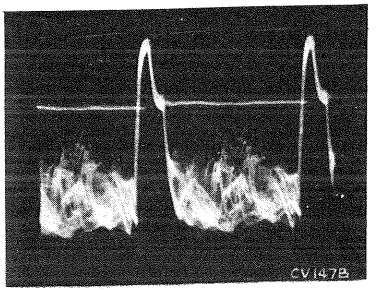




Grid of Sync Separator (Pin 1 of V113) (6SN7)

Figure 55—Vertical (110 Volts PP)

Figure 56—Horizontal (110 Volts PP)



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

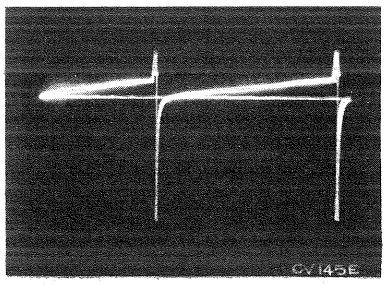


Figure 47—Grid of Vertical Oscillator (Pin 1 of V114B) (6SN7) (135 Volts PP)

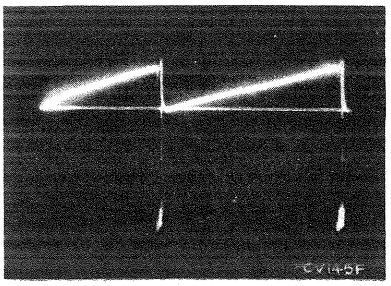


Figure 48—Plate of Vertical Oscillator (Pin 2 of V114B) (6SN7) (105 Volts PP)

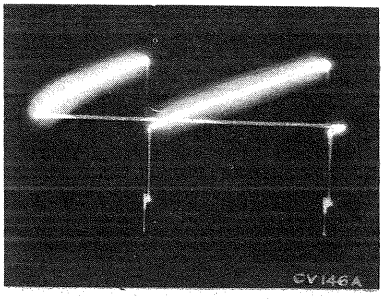


Figure 49—Grid of Vertical Output (105 Volts PP) (Pin 1 of V115) (6AQ5)

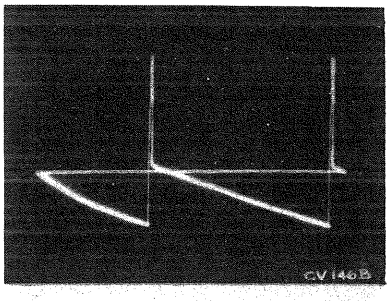


Figure 50—Plate of Vertical Output (900 Volts PP) (Pin 5 of V115) (6AQ5)

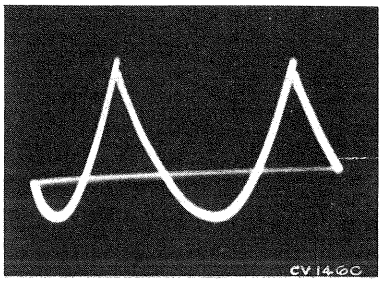


Figure 51—Cathode of Vertical Output (1.0 Volts PP) (Pin 2 of V115) (6AQ5)

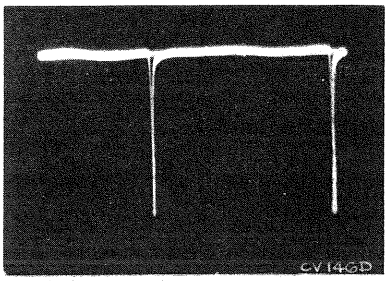
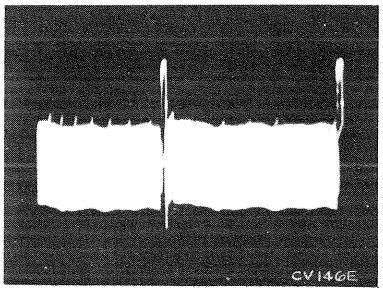


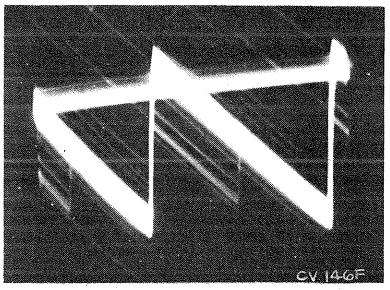
Figure 52—Grid of Kinescope (Pin 2 of V121) (12 Volts PP)

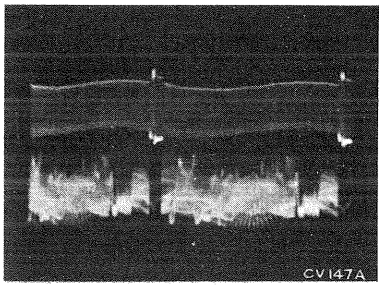


Cathode of Sync Separator (Pin 3 of V113) (6SN7)

Figure 53—Vertical (15 Volts PP)

Figure 54—Horizontal (8 Volts PP)

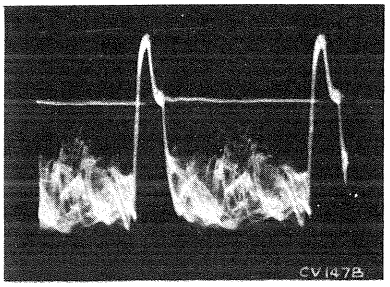




Grid of Sync Separator (Pin 1 of V113) (6SN7)

Figure 55—Vertical (110 Volts PP)

Figure 56—Horizontal (110 Volts PP)



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

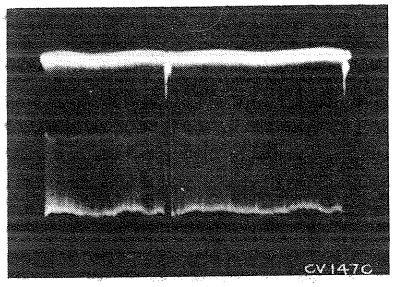
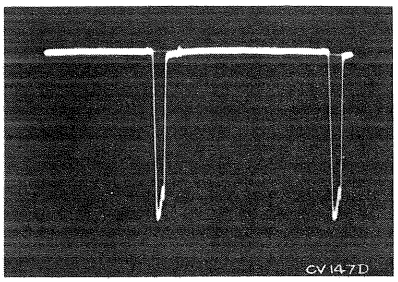
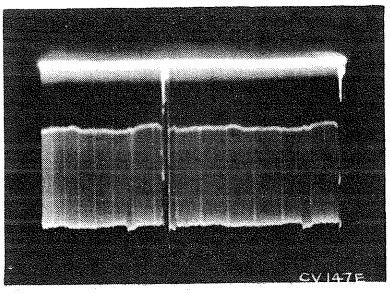


Plate of Sync Separator
(Pin 2 of V113)

Figure 57—Vertical (30 Volts PP)

Figure 58—Horizontal (30 Volts PP)

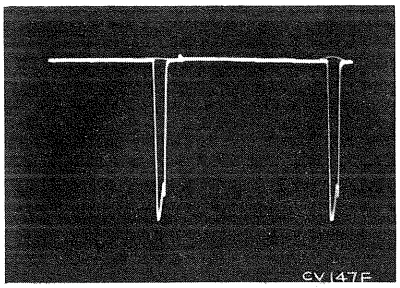




Grid of Hor Sync Amp
(Pin 4 of V112) (6SN7)

Figure 59—Vertical (30 Volts PP)

Figure 60—Horizontal (30 Volts PP)



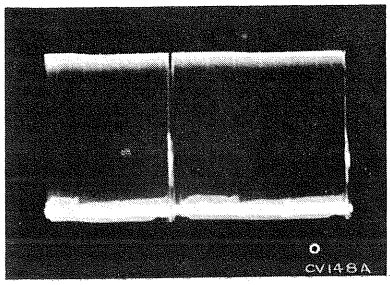
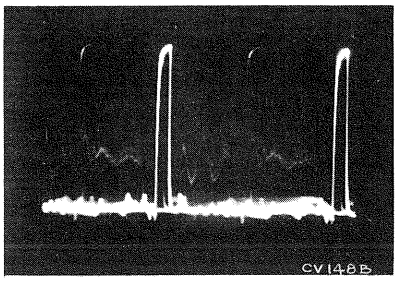
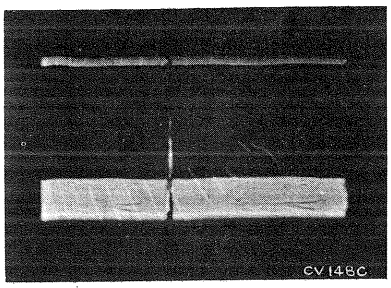


Plate of Hor Sync Amp
(Pin 5 of V112) (6SN7)

Figure 61—Vertical (85 Volts PP)

Figure 62—Horizontal (85 Volts PP)

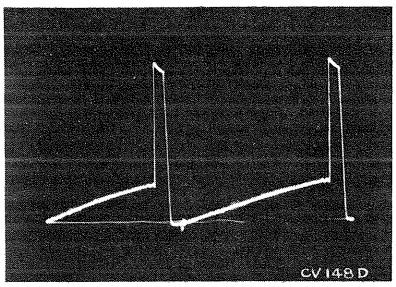


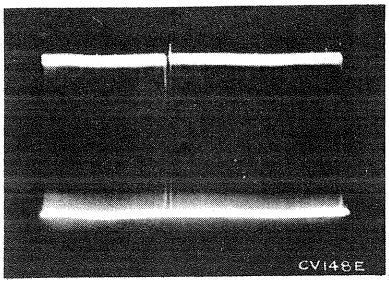


Grid of Hor Sync Amp
(Pin 1 of V112) (6SN7)

Figure 63—Vertical (75 Volts PP)

Figure 64—Horizontal (75 Volts PP)

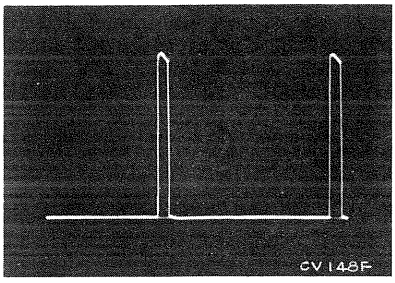




Cathode of Hor Sync Amp
(Pin 3 of V112) (6SN7)

Figure 65—Vertical (18 Volts PP)

Figure 66—Horizontal (18 Volts PP)



WAVEFORM PHOTOGRAPHS

Taken from RCA WO58A Oscilloscope

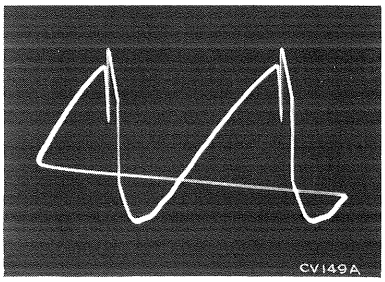
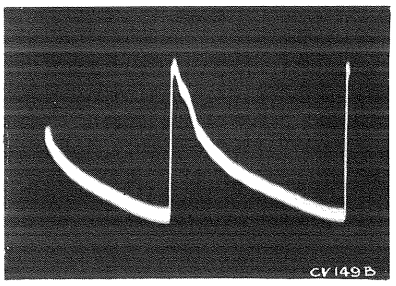


Figure 67—Grid of Horizontal Oscillator Control (25 Volts PP) (Pin 1 of V116) (6SN7GT)

Figure 68—Cathode of Horizontal Oscillator Control (1.3 Volts PP) (Pin 3 of V116) (6SN7GT)



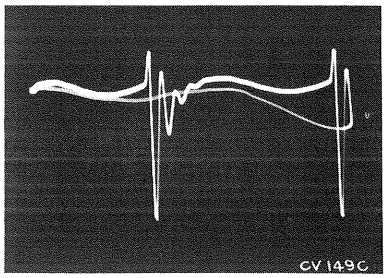
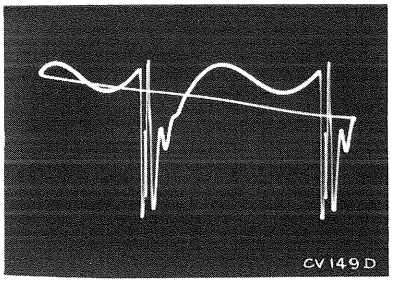


Figure 69—Grid of Horizontal Oscillator (550 Volts PP) (Pin 4 of V116) (6SN7GT)

Figure 70—Plate of Horizontal Oscillator (290 Volts PP) (Pin 5 of V116) (6SN7GT)



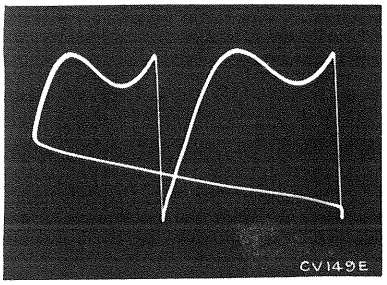
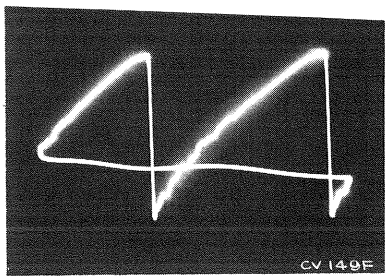


Figure 71—Terminal "C" of T114 (150 Volts PP)

Figure 72—Grid of Horizontal Output Tube (140 Volts PP) (Pin 5 of V117) (6CD6G)



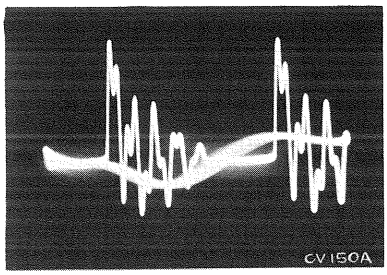
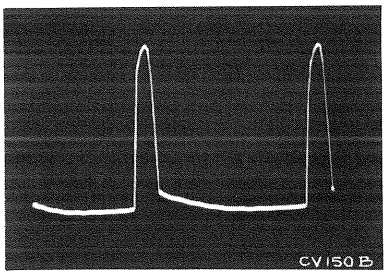


Figure 73—Plate of Horizontal Output (Approx. 5400 Volts PP) (Measured Through a Capacity Voltage Divider Connected from Top Cap of V117 to Ground)

Figure 74—Cathode of Damper (2300 Volts PP) (Pin 3 of V119) (6W4GT)



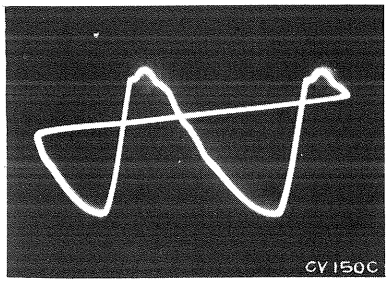
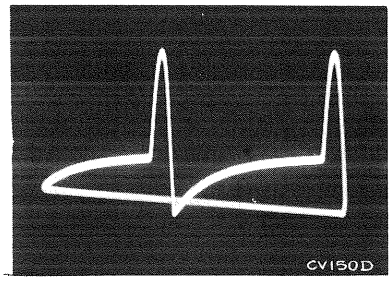


Figure 75—Plate of Damper (100 Volts PP) (Pin 5 of V119) (6W4GT)

Figure 76—Plate of AGC Amplifier (Pin 5 of V111) (6CB6) (700 Volts PP)



VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition, a 5000 microvolt test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. The second condition was obtained by removing the antenna leads and short circuiting the receiver antenna terminals. Voltages shown are read with a type WV97A senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V1	6X8	Mixer	5000 Mu. V. Signal	9	160	8	160	6	0	7	−2.4 to −3.0	—	—	
			No Signal	9	145	8	145	6	0	7	−2.8 to −3.5	—	—	
V1	6X8	R-F Oscillator	5000 Mu. V. Signal	3	95	—	—	6	0	2	−3.8 to −5.5	—	—	
			No Signal	3	90	—	—	6	0	2	−3.0 to −5.1	—	—	
V2	6BQ7	R-F Amplifier	5000 Mu. V. Signal	6	170	—	—	8	0.1	7		—	—	
			No Signal	6	133	—	—	8	1.1	7	0	—	—	
V2	6BQ7	R-F Amplifier	5000 Mu. V. Signal	1	270	—	—	3	170	2	—	—	—	
			No Signal	1	260	—	—	3	133	2	—	—	—	Depending on channel
V101	6AU6	1st Sound I-F Amp.	5000 Mu. V. Signal	5	127	6	124	7	0.7	1	−0.4	6.0	3.0	
			No Signal	5	126	6	123	7	0.5	1	−1.2	5.0	3.0	
V102	6AU6	2d Sound I-F Amp.	5000 Mu. V. Signal	5	132	6	60	7	0.14	1	−10	2.8	1.2	
			No Signal	5	131	6	65	7	0.14	1	−5	2.0	1.0	
V103	6AL5	Ratio Detector	5000 Mu. V. Signal	7	1.0	—	—	1	9.2	—	—	—	—	
			No Signal	7	0	—	—	1	8.0	—	—	—	—	
V104	6AV6	1st Audio Amplifier	5000 Mu. V. Signal	7	90	—	—	2	0	1	−0.7	0.45	—	At min. volume
			No Signal	7	86	—	—	2	0	1	−0.7	0.45	—	
V105	6AQ5	Audio Output	5000 Mu. V. Signal	5	350	6	360	2	150	7	116	30.0	2.0	At min. volume
			No Signal	5	346	6	356	2	145	7	114	30.0	2.0	
V106	6AU6	1st Pix. I-F Amplifier	5000 Mu. V. Signal	5	180	6	230	7	0.15	1	−6.5	1.5	0.3	
			No Signal	5	97	6	129	7	1.0	1	0	7.0	3.0	
V107	6CB6	2nd Pix. I-F Amplifier	5000 Mu. V. Signal	5	236	6	233	2	0.1	1	−6.5	1.5	0.14	
			No Signal	5	226	6	138	2	0,85	1	0	12.0	3.0	
V108	6CB6	3d Pix. I-F Amplifier	5000 Mu. V. Signal	5	149	6	144	2	0.9	1	0	11.0	3.0	
			No Signal	5	129	6	133	2	0.8	1	0	10.0	2.0	
V109	6CB6	4th Pix. I-F Amplifier	5000 Mu. V. Signal	5	178	6	163	2	2.2	1	0	8.9	2.1	
			No Signal	5	165	6	150	2	2.0	1	0	7.9	2.1	
V110	6AG7	Video Amplifier	5000 Mu. V. Signal	8	130	6	172	5	1.2	4	*−5.0	22.5	5.5	*Depends on picture
			No Signal	8	130	6	107	5	0.8	4	*−2.0	15.0	4.0	*Depends on picture

VOLTAGE CHART

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V111	6CB6	AGC Amplifier	5000 Mu. V. Signal	5	–27	6	238	2	152	1	155	0.1	3.4	AGC control set for normal operation
			No Signal	5	4.5	6	218	2	135	1	118	0	0	
V112	6SN7GT	Hor. Sync Amplifier	5000 Mu. V. Signal	2	152	—	—	3	0.9	1	–44	1.1	—	
			No Signal	2	135	—	—	3	*0.4	1	*–30	0.5	—	*Depends on noise
			5000 Mu. V. Signal	5	86	—	—	6	0	4	–2.0	5.5	—	
			No Signal	5	50	—	—	6	0	4	–1.8	4.6	—	
V113	6SN7GT	Hor. Sync Separator	5000 Mu. V. Signal	2	374	—	—	3	216	1	155	1.2	—	
			No Signal	2	372	—	—	3	155	1	134	0.8	—	
V113	6SN7GT	Vert. Sync Separator	5000 Mu. V. Signal	5	345	—	—	6	205	4	135	<0.1	—	
			No Signal	5	340	—	—	6	160	4	130	<0.1	—	
V114A	6SN7GT	Vert. Sync Amplifier	5000 Mu. V. Signal	5	7.0	—	—	6	0	4	–0.2	0.6	—	
			No Signal	5	*7.0	—	—	6	0	4	*0	0.5	—	*Depends on noise
V114B	6SN7GT	Vertical Oscillator	5000 Mu. V. Signal	2	176	—	—	3	0	1	–27	0.2	—	
			No Signal	2	176	—	—	3	0	1	–27	0.2	—	
V115	6AQ5	Vertical Output	5000 Mu. V. Signal	5	359	6	359	2	30	1	0	17.3	1.2	
			No Signal	5	357	6	357	2	29	1	0	17.3	1.2	
V116	6SN7GT	Horizontal Osc. Control	No Signal	2	188	—	—	3	–24	1	–42	0.37	—	
			5000 Mu. V. Signal	2	145	—	—	3	–18	1	–42	0.4	—	Hor. hold counter-clockwise
			5000 Mu. V. Signal	2	230	—	—	3	–18	1	–42	0.4	—	Hor. hold clockwise
V116	6SN7GT	Horizontal Oscillator	5000 Mu. V. Signal	5	258	—	—	6	0	4	*–91	2.0	—	Depends on Oscillator Adjustment
			No Signal	5	256	—	—	6	0	4	*–94	2.0	—	
V117	6CD6G	Horizontal Output	5000 Mu. V. Signal	Cap	*700	8	165	3	12.5	5	–30	110	15.0	*High Voltage Pulse Present
			No Signal	Cap	*700	8	165	3	12.5	5	–30	110	15.0	
V118	1E3GT /8016	H. V. Rectifier	5000 Mu. V. Signal	Cap	*	—	—	2 & 7	16,000	—	—	0.2	—	*High Voltage Pulse Present
			No Signal	Cap	*	—	—	2 & 7	16,400	—	—	0.2	—	
V119 V120	6W4GT	Dampers	5000 Mu. V. Signal	5	355	—	—	3	*640	—	—	57	—	*High Voltage Pulse Present
			No Signal	5	353	—	—	3	*640	—	—	57	—	
V121	21AP4	Kinescope	5000 Mu. V. Signal	Cone	16,000	10	555	11	140	2	82	0.2	—	At average Brightness
			No Signal	Cone	16,400	10	550	11	132	2	76	0.2	—	
V122 V123	5U4G	Rectifiers	5000 Mu. V. Signal	4 & 6	388	—	—	2 & 8	389	—	—	*139	—	Per Tube
			No Signal	4 & 6	386	—	—	2 & 8	387	—	—	*145	—	

KRK11 R-F UNIT WIRING DIAGRAM

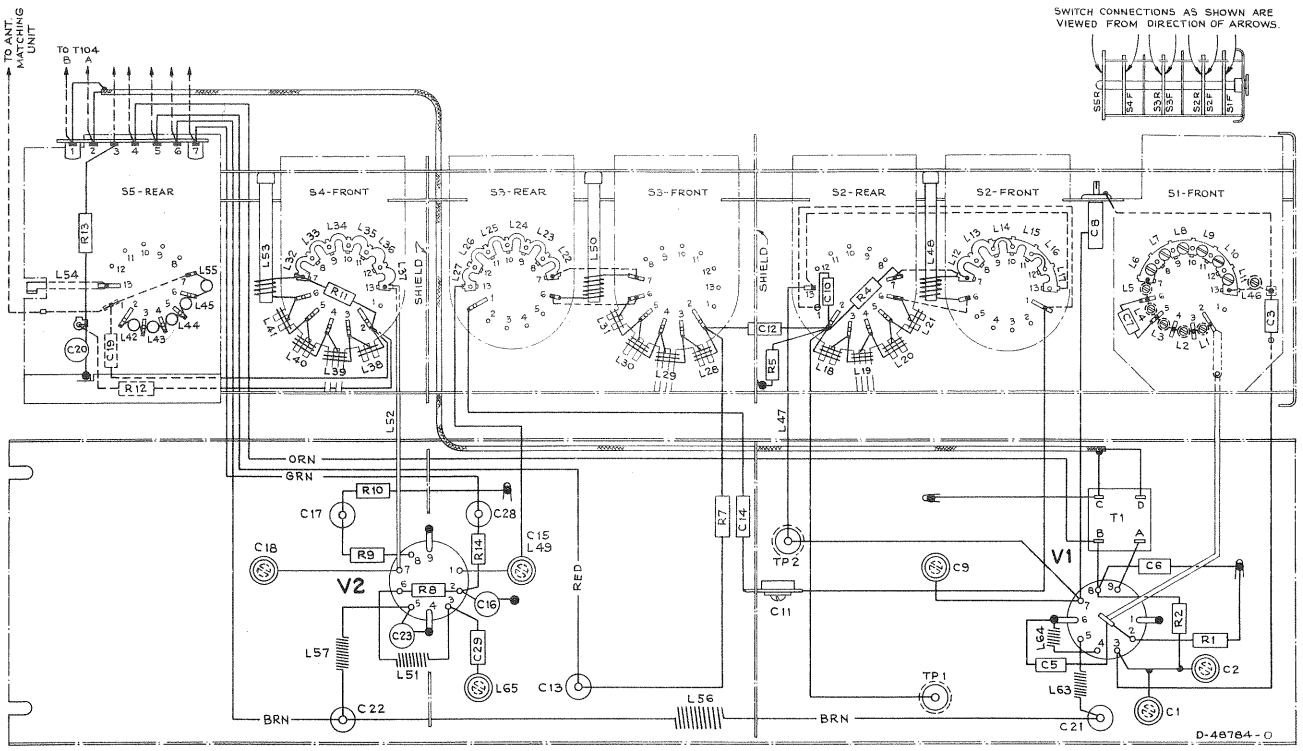


Figure 77—KRK11 R-F Unit Wiring Diagram

CRITICAL LEAD DRESS:

1. Keep all wiring in the pix i-f, sound i-f and video circuits as short as possible.
2. Keep the leads on C110, C111, C112, C200, R109, R110, R111, R112, R114, R115 and R233 as short and direct as possible.
3. Do not change the bus wire connection to pin 2 of V101 and V102. Sleeving is used on these wires to insure length and to prevent shorting.
4. Dress C114 down between R117 (volume control) and wafer S101-2.
5. Ground R130 to pin 3 of V106 and R138 to pin 7 of V107.
6. Do not change the grounding of R141, R146 and R149.
7. Keep the bus wire from T109-A to C146 (plug in capacitor) short and direct.
8. Ground the filaments of sockets of V107, V108 and V109 independently of the socket center pin. Use ground lances provided near each socket.
9. Dress C198 straight up to act as a shield between T101-A and V110-4.
0. Dress C153 and R170 (kine cathode) up in the air above the terminal board.
11. Keep the leads connected to T114-C and T114-D (synchoguide) down so that they will not short out when the chassis is placed in the cabinet.
12. Do not reroute any wires between T104 and the terminal board along side it. Keep all leads on the foot side of the terminal board.
13. Dress all wires routed past T104, shielded wires W102 and W103 under the big lances near T104.
14. Dress all a-c leads to S102 under the large lances on the front apron and away from R243.
15. Dress R116 close to the chassis with leads as short as possible.
16. Dress C206, C221 and C212 up in the air and away from all other leads and components.
17. Dress all leads away from bleeder resistor R243.
18. The blue lead from pin 5 of V111 to the terminal board under the high voltage cage should be routed between V117 socket and the rear apron.
19. Keep leads on C214 as short and direct as possible.
20. Dress R206 away from all other wires and components to prevent excessive heating.
21. Keep the wire from the vertical output transformer T114 away from the 5U4G rectifier tubes.
22. Dress all 2 watt resistors away from each other and all other wires and components.
23. Dress all wires away from damper tubes V119 and V120.
24. Blue wire from pin 5 V116 to T114-A should not be more than 5 inches long.
25. Dress all peaking coils up and away from the base.

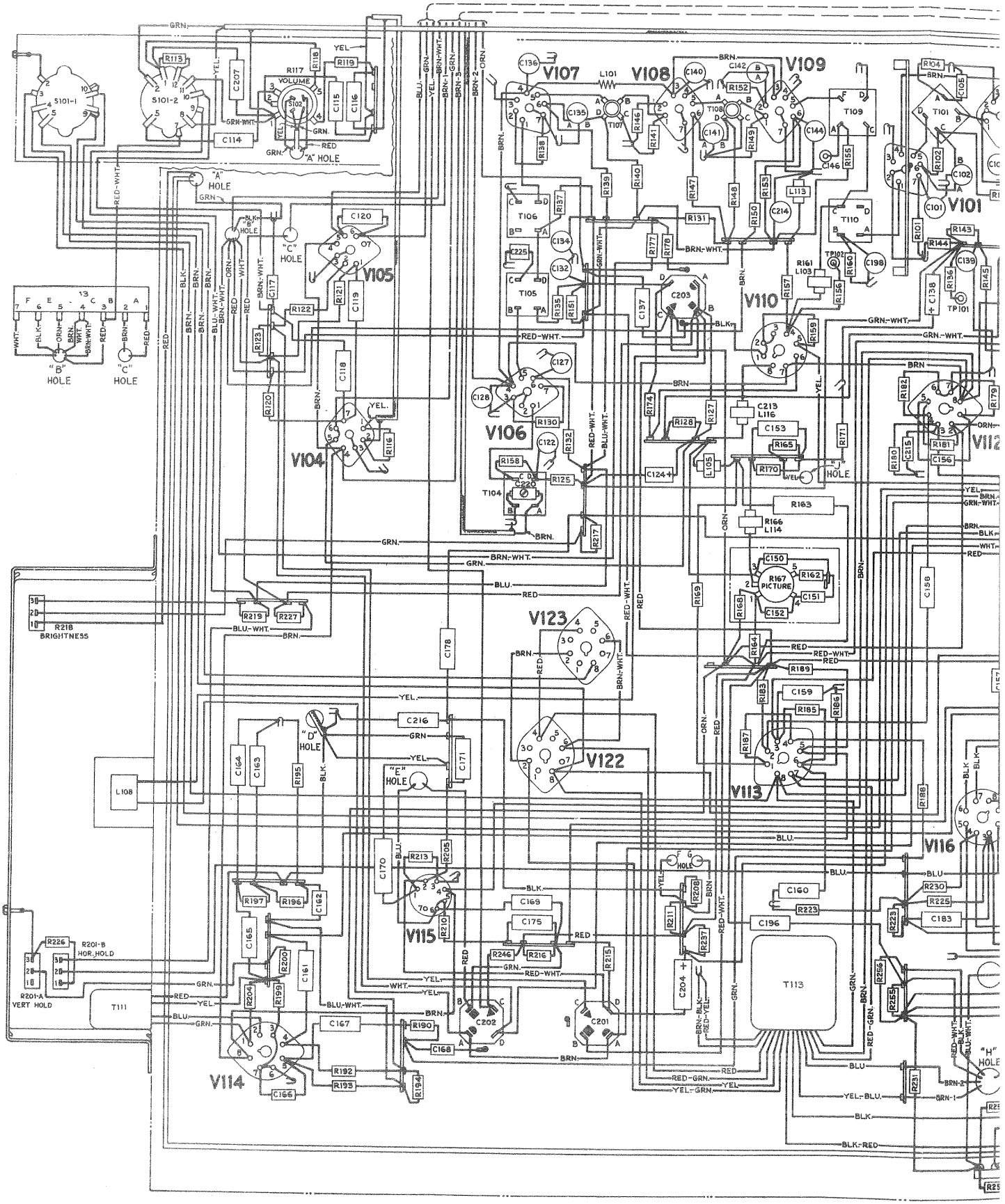
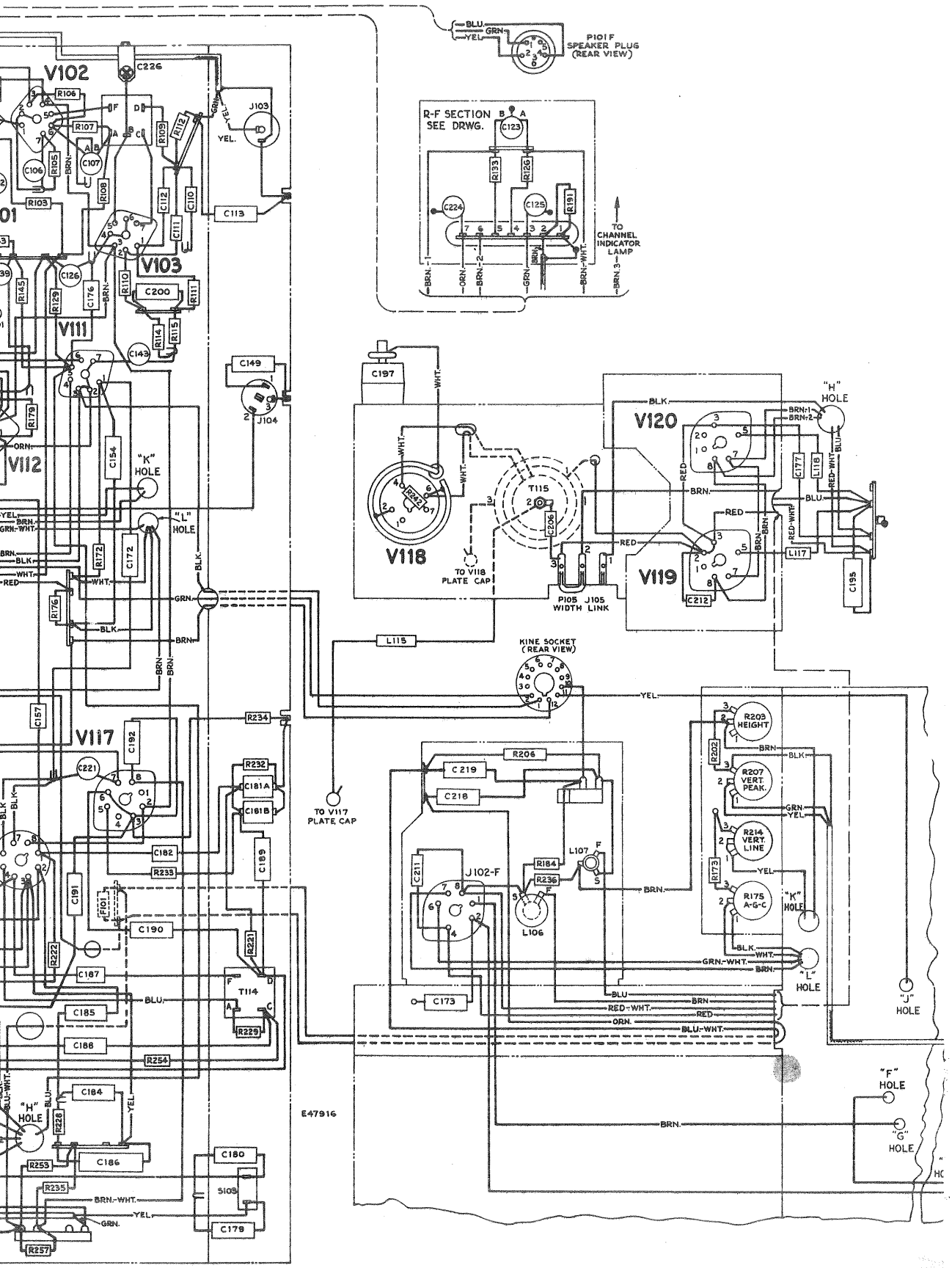
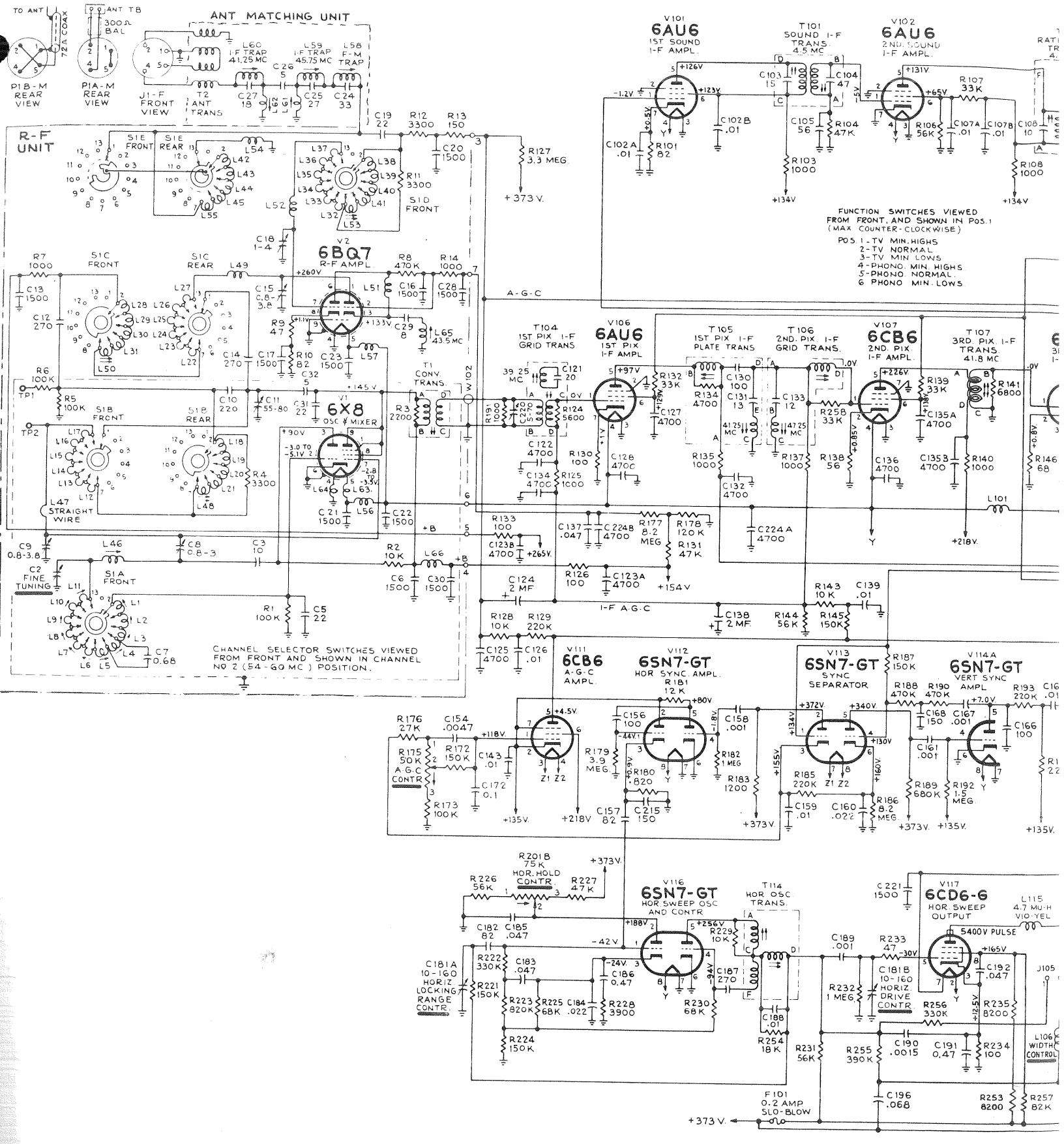


Figure 78—Chassis Wiring Diagr



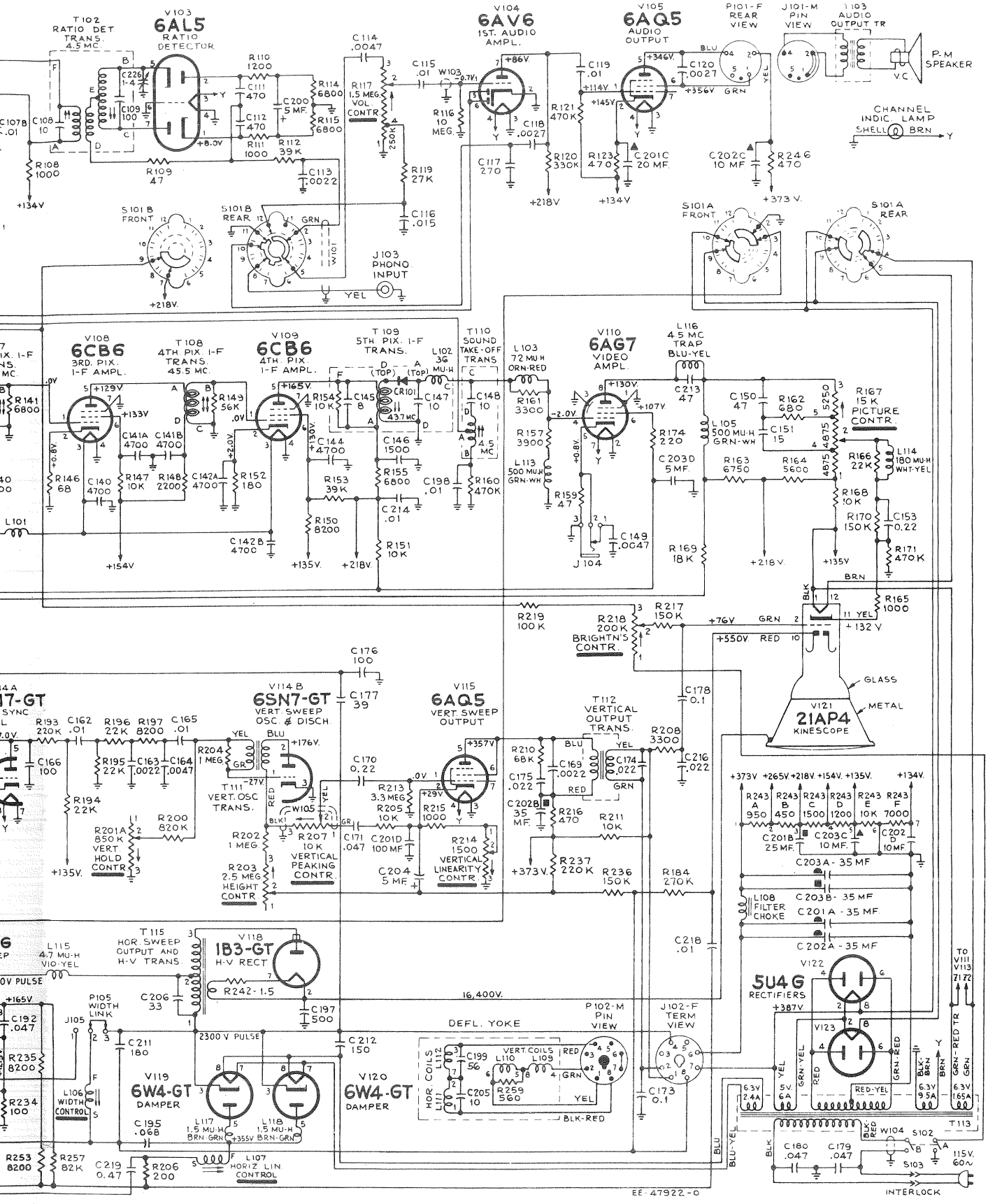
Diagram, KCS68C, KCS68E



The schematic is shown in the latest condition at the time of printing.

All resistance value in ohms. K = 1000.

All capacitance values less than and above 1 in MMF unless noted.

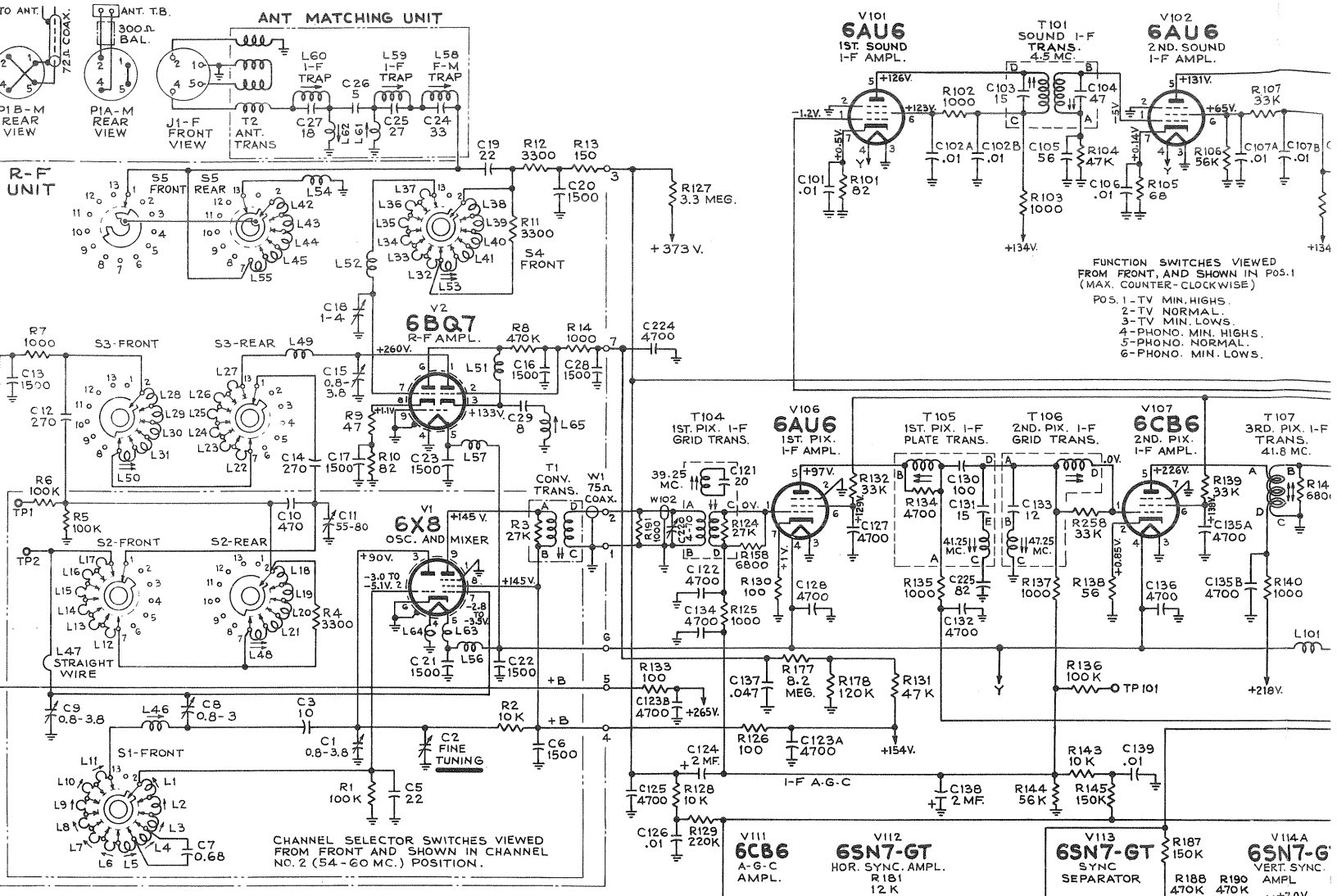


alues less than 1 in FM
MMF unless otherwise

Direction of arrows at controls indicate clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 79—Circuit Schematic Diagram, KCS68F



PRODUCTION CHANGES IN KCS68E AND KCSC68E

schematic is shown in the latest condition. The notes below tell early receivers differed from the schematic shown above.

some receivers, terminal C of I-F trans. T105 was connected to d and C225 was omitted.

ome receivers ratio detector trimmer C226 was omitted.

ome receivers C195 at damper plate was .082 mfd.

ome receivers R186 at V113-3 was 5.6 meg.

ome receivers R188 at V113-4 was 1 meg. and R190 and C168 were ed.

some receivers, fourth pix i-f screen resistor R153 was 33K and was omitted.

ome receivers C120 at V105-5 was .0033 mfd.

ome receivers R165 at V121-11 was omitted.

some receivers video peaking coil L113 was Grn-Orange and was ed by a 6800 ohm resistor R174.

ome receivers video peaking coil L105 was 250 Muh and was coded

ome receivers C221 at V117-7 was omitted.

ome receivers a 1000 megohm bleeder resistor was connected from 2 to ground.

ome receivers R176 at the AGC control was 33K.

ome receivers R191 across T104 link was omitted.

some receivers C220 across T104 link was 27 mmf. and was not table.

some receivers a 5 mfd. capacitor C222 was connected between tness control R218-3 and ground.

some receivers S102-1 was omitted and brightness control R218-1 onnected to ground.

ome receivers fourth pix i-f loading resistor R154 may be any valve een 5600 to 10K.

ome receivers R174 at V110-24 was omitted.

ome receivers F101 was a .25 amp. quick blow type fuse.

some receivers C196 and C219 were connected to the junction of and R253.

some receivers a 270 mmf. capacitor C217 was connected from the on of R253 and F101 to ground.

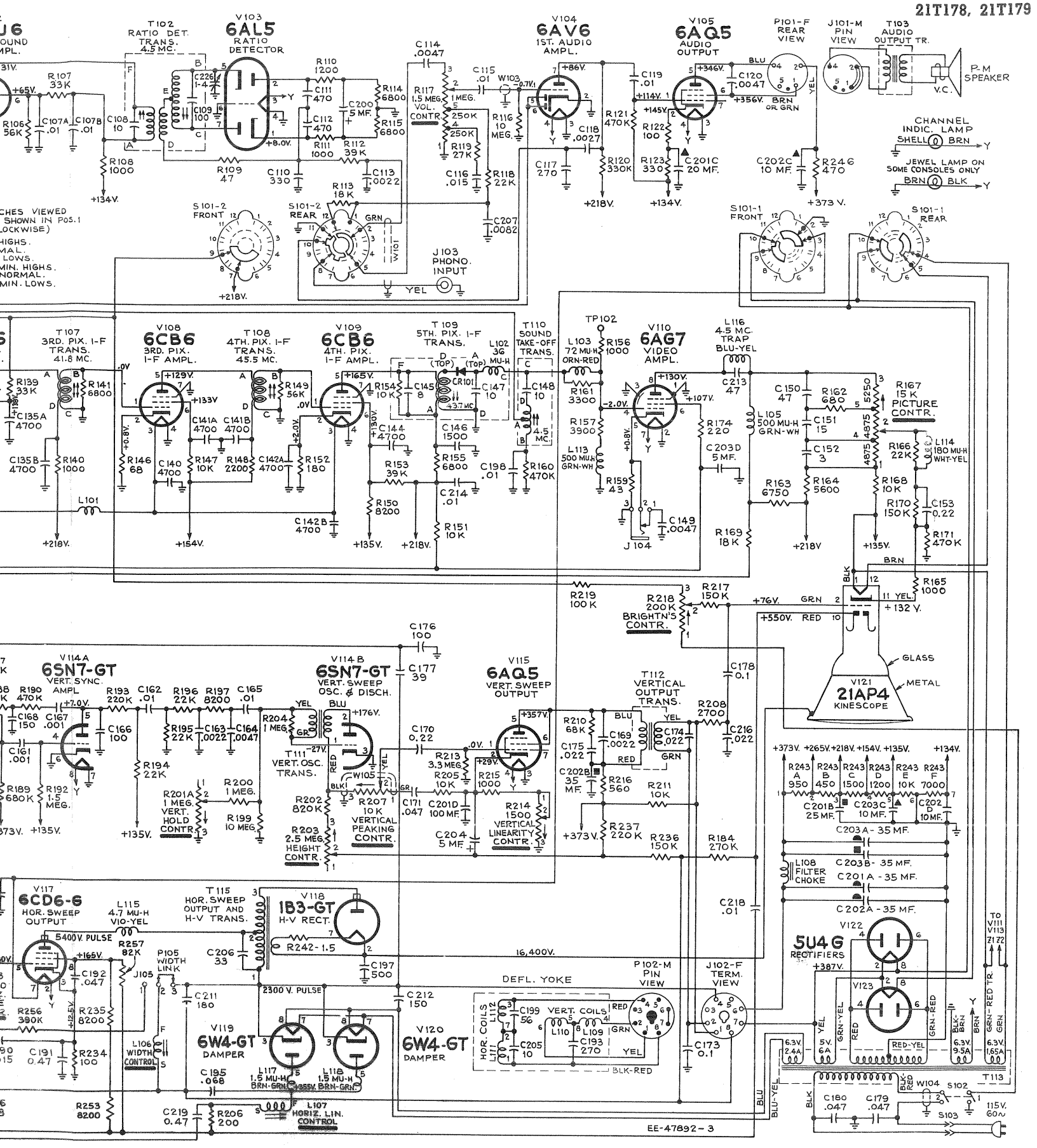
early production r-f units, C10 was 330 mmf., C8 was 0.8 — 1.4 C3 was 12 mmf. and L47 was shown as a coil. TP2 was connected junction of L47 and C9. Early production r-f units are unmarked. production r-f units are marked M1. Replacement parts are affected.

c

The schematic is shown in the latest condition at the time of printing.

All resistance values in ohms. K — 1000.

All capacitance values less than 1 and above 1 in MMF unless oth noted.



alues less than 1 in MF MMF unless otherwise

Direction of arrows at controls indicates clockwise rotation.

All voltages measured with "VoltOhmyst" and with no signal input. Voltages should hold within ±20% with 117 v. a-c supply.

Figure 80—Circuit Schematic Diagram, KCS68C, KCS68E