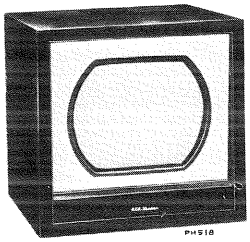


Model T164
Walnut,
Mahogany
or Oak

RCA VICTOR

TELEVISION RECEIVERS

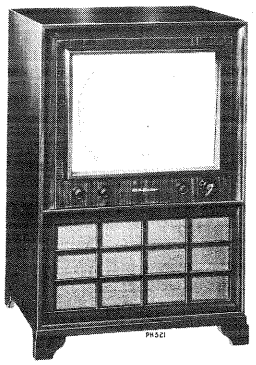
MODELS T164, TC165, TC166, TC167, TC168

Chassis Nos. KCS40 or KCS40A
— Mfr. No. 274 —

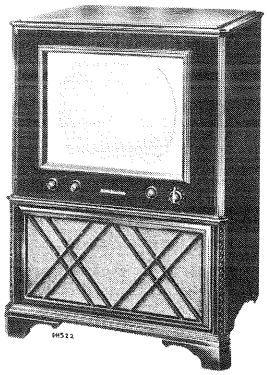
SERVICE DATA

— 1950 No. T5 —

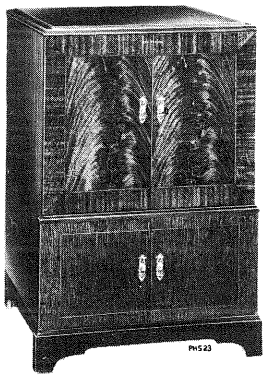
RADIO CORPORATION OF AMERICA
RCA VICTOR DIVISION
CAMDEN, N. J., U. S. A.



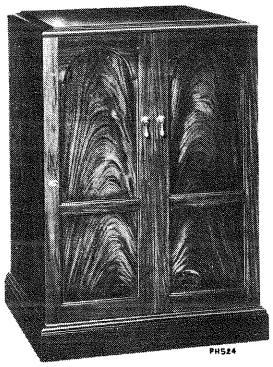
Model TC165
Walnut, Mahogany or Oak



Model TC166
Walnut, Mahogany or Oak



Model TC167
Walnut, Mahogany or Oak



Model TC168
Walnut, Mahogany or Oak

GENERAL DESCRIPTION

Models T164, TC165, TC166, TC167 and TC168 receivers employ twenty-one tubes plus two rectifiers and a 16GP4 kinescope. The receivers are identical except for cabinets, jewel lights and speakers. A phono input jack is provided to permit the use of an external record player.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE..... 146 square inches on a 16GP4 kinescope

R-F FREQUENCY RANGES

All 12 television channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
Fine Tuning Range..±250 kc. on chan. 2, ±650 kc. on chan. 13
Picture Carrier Frequency..... 25.75 mc.
Sound Carrier Frequency..... 21.25 mc.

CHASSIS DESIGNATIONS

KCS40..... In Model T164
KCS40A..... In Models TC165, TC166, TC167, TC168

LOUDSPEAKERS

KCS40..... (92580-3W) 8" PM Dynamic, 3.2 ohms
KCS40A..... (92569-10W) 12" PM Dynamic, 3.2 ohms

POWER SUPPLY RATING..... 115 volts, 60 cycles, 250 watts

AUDIO POWER OUTPUT RATING..... 3.5 watts max.

RECEIVER ANTENNA INPUT IMPEDANCE

Choice: 300 ohms balanced or 72 ohms unbalanced.

RCA TUBE COMPLEMENT

	Tube Used	Function
(1)	RCA 6AG5	R-F Amplifier
(2)	RCA 6AG5	Converter
(3)	RCA 6J6	R-F Oscillator
(4)	RCA 6AU6	1st Sound I-F Amplifier
(5)	RCA 6AU6	2nd Sound I-F Amplifier
(6)	RCA 6AL5	Sound Discriminator
(7)	RCA 6AV6	1st Audio Amplifier
(8)	RCA 6K6GT	Audio Output
(9)	RCA 6BA6	1st Picture I-F Amplifier
(10)	RCA 6AG5	2nd Picture I-F Amplifier
(11)	RCA 6BA6	3rd Picture I-F Amplifier
(12)	RCA 6AG5	4th Picture I-F Amplifier
(13)	RCA 6AL5	Picture 2nd Detector and Sync Limiter
(14)	RCA 12AU7	1st and 2nd Video Amplifier
(15)	RCA 6SN7GT	AGC Amplifier and Vertical Sweep Osc.
(16)	RCA 6SN7GT	AGC Rectifier and 1st Sync Separator
(17)	RCA 6SN7GT	Sync Amplifier and 2nd Sync Separator
(18)	RCA 6K6GT	Vertical Sweep Output
(19)	RCA 6SN7GT	Horizontal Sweep Oscillator and Control
(20)	RCA 6BG6G	Horizontal Sweep Output
(21)	RCA 6W4GT	Damper
(22)	RCA 1B3-GT/8016	High Voltage Rectifier
(23)	RCA 5U4G	Power Supply Rectifier
(24)	RCA 16GP4	Kinescope

DIMENSIONS (inches)	Width	Height	Depth
Cabinet (outside), T164	23	21¼	21⅜
Cabinet (outside), TC165	27⅞	38¼	20⅝
Cabinet (outside), TC166	27⅝	38¾	22¾
Cabinet (outside), TC167	25¾	38¾	22¾
Cabinet (outside), TC168	26⅝	37⅞	22⅞
Chassis (overall)	19¼	11	18½

WEIGHT Model	Chassis with Tubes in Cabinet	Shipping Weight
T164	96	115
TC165	101	123
TC166	106	130
TC167	123	148
TC168	117	141

Specifications continued on page 2

T164, TC165, TC166, TC167, TC168

ELECTRICAL AND MECHANICAL SPECIFICATIONS (Continued)

PICTURE INTERMEDIATE FREQUENCIES

Picture Carrier Frequency ..... 25.75 Mc.
Adjacent Channel Sound Trap ..... 27.25 Mc.
Accompanying Sound Traps ..... 21.25 Mc.
Adjacent Channel Picture Carrier Trap ..... 19.75 Mc.

SOUND INTERMEDIATE FREQUENCIES

Sound Carrier Frequency ..... 21.25 Mc.
Sound Discriminator Band Width between peaks ..... 350 kc

VIDEO RESPONSE ..... To 4 Mc.

FOCUS ..... Magnetic

SCANNING ..... Interlaced, 525 line

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

SWEEP DEFLECTION ..... Magnetic

VERTICAL SWEEP FREQUENCY ..... 60 cps

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

OPERATING INSTRUCTIONS

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

1. See that the TV-PH switch on the rear apron 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 sound fidelity 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.

8. Turn the BRIGHTNESS control counter-clockwise until the retrace lines just disappear.

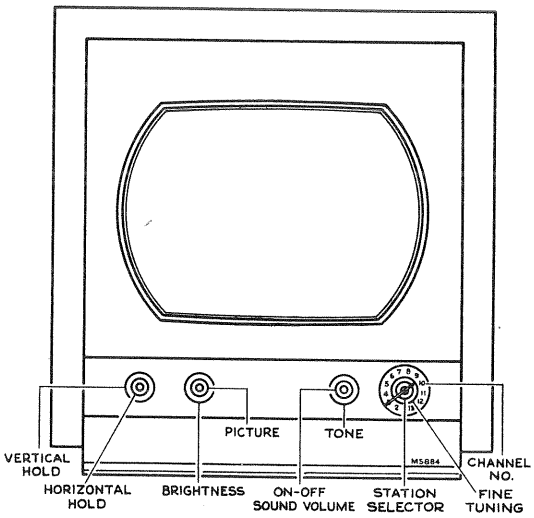


Figure 1—Receiver Operating Controls

9. Adjust the PICTURE control for suitable picture contrast.

10. After the receiver has been on for some time, it may be necessary to readjust the FINE TUNING control slightly for improved sound fidelity.

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

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

13. If the positions of the controls have been changed, it may be necessary to repeat steps 2 through 9.

14. To use the instrument with a record player, plug the record-player output cable into the PHONO jack on the rear apron, and set the TV-PH switch on "PH." Set the TV-PH switch back to TV on completion of the record program.

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 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.

INSTALLATION INSTRUCTIONS

ION TRAP MAGNET ADJUSTMENT.—Set the ion trap magnet approximately in the position shown in Figure 2, and with the part number on magnet towards the rear of the chassis. 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. Reduce the brightness control setting until the raster is slightly above average brilliance. Adjust the focus control (R191 on the chassis rear apron) until the line structure of the raster is clearly visible. Readjust the ion trap magnet for maximum raster brilliance. The final touches of this adjustment should be made with the brightness control at the maximum position with which good line focus can be maintained.

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.

INSTALLATION INSTRUCTIONS

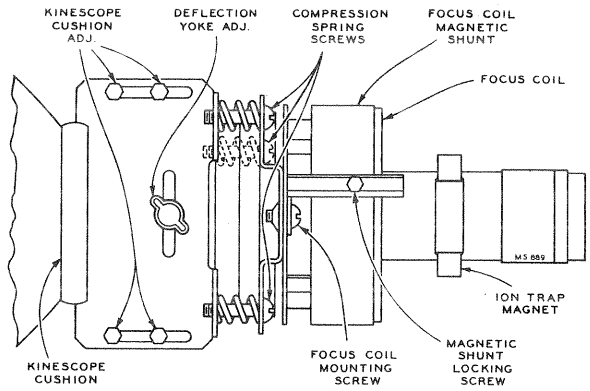


Figure 2—Yoke and Focus Coil Adjustments

PICTURE ADJUSTMENTS.—It will now be necessary to obtain a test pattern picture in order to make further adjustments. See steps 3 through 9 of the receiver operating instructions.

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 threshold control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading, turn R138 on the rear apron (see Figure 3) clockwise until the set operates normally and the picture can be synced.

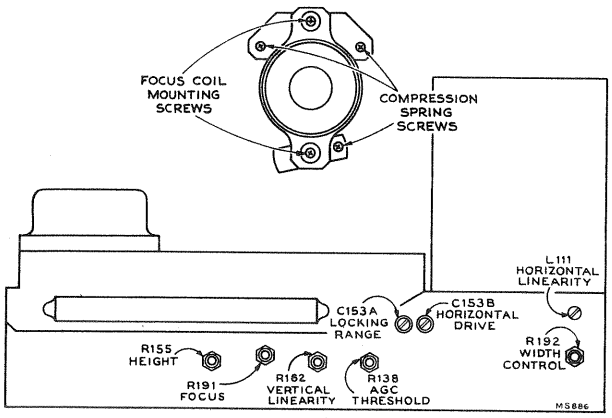


Figure 3—Rear Chassis Adjustments

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. Usually the picture will remain in sync. Turn the control clockwise slowly. If the picture did fall out of sync upon removal of the signal, 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. The picture should remain in sync for approximately 180 degrees of additional clockwise rotation of the control. At the extreme clockwise position, the picture should be out of sync and should show 1 vertical or diagonal black bar in the raster.

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

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 180 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 T109 sine wave core (on the outside of the apron) all the way out of the coil.

Set the locking range trimmer C153A one-half turn out from maximum capacity.

Turn the horizontal hold control to the extreme clockwise position. Tune in a television station and turn the frequency wave core of T109 under the chassis until the picture syncs and the sync bar just begins to move into the picture.

Note.—Occasionally, a tube may be found which does not respond to this alignment procedure since it may not be possible to sync the picture by means of the frequency core when the sine wave core is all the way out of the coil. Yet, the tube may work perfectly well when the circuit is properly aligned. In such a case, it may be necessary to turn the sine wave core in slightly, and readjust the frequency core to obtain sync.

Turn the sine wave core of T109 in until the blanking bar begins to move off to the left of the picture. Alternately turn the sine wave core in and the frequency out, keeping the picture in sync and the blanking bar showing in the picture.

Continue alternate adjustments until the picture falls from sync into a parasitic oscillation as indicated by a non-synchronized pattern which flickers in width and centering with possibly a light ragged vertical bar through the center of the screen.

Turn the sine wave core out ½ turn. Adjust the frequency core in until the picture is in sync and horizontal blanking appears as a vertical bar in the picture.

Check of Pull-in Range.—Turn the horizontal hold control fully counter-clockwise. Connect a 270K ohm resistor across C156. Momentarily switch off channel and back; the picture will then be out of sync. Turn the hold control clockwise slowly and observe the minimum number of bars obtained just before the picture pulls into sync.

The picture should snap in from two complete blanking bars. If two bars are not obtained, turn the locking range trimmer C153A in to obtain less bars or out to obtain more bars.

If C153A was adjusted, remove the 270K resistor, turn the horizontal hold control fully clockwise and adjust the T109 frequency core until horizontal blanking appears as a vertical bar in the synced picture. Then repeat the entire check of pull-in range to this point.

Repeat the adjustments under "Check of Pull-in Range" until the conditions specified are fulfilled. When the horizontal hold operates as outlined under "Check of Horizontal Oscillator Alignment" the oscillator is properly adjusted.

If the oscillator does not hold sync properly 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 13.

FOCUS COIL ADJUSTMENTS.—The focus coil should be adjusted so that there is approximately one-quarter inch of space between the rear cardboard shell of the yoke and the flat of the front face of the focus coil. This spacing gives best average focus over the face of the tube. The axis of the hole through the focus coil should be parallel with the axis of the kinescope neck.

The focus coil is provided with a magnetic shunt in the form of a metal sleeve as shown in Figure 2. If the receiver focuses with the focus control near the end of its range, loosen the shunt locking screw and slide the shunt backward or forward until focus occurs in the center range of the focus control.

CENTERING ADJUSTMENT. — No electrical centering controls are provided. Centering is obtained by loosening the two focus coil mounting screws and sliding the coil up or down or from side to side. If the focus coil was appreciably changed in position or 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 sliding the coil. In no case should the magnet be adjusted to cause any loss of brightness since such operation may cause immediate or eventual damage to the tube. In extreme cases it may be necessary to adjust one or more of the three focus coil compression spring screws 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 counter-clockwise as far as possible without losing tension on trimmer.

T164, TC165, TC166, TC167, TC168

Set the width control to minimum picture width.

Turn the horizontal linearity coil out until appreciable loss in width occurs, then in until nearly maximum width and the best linearity is obtained. Do not run the core in beyond the point of maximum linearity change, as the current drawn by the 6BG6G then becomes excessive.

Adjust the width control for the proper picture width.

Readjust linearity, but again not beyond the point of maximum linearity change. If necessary adjust the drive control for best linearity.

If at very high line voltage, the picture width is excessive even with the width control set at minimum, turn the linearity coil out to obtain the proper width. On high line voltage, excessive width generally will be accompanied by good linearity, without retouching the drive.

Adjustments of the horizontal drive control affect horizontal oscillator hold and locking range. If the drive control was adjusted, recheck the oscillator alignment.

FOCUS.—Adjust the focus control (R191 on chassis rear apron) for maximum definition in the test pattern vertical "wedge" and best focus in the white areas of the pattern.

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control (R155 on chassis rear apron) until the picture fills the mask vertically. Adjust vertical linearity (R162 on rear apron) until the test pattern is symmetrical from top to bottom. Adjustment of either control will require a readjustment of the other. Adjust the focus coil to align the picture with the mask.

Check to see that the cushion and yoke thumbscrews and the focus coil mounting screws are tight.

AGC THRESHOLD CONTROL.—The AGC threshold control R138 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, sync the picture and turn the picture control to the maximum clockwise position. Turn the brightness control counter-clockwise until the vertical retrace lines are just invisible. 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 R138. If the picture requires an appreciable portion of a second to reappear, R138 should be readjusted.

Set the picture control at the maximum clockwise position. Turn R138 fully clockwise. The top one-half inch of the picture may be bent slightly. This should be disregarded. Turn R138 counter clockwise until there is a very, very slight bend or change of bend in the top one-half inch of the picture. Then turn R138 clockwise just sufficiently to remove this bend or change of bend.

If the signal is very weak, the above method may not work as it may be impossible to get the picture to bend. In this case, turn R138 counter-clockwise until the snow in the picture becomes more pronounced, then 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 counter-clockwise on a weak signal, then the receiver may overload when a strong signal is received.

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 9. The adjustments for channels 2 through 5 and 7 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 and channel 6 adjustment is in the kinescope well. See Figures 8 and 9 for their location.

Replace the cabinet back and make sure that the screws are tight in order to prevent rattling at high volume.

WEAK SIGNAL AREA OPERATION.—Since the vast majority of receivers are sold in strong signal areas, the chassis are aligned to produce the cleanest pictures in those areas. However, if the receiver is to be operated in a weak signal area, better performance can be obtained by "peaking" the r-f unit.

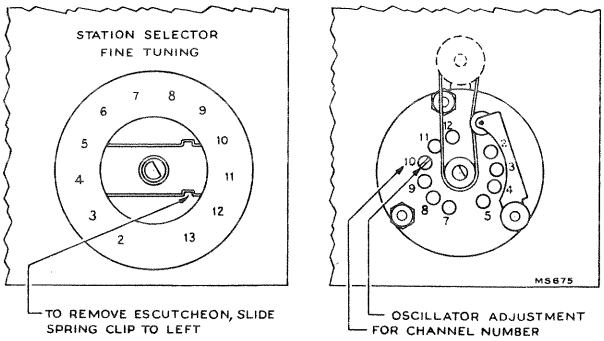


Figure 4—R-F Oscillator Adjustments

To peak the r-f unit in these receivers, disconnect the 390-ohm resistor R14 which is on top of the r-f unit chassis. Adjust L66 to obtain the best possible picture on the weakest low channel station received.

If the peaked receiver is subsequently taken to a strong signal area, the resistor R14 should be connected in place and L66 adjusted for "flat" response on the low channels.

CHASSIS REMOVAL.—To remove the chassis from the cabinet for repair or installation of a new kinescope, remove the control knobs, the cabinet back, unplug the speaker cable, the kinescope socket, the antenna cable, the pilot light cable, the yoke and focus coil cable. Remove the yoke frame grounding strap and the interlock switch. Take out the six chassis bolts under the cabinet. Withdraw the chassis from the back of the cabinet.

KINESCOPE HANDLING PRECAUTION.—Do not install, remove, or handle the kinescope in any manner, unless shatter-proof 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.

To remove the kinescope from the cabinet, take out the four screws and one wing screw which hold the yoke frame to the cabinet. Remove the kinescope, the yoke frame with yoke and focus coil 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 and focus coils. 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 four screws and wing screw and tighten.

Slip the kinescope as far forward as possible. Slide the kinescope cushion firmly up against the flare of the tube and tighten the adjustment wing screws. Slide the deflection yoke as far forward as possible. If this is not done, difficulty will be encountered in adjusting the ion trap magnet and focus coil because of shadows on the corner of the raster.

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

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

Connect the kinescope socket to the tube base and slip the high voltage lead clip between the rim of the kinescope and the mask.

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

CABINET ANTENNA.—A cabinet antenna is provided which may be employed in strong signal areas in which no reflections are experienced. The antenna leads are brought out near the receiver antenna terminal board.

CHASSIS TOP VIEW

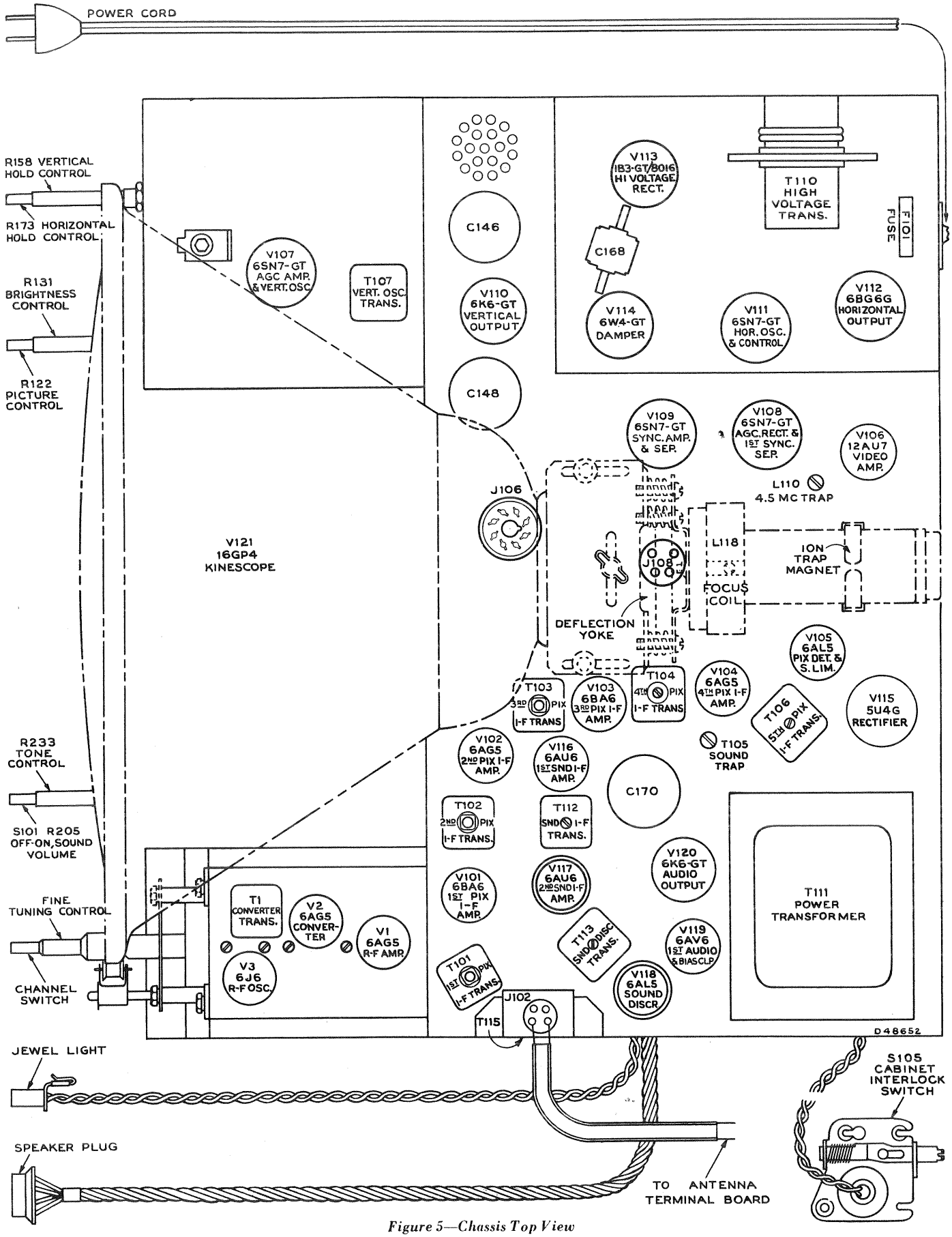


Figure 5—Chassis Top View

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CHASSIS BOTTOM VIEW

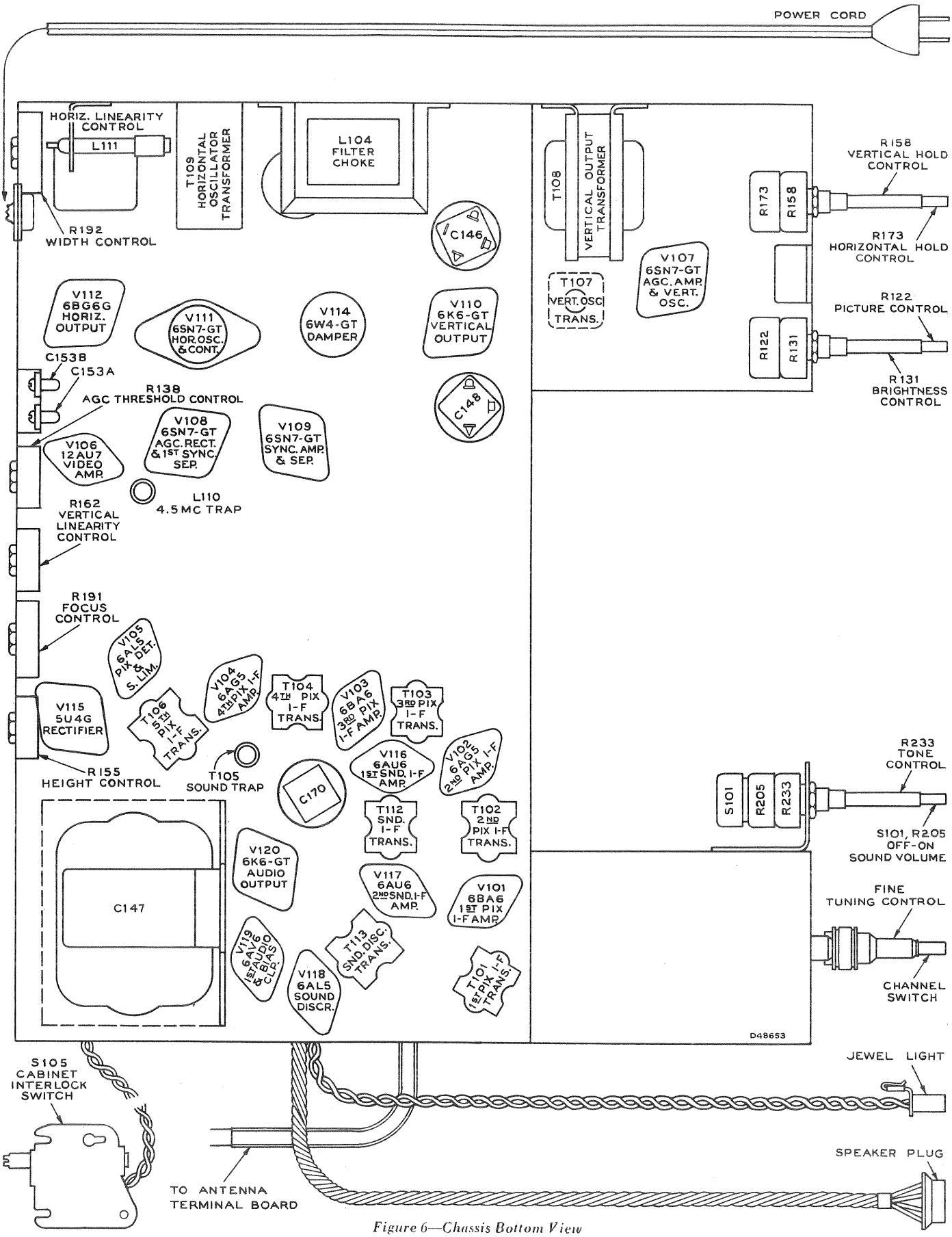


Figure 6—Chassis Bottom View

ALIGNMENT PROCEDURE

TEST EQUIPMENT. — To service properly 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
20 to 30 mc., 1 mc. and 10 mc. sweep width
50 to 90 mc., 10 mc. sweep width
170 to 225 mc., 10 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, and should be capable of passing a 60-cycle square wave without appreciable distortion. While this requirement is not met by many commercial instruments, RCA Oscilloscopes, types WO-55A, WO-58A, WO-79A, and WO-60C fill the requirement and any of these may be employed.

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. The RCA types WO-58A and WO-79A are ideally suited for this purpose.

Signal Generator to provide the following frequencies with crystal accuracy.

(a) Intermediate frequencies
19.75 mc. adjacent channel picture trap
21.25 mc. sound i-f and sound traps
22.05 and 24.75 mc. conv. and first pix i-f trans.
25.9 mc. second picture i-f transformer
24.6 mc. fourth picture i-f transformer
22.0 mc. third picture i-f transformer
22.5 mc. fifth picture i-f transformer
25.75 mc. picture carrier
27.25 mc. adjacent channel sound trap

(b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

(c) Output on 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 "VoltOhmyst" type and a high voltage multiplier probe for use with this meter to permit measurements up to 15 kv.

Service Precautions. — If possible, the chassis should be serviced without the kinescope. However, if it is necessary to view the raster during servicing, it would be a great convenience to have a set of yoke, focus coil, kinescope socket, high voltage and speaker extension cables.

CAUTION: Do not short the kinescope second-anode lead. Its short circuit current represents a considerable overload on the high voltage rectifier V113.

Adjustments Required. — Normally, only the r-f oscillator line will require the attention of the service technician. All other circuits are either broad or very stable and hence will seldom require readjustment.

The oscillator line is relatively non-critical. When oscillator tubes are changed, in all probability it will be necessary to adjust only C6 in order to bring the entire line into adjustment.

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

(1) Sound discriminator
(2) Sound i-f transformers
(3) Picture i-f traps
(4) Picture i-f transformers
(5) R-F and converter lines
(6) R-F oscillator line
(7) 4.5 mc. video trap
(8) Sensitivity check

SOUND DISCRIMINATOR ALIGNMENT. — Set the signal generator for approximately .1 volt output at 21.25 mc. and connect it to the second sound i-f grid.

Detune T113 secondary (bottom).

Set the "VoltOhmyst" on the 3-volt scale.

Connect the meter, in series with a 1-megohm resistor, to the junction of diode resistors R203 and R204.

Adjust the primary of T113 (top) for maximum output on the meter.

Connect the "VoltOhmyst" to the junction of C183 and R203. Adjust T113 secondary (bottom). It will be found that it is possible to produce a positive or negative voltage on the meter dependent upon this adjustment. Obviously to pass from a positive to a negative voltage, the voltage must go through zero. T113 (bottom) should be adjusted so that the meter indicates zero output as the voltage swings from positive to negative. This point will be called discriminator zero output.

Connect the sweep oscillator to the grid of the second sound i-f amplifier.

Adjust the sweep band width to approximately 1 mc. with the center frequency at approximately 21.25 mc. and with an output of approximately .1 volt.

Connect the oscilloscope to the junction of C183 and R203. The pattern obtained should be similar to that shown in Figure 12. If it is not, adjust T113 (top) until the waveform is symmetrical.

The peak-to-peak band width of the discriminator should be approximately 350 kc. and the trace should be linear from 21.175 mc. to 21.325 mc.

SOUND I-F ALIGNMENT. — Connect the sweep oscillator to the first sound i-f amplifier grid.

Connect the oscilloscope to the second sound i-f grid return (terminal A of T112) in series with a 33,000-ohm isolating resistor.

Insert a 21.25 mc. marker signal from the signal generator into the first sound i-f grid.

Adjust T112 (top and bottom) for maximum gain and symmetry about the 21.25 mc. marker. The pattern obtained should be similar to that shown in Figure 13.

The output level from the sweep should be set to produce approximately .3 volt peak-to-peak at the second sound i-f grid return 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.

The band width at 70% response from the first sound i-f grid to the second i-f grid should be approximately 200 kc.

ALIGNMENT PROCEDURE

PICTURE I-F TRAP ADJUSTMENT. — Connect the "VoltOhmyst" to the junction of R135 and C190.

Remove the 6SN7GT AGC Amplifier tube V107. Connect a 250,000-ohm potentiometer between pins 5 and 6 of the V107 socket. Adjust the potentiometer until the "VoltOhmyst" reads approximately −12 volts.

Set the channel switch to the blank position between channels number 2 and 13.

Connect the "VoltOhmyst" across the picture detector load resistor R119. Under this condition, both leads of the meter are at approximately −120 volts. In making this connection, care should be taken not to touch the case of the meter or to permit the meter case to become grounded.

Connect the output of the signal generator to the grid of the converter tube 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 1. 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 keeping the leads as short as possible.

Set the generator to each of the following frequencies and with a thin fiber screwdriver tune the specified adjustment for minimum indication on the "VoltOhmyst." In each instance the generator should be checked against a crystal calibrator to insure that the generator is exactly on frequency.

(1) 21.25 mc.—T103 (top)	(4) 27.25 mc.—T104 (top)
(2) 21.25 mc.—T105 (top)	(5) 19.75 mc.—T106 (top)
(3) 27.25 mc.—T102 (top)	(6) 19.75 mc.—T101 (top)

In the above transformers using threaded cores, it is possible to run the cores completely through the coils and secure two peaks or nulls. The correct position is with the cores in the outside ends of the coils. If the cores are not in the correct position, the coupling will be incorrect and it will be impossible to secure the correct response.

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 to prevent overloading.

22.5 mc.—T106 (bottom)
24.6 mc.—T104 (bottom)
22.0 mc.—T103 (bottom)
25.9 mc.—T102 (bottom)

T1 and T101 are coupled by a link and in combination constitute an overcoupled transformer. The characteristics of such a transformer are such that it is impossible to adjust it to a single frequency.

To sweep align T1 and T101, connect a 330-ohm composition resistor across the primary coils of T102, T103, T104 and T106.

Connect the "VoltOhmyst" to the junction of R135 and C190. Adjust the 250,000-ohm variable resistor for −2.0 volts on the meter.

Connect the oscilloscope to the plate of the first video amplifier, pin 1 of V106.

Connect a sweep generator to the converter grid through a 1,500 mmf capacitor. Set the generator to sweep from 20.0 mc. to 30.0 mc. and adjust the output to provide a 4-volt peak-to-peak signal on the scope.

Connect the signal generator loosely to the converter grid and tune it to provide markers at 22.05 mc. and 24.75 mc.

Adjust T1 (top) and T101 (bottom) to obtain the response shown in Figure 14. The T1 core must penetrate to the terminal-board end of the coil in order to obtain the correct response.

Remove the 330-ohm resistors from across T102, T103, T104 and T106.

Adjust the 250,000-ohm potentiometer for a 15-volt peak-to-peak signal at the plate of the first video amplifier. The bias as measured by the "VoltOhmyst" should be −12 volts or less.

Observe and analyze the response curve obtained. The response will not be ideal and the i-f adjustments must be retouched in order to obtain the desired curve. See Figure 15.

On final adjustment the picture carrier marker must be at approximately 45% response. The curve must be approximately flat topped, with the 22.1 mc. marker at approximately 95% response and the 25.0 mc. marker below 90% response. A 26.5 mc. marker must fall between 5 and 10% response.

The most important consideration in making the i-f adjustments is to get the picture carrier at the 45% response point. If the picture carrier operates too low on the response curve, loss of low frequency video response, of picture brilliance, of blanking, and of sync may occur. If the picture carrier operates too high on the response curve, the picture becomes smeared. In making these adjustments, care should be taken to see that no two transformers are tuned to the same frequency as i-f oscillation may result.

Remove the converter tube and take off the clip to pin number 1. Replace the tube in the socket.

Picture I-F Oscillation. — If the receiver will operate without oscillating with the test equipment disconnected but breaks into oscillation or becomes unstable with the equipment connected, it may become necessary to establish a ground plane. Cover the test bench with a sheet of copper and set the chassis on the sheet. Set all the test equipment except the "VoltOhmyst" on the sheet and bond or bypass them to it. A Junior "VoltOhmyst" should not be bonded to the sheet since the negative test probe is not always connected to ground during alignment. If the receiver is badly misaligned and two or more of the i-f transformers are tuned to the same frequency, the receiver may fall into i-f oscillation. I-F oscillation shows up as a voltage across the picture detector load resistor that is unaffected by r-f signal input. If such a condition is encountered, it is sometimes possible to stop oscillation by adjusting the transformers approximately to frequency by setting the adjustment cores of T101, T102, T103, T104, T105 and T106 to be approximately equal to those of another receiver known to be in proper alignment. If this does not have the desired effect, it may now be possible to stop oscillation by increasing the grid bias. If so, it should then be possible to align the transformers by the usual method. Once aligned in this manner, the i-f amplifier should be stable with reduced bias.

If the oscillation cannot be stopped in the above manner, shunt the grids of the first three pix i-f amplifiers to ground with 1,000 mmf. capacitors. Connect the signal generator to the fourth pix i-f grid and align T106 to frequency. Progressively remove the shunt from each grid and align the plate coil of that stage to frequency.

If this does not stop the oscillation, the difficulty is not due to i-f misalignment as the i-f section is stable when properly aligned. Check all i-f by-pass condensers, transformer shunting resistors, tubes, socket voltages, etc.

ANTENNA, R-F AND CONVERTER LINE ADJUSTMENT. — In order to align the r-f tuner, it will first be necessary to set the channel-13 oscillator to frequency. The shield over the bottom of the r-f unit must be in place when making any adjustments.

The channel-13 oscillator may be aligned by adjusting it to beat with a crystal-calibrated heterodyne frequency meter, or by feeding a signal into the receiver at the r-f sound carrier frequency and adjusting the oscillator for zero output from the sound discriminator. In this latter case the sound discriminator must first have been aligned to exact frequency. Either method of adjustment will produce the same results. The method used will depend upon the type of test equipment available. Regardless of which method of oscillator alignment is used, the frequency standard must be crystal controlled or calibrated.

If the receiver oscillator is to be adjusted by the heterodyne frequency meter method, couple the meter probe loosely to the receiver oscillator.

If the receiver oscillator is adjusted by feeding in the r-f sound carrier signal, connect the signal generator to the receiver antenna terminals. Connect the "VoltOhmyst" to the sound discriminator output (junction of C183 and R203).

Set the receiver switch to 13.

Adjust the frequency standard to the correct frequency (237 mc. for heterodyne frequency meter or 215.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range.

Adjust C6 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator.

Now that the channel-13 oscillator is set to frequency, we may proceed with the r-f alignment.

Connect the "VoltOhmyst" to the junction of R135 and L117. Adjust the 250K pot. for −3.5 volts on the meter

Remove the first pix i-f amplifier tube V101.

Connect the oscilloscope to the test connection at R13 in the r-f tuning unit.

Connect the r-f sweep oscillator to the receiver antenna terminals. The method of connection depends upon the output impedance of the sweep. The P102 connections for 300-ohm balanced or 72-ohm single-ended input are shown in the circuit diagrams in Figure 78. If the sweep oscillator has a 50-ohm single-ended output, 300-ohm balanced output can be obtained by connecting as shown in Figure 7.

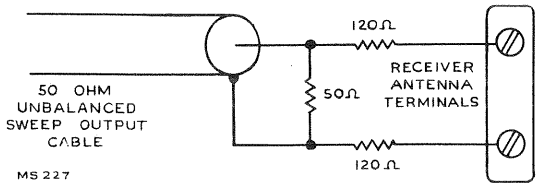


Figure 7—Unbalanced Sweep Cable Termination

Connect the signal generator loosely to the receiver antenna terminals.

Since channel 7 has the narrowest response of any of the high frequency channels, it should be adjusted first.

Set the receiver channel switch to channel 7.

Set the sweep oscillator to cover channel 7.

Insert markers of channel 7 picture carrier and sound carrier, 175.25 mc. and 179.75 mc.

Adjust C10 and C14 until the curve falls symmetrically between the sound and picture carrier markers. Adjust C11 to give the proper band width. Roughly peak L6 in conjunction with slight adjustments of C10 and C14 for a flat-topped response curve with the sound and picture carriers at 90% to 95% response points on this curve. See Figure 16, channel 7.

Switch to channel 12 and adjust L6 for maximum response and minimum top slope of the curve.

Check the response of channels 7 through 13 by switching the receiver channel switch, sweep oscillator and marker oscillator to each of these channels and observing the response obtained. See Figure 16 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 on one or more high frequency channels, since there are no individual channel adjustments, it will be necessary to readjust L6, C10, C11 and C14, and possibly compromise some channel slightly in order to get the markers up on other channels. Normally, however, no difficulty of this type should be experienced since the higher frequency channels are comparatively broad and the markers easily fall within the required range.

Channel 6 is next aligned in the same manner.

Set the receiver to channel 6.

Set the sweep oscillator to cover channel 6.

Set the marker oscillator to channel 6 picture and sound carrier frequencies.

Adjust L9, L13, L66, and C12 for an approximately flat-topped response curve located symmetrically between the markers. L9, L13 and L66 are the center frequency adjustments. C12 is the band-width adjustment

Check channels 5 down through channel 2 by switching the receiver, sweep oscillator and marker oscillator to each channel and observing the response obtained. In all cases, the markers should be above the 80% response point. If this is not the case, L9, L13, L66 and C12 should be retouched. On final adjustment, all channels must be within the 80% specification.

Disconnect the 250K pot., and replace V107 and V101.

Following an r-f alignment, the oscillator alignment must be checked.

R-F OSCILLATOR LINE ADJUSTMENT. — The r-f oscillator line may be aligned by adjusting it to beat with a crystal calibrated heterodyne frequency meter, or by feeding a signal into the receiver at the r-f sound carrier frequency and adjusting the oscillator for zero output from the sound discriminator. In this latter case the sound discriminator must first have been aligned to exact frequency. Either method of adjustment will produce the same results. The method used will depend upon the type of test equipment available.

Regardless of which method of oscillator alignment is used, the frequency standard must be crystal controlled or calibrated. If the receiver oscillator is to be adjusted by the heterodyne frequency meter method, the calibration frequency listed under R-F Osc. Freq. must be available.

If the receiver oscillator is adjusted by feeding in the r-f sound carrier frequency, the frequencies listed under Sound Carrier Freq. must be available.

Channel Number	Receiver R-F Osc. Freq. Mc.	R-F Sound Carrier Freq. Mc.	Channel Oscillator Adjustment
2	81	59.75	L24
3	87	65.75	L23
4	93	71.75	L22
5	103	81.75	L21
6	109	87.75	L31
7	201	179.75	L19
8	207	185.75	L18
9	213	191.75	L17
10	219	197.75	L16
11	225	203.75	L15
12	231	209.75	L14
13	237	215.75	C6

If the heterodyne frequency meter method is used, couple the meter probe loosely to the receiver oscillator.

If the r-f sound carrier method is used, connect the "VoltOhmyst" to the sound discriminator output (junction of C183 and R203) and connect the signal generator to the receiver antenna terminals. The order of alignment remains the same regardless of which method is used.

If the r-f unit is removed from the receiver for service and is aligned separately, the shield over the bottom of the r-f unit must be in place when making adjustments.

Since the lower frequencies are obtained by adding steps of inductance, it is necessary to align channel 13 first and continue in reverse numerical order.

Set the receiver channel switch to 13.

Adjust the frequency standard to the correct frequency (237 mc. for heterodyne frequency meter or 215.75 mc. for the signal generator).

Set the fine tuning control to the middle of its range while making the adjustment.

Adjust C6 for an audible beat on the heterodyne frequency meter or zero voltage from sound discriminator. Oscillator adjustments L1 and L2 shown on the schematic are factory control adjustments and should not be touched in the field.

Switch the receiver to channel 12.

Set the frequency standard to the proper frequency as listed in the alignment table.

Adjust L14 for indications as above.

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 for the speci-

Continued on page 13

T164, TC165, TC166, TC167, TC168

ALIGNMENT TABLE

THE DETAILED ALIGNMENT PROCEDURE BEGINNING ON PAGE 7 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 OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
				DISCRIMINATOR AND SOUND I-F ALIGNMENT					
1	2nd sound i-f grid (pin 1, V117)	21.25 .1 volt output	Not used		Not used	In series with 1 meg. to junction of R203 & R204		Detune T113(bot.) Adjust T113 (top) for max. on meter	Fig. 8 Fig. 9 Fig. 10
2	"	"	"		"	Junct. of C183 & R203	Meter on 3 volt scale	T113 (bottom) for zero on meter	Fig. 9 Fig. 10
3	"	"	2nd sound i-f grid (pin 1, V117)	21.25 center 1 mc. wide .1 v. out	Junction of C183 & R203	Not used	Check for symmetrical response waveform (positive & negative). If not equal adjust T113 (top) until they are equal		Fig. 10 Fig. 12
4	1st sound i-f grid (pin 1, V116)	21.25 reduced output	1st sound i-f grid	21.25 reduced output	Terminal A, T112 in series with a 33,000 ohm resistor	"	Sweep output reduced to provide .3 volt p-to-p on scope	T112 (top & bot.) for max. gain and symmetry at 21.25 mc.	Fig. 8 Fig. 9 Fig. 10 Fig. 13
				PICTURE I-F AND TRAP ADJUSTMENT					
5	Not used		Not used		Not used	Junction of R135 & C190	Remove V107. Connect potentiometer between pins 5 & 6 of V107 socket	Adjust pot. for meter reading of −12 volts	Fig. 10
6	Converter grid (pin 1, V2)	21.25	"		"	Across R119	Meter on 3 volt scale. Receiver between 2 and 13	T103 (top) for min. on meter	Fig. 8
7	"	21.25	"		"	"	"	T105 (top) for min.	"
8	"	27.25	"		"	"	"	T102 (top) for min.	"
9	"	27.25	"		"	"	"	T104 (top) for min.	"
10	"	19.75	"		"	"	"	T106 (top) for min.	"
11	"	19.75	"		"	"	"	T101 (top) for min.	"
12	"	22.5	"		"	"	"	T106 (bottom) for max. on meter	Fig. 9
13	"	24.6	"		"	"	"	T104 (bottom) for max.	"
14	"	22.0	"		"	"	"	T103 (bottom) for max.	"
15	"	25.9	"		"	"	"	T102 (bottom) for max.	"
16	"	22.05 24.75	Converter grid (pin 1, V2)	Sweeping 20 to 30 mc.	Pin 1, V106	Junction of R135 & C190	Shunt 330 ohms across pri. T102, T103, T104, T106. Set bias −2 V. Set swp. gen. for 4 V. P-P on scope.	Adjust T1 (top) and T101 (bottom) for proper response	Fig. 8 Fig. 9 Fig. 14
17	"		"	"	"	"	Remove shunt resistors. Set bias to give 15 volts P to P on scope.	Adjust T1 (top), T101, T102, T103, T104, T106 (bot.) for proper resp.	Fig. 8 Fig. 9 Fig. 15
				ANTENNA, R-F AND CONVERTER LINE ALIGNMENT					
18	Antenna terminals	215.75	Not used		Not used	Junction of C183 & R203 for signal gen. method only	Fine tuning centered. Receiver on channel 13. Heterodyne meter coupled to oscillator if used.	C6 for zero on meter or beat on het. freq. meter	Fig. 8 Fig. 10
19						Junction of R135 & L117	Remove V101	Potentiometer for −3.5 volts on meter	Fig. 8 Fig. 10
20	Antenna terminal (loosely)	175.25 & 179.75	Antenna terminals (see text for precaution)	Sweeping channel 7	Test Connection R13	Not used	Receiver on channel 7	L6, C10, C11 & C14 for flat top response between markers. Markers above 90%.	Fig. 8 Fig. 9 Fig. 16 (7)
21	"	205.25 209.75	"	channel 12	"	"	Receiver on channel 12	L6 for max. response and min. slope of top of curve	Fig. 8 Fig. 16 (12)
22	"	175.25 179.75	"	channel 7	"	"	Receiver on channel 7	Check to see that response is as above	Fig. 16 (7)
23	"	181.25 185.75	"	channel 8	"	"	Receiver on channel 8	"	Fig. 16 (8)
24	"	187.25 191.75	"	channel 9	"	"	Receiver on channel 9	"	Fig. 16 (9)
25	"	193.25 197.75	"	channel 10	"	"	Receiver on channel 10	"	Fig. 16 (10)

ALIGNMENT PROCEDURE

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT SWEEP GENERATOR TO	SWEEP GEN. FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
ANTENNA, R-F AND CONVERTER LINE ALIGNMENT (Continued)									
26	"	199.25 203.75	"	channel 11	"	"	Receiver on channel 11	"	Fig. 16 (11)
27	"	205.25 209.75	"	channel 12	"	"	Receiver on channel 12	"	Fig. 16 (12)
28	"	211.25 215.75	"	channel 13	"	"	Receiver on channel 13	"	Fig. 16 (13)
29	If the response on any channel (steps 22 through 28) is below 80% at either marker, switch to that channel and adjust L6, C10, C11 & C14 to pull response up on that channel. Then recheck steps 22 through 28.								
30	Antenna terminals (loosely)	83.25 87.75	Ant. terminals (see text for precaution)	Sweeping chan. 6	Test Connection R13	Not used	Receiver on channel 6	L9, L13, L66 & C12 for response as above	Fig. 16 (6)
31	"	77.25 81.75	"	channel 5	"	"	Receiver on channel 5	Check to see that response is as above	Fig. 16 (5)
32	"	67.25 71.75	"	channel 4	"	"	Receiver on channel 4	"	Fig. 16 (4)
33	"	61.25 65.75	"	channel 3	"	"	Receiver on channel 3	"	Fig. 16 (3)
34	"	55.25 59.75	"	channel 2	"	"	Receiver on channel 2	"	Fig. 16 (2)
35	If the response on any channel (steps 31 through 34) is below 80% at either marker, switch to that channel and adjust L9, L13, L66 & C12 to pull response up on that channel. Then recheck steps 30 through 34. Disconnect the bias pot. and replace V101 and V107.								

R-F OSCILLATOR ALIGNMENT

STEP No.	CONNECT SIGNAL GENERATOR TO	SIGNAL GEN. FREQ. MC.	CONNECT HETERODYNE FREQ. METER TO	HET. METER FREQ. MC.	CONNECT OSCILLOSCOPE TO	CONNECT "VOLTOHMYST" TO	MISCELLANEOUS CONNECTIONS AND INSTRUCTIONS	ADJUST	REFER TO
36	Antenna terminals	215.75	Loosely coupled to r-f osc.	237	Not used	Junction of C183 & R203 for sig. gen. method only	Fine tuning centered. Receiver on channel 13	C6 for zero on meter or beat on het. freq. meter	Fig. 8 Fig. 10
37	"	209.75	"	231	"	"	Rec. on chan. 12	L14 as above	Fig. 11
38	"	203.75	"	225	"	"	Rec. on chan. 11	L15 as above	"
39	"	197.75	"	219	"	"	Rec. on chan. 10	L16 as above	"
40	"	191.75	"	213	"	"	Rec. on chan. 9	L17 as above	"
41	"	185.75	"	207	"	"	Rec. on chan. 8	L18 as above	"
42	"	179.75	"	201	"	"	Rec. on chan. 7	L19 as above	"
43	"	87.75	"	109	"	"	Rec. on chan. 6	L31 as above	Fig. 9
44	"	81.75	"	103	"	"	Rec. on chan. 5	L21 as above	Fig. 11
45	"	71.75	"	93	"	"	Rec. on chan. 4	L22 as above	"
46	"	65.75	"	87	"	"	Rec. on chan. 3	L23 as above	"
47	"	59.75	"	81	"	"	Rec. on chan. 2	L24 as above	"
48	Repeat steps 36 through 47 as a check.								

AGC THRESHOLD ADJUSTMENT

49	Not used		Not used		Pin 1, V106	Not used	Tune in station, turn pix control clockwise. Adjust R138 for max. gain without clipping sync on scope		Fig. 10 Fig. 17

HORIZONTAL OSCILLATOR ADJUSTMENT

50	Short circuit terminals C and D of T109. Tune in a station. Set locking range trimmer C153A ½ turn out from maximum.
51	Turn hold control fully clockwise. Adjust T109 Frequency Adjustment until horizontal blanking bar appears in the picture.
52	Turn hold control ¼ turn from clockwise to sync picture. Adjust width (R192), linearity (L111) and drive (C153B) controls until picture is correct. Repeat step 51, then proceed with step 53.
53	Remove clip from terminals C and D of T109. Turn hold control fully clockwise. Adjust T109 Oscillator Waveform Adjustment until horizontal blanking bar appears in picture with core in outer of two possible positions.
54	Connect low capacity probe of oscilloscope to terminal C of T109. Alternately adjust T109 Oscillator Waveform Adjustment and frequency adjustment until broad and sharp peaks of wave on oscilloscope are same height while keeping picture in sync. Remove oscilloscope.
55	Connect a 270K resistor across C156. Turn hold control fully counter-clockwise. Momentarily remove signal. Turn hold control slowly clockwise. Note least number of bars before pull-in. Adjust Locking Range Control (C153A) for 2 bar pull-in.
56	Turn hold control fully clockwise. Adjust T109 Freq. Adjustment until horizontal blanking appears as single vertical or diagonal bar in pix.

4.5 MC VIDEO TRAP ADJUSTMENT

57	Tune in a strong station. Short T103 trap. If a 4.5 mc. beat appears in picture adjust 4.5 mc. trap (L110) until beat is eliminated.

SENSITIVITY CHECK

58	Connect antenna to receiver through attenuator pad to provide weak signal. Compare the picture and sound obtained to that obtained on other receivers under the same conditions.

ALIGNMENT DATA

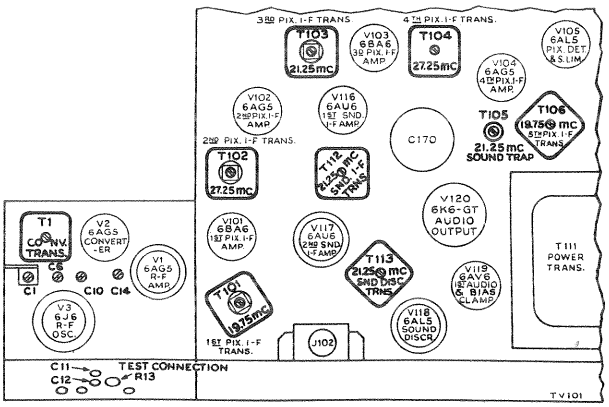


Figure 8—Top Chassis Adjustments

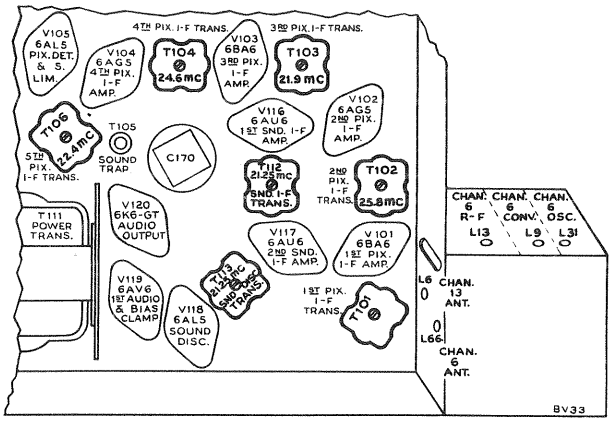


Figure 9—Bottom Chassis Adjustments

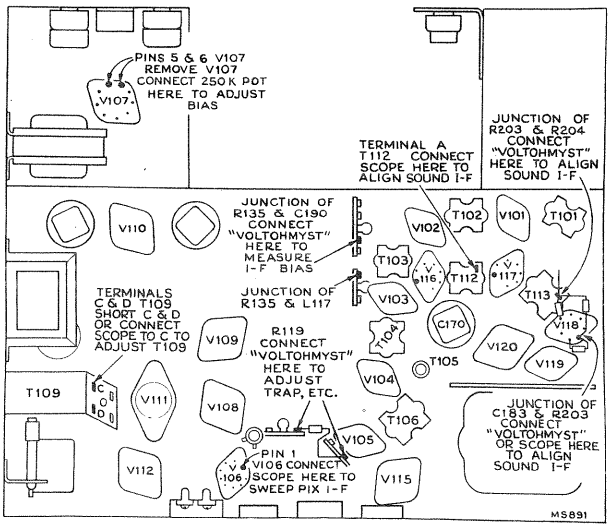
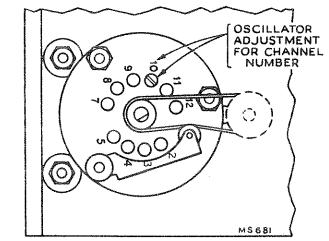


Figure 10—Test Connection Points



OSCILLATOR ADJUSTMENT FOR CHANNEL 13 IS ON TOP OF R-F UNIT AND CHANNEL 6 IS ON SIDE.

Figure 11—R-F Oscillator Adjustments

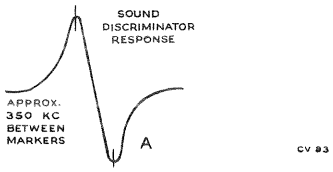


Figure 12 Discriminator Response

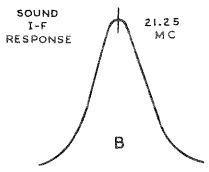


Figure 13 Sound I-F Response

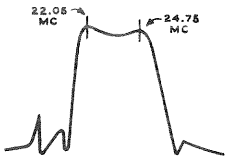


Figure 14 T1 and T101 Response

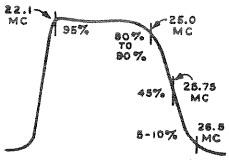


Figure 15 Overall I-F R-F Response

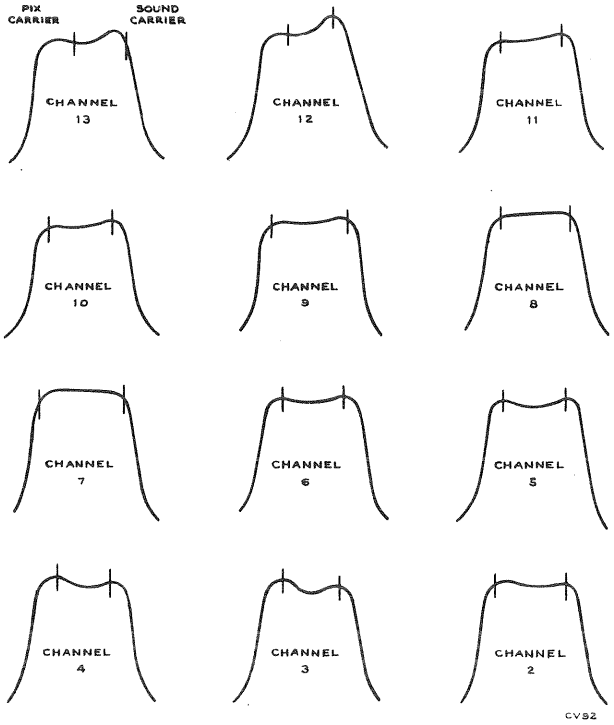


Figure 16—R-F Response

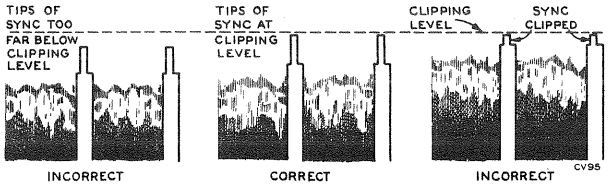


Figure 17—AGC Threshold Adjustment Waveforms

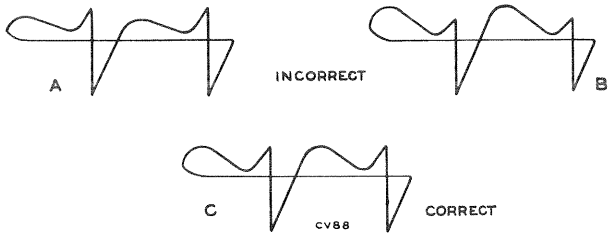


Figure 18—Horizontal Oscillator Waveforms

RESPONSE AND WAVEFORM PHOTOGRAPHS

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:

Shunt all i-f transformers and coils with a 330 ohm carbon resistor except the one whose response is to be observed.

Connect a wide band sweep generator to the converter grid and adjust it to sweep from 18 mc. to 30 mc.

Connect the oscilloscope across the picture detector load resistor and observe the overall response. The response obtained will be essentially that of the unshunted stage. The effects of the various traps are also visible on the stage response.

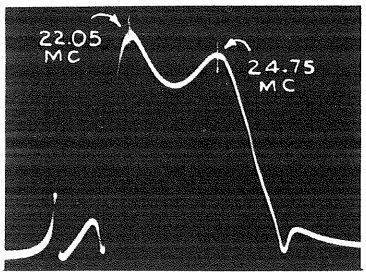


Figure 19—Response of Converter and First Pix I-F Transformer

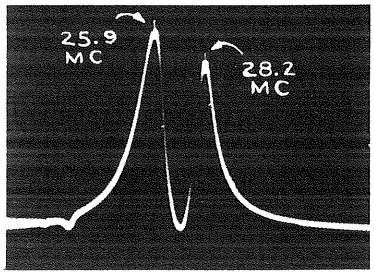


Figure 20—Response of Second Pix I-F Transformer

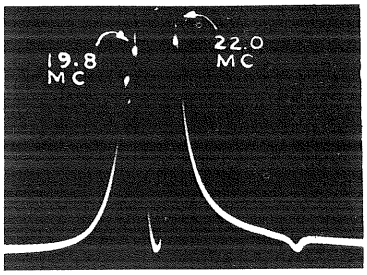


Figure 21—Response of Third Pix I-F Transformer

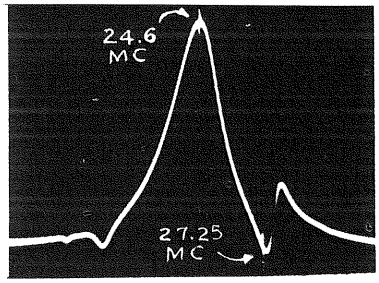


Figure 22—Response of Fourth Pix I-F Transformer

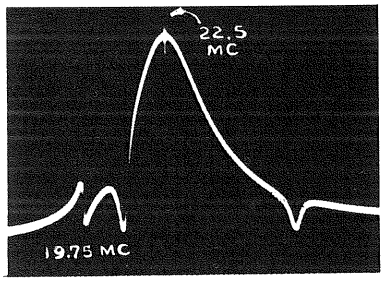


Figure 23—Response of Fifth Pix I-F Transformer

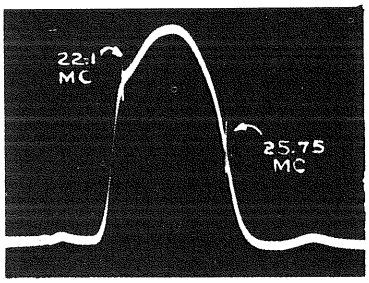


Figure 24—Response from First Pix I-F grid to Pix Det.

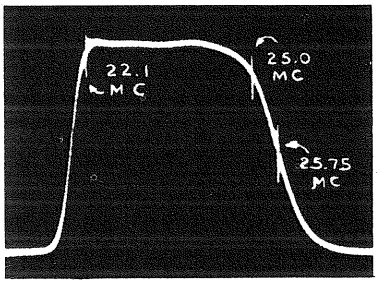


Figure 25—Overall Pix I-F Response

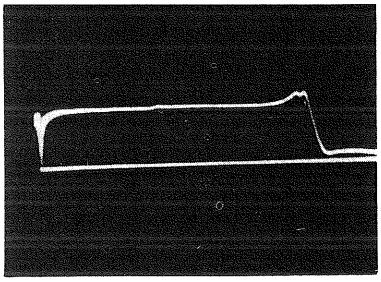


Figure 26—Video Response at Average Contrast

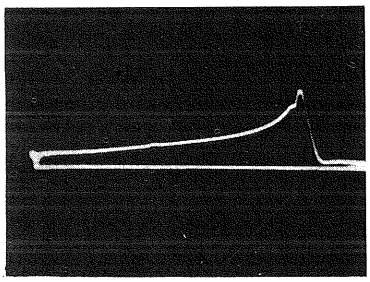
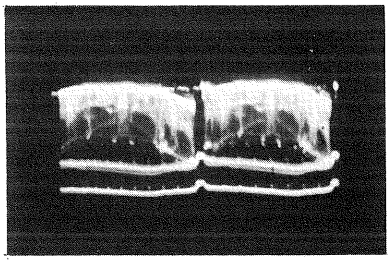


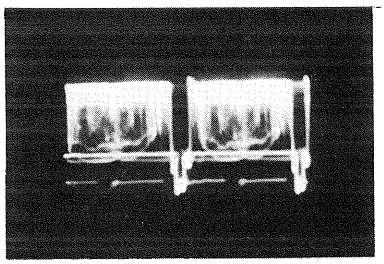
Figure 27—Video Response at Minimum Contrast

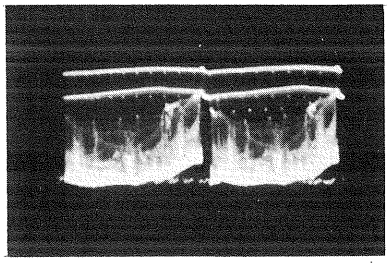


Video Signal Input to 1st Video Amplifier (Pin 2 of V106) (12AU7)

Figure 28—Vertical (Oscilloscope Synced to ½ of Vertical Sweep Rate) (5.4 Volts PP)

Figure 29—Horizontal (Oscilloscope Synced to ½ of Horizontal Sweep Rate) (5.4 Volts PP)

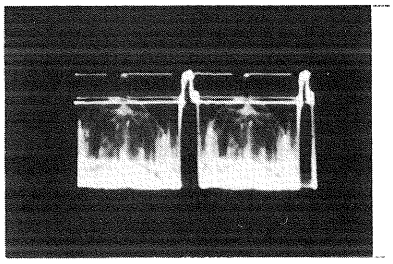




Sync Feed (Junction of L104, R219 and C194)

Figure 30—Vertical (28 Volts PP)

Figure 31—Horizontal (28 Volts PP)



ALIGNMENT PROCEDURE (Continued)

fied indication. 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.

After the oscillator has been set on all channels, start back at channel 13 and recheck to make sure that all adjustments are correct.

AGC THRESHOLD ADJUSTMENT. — The AGC threshold adjustment can be made by the method outlined in the Installation Instructions. However, a more accurate adjustment can be obtained by the use of an oscilloscope.

Tune in a station and advance the picture control to the maximum clockwise position. Connect the low capacity probe from the oscilloscope to the plate of the first video amplifier, pin 1 of V106. Adjust the oscilloscope to observe the horizontal sync pulse.

Turn the AGC threshold control R138 fully clockwise, then slowly counter-clockwise. As the control is turned counter-clockwise, the receiver gain will increase slowly, increasing the size of the pattern on the oscilloscope. R138 should be turned counter-clockwise until the receiver begins to overload as indicated by clipping of the sync. The control should be left in the maximum gain position in which no clipping of sync is observed. See Figure 17 for proper waveforms.

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 requires 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.—Set the locking range trimmer one half turn out from maximum capacity. With a clip lead, short circuit the coil between terminals C and D of the horizontal oscillator transformer T109. Tune in a television station and sync the picture if possible.

A. — Turn the horizontal hold control R173 to the extreme clockwise position. Adjust the T109 Frequency Adjustment (under the chassis) so that the picture is just out of sync and the horizontal blanking appears in the picture as a vertical bar. The position of the bar is unimportant.

Note.—Occasionally a tube may be found which does not respond to step "A" above, since it may not be possible to sync the picture by means of the frequency core when the sine wave coil is shorted out. Yet, the tube may work perfectly well when the circuit is properly aligned. In such a case it may be necessary to remove the short then turn the sine wave core out then in until it is possible to obtain sync by adjustment of the frequency core.

B. — Turn the hold control approximately one-quarter of a turn from the extreme clockwise position and examine the width and linearity of the picture. If picture width or linearity is incorrect, adjust the horizontal drive control C153B, the width control R192 and the linearity control L111 until the picture is correct. If C153B was adjusted, repeat step "A" and note above.

Horizontal Oscillator Waveform Adjustment. — Remove the shorting clip from terminals C and D of T109. Turn the horizontal hold control to the extreme clockwise position. With a thin fibre screwdriver, if necessary, adjust the Oscillator Waveform Adjustment Core of T109 (on the outside of the chassis) until the horizontal blanking bar appears in the raster. The waveform adjustment core will sync the picture in two positions. The core should be in the position nearest the outside of the chassis.

A. — Connect the low capacity probe of an oscilloscope to terminal C of T109. Alternately adjust the waveform and frequency cores of T109 until the peak of the sine wave is equal in amplitude to the peak of the saw tooth, on the oscilloscope as shown in Figure 18, while maintaining the picture in synchronization. Then adjust the frequency core until horizontal blanking shows as a vertical bar in the picture.

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.

Check of Oscillator Pull-in Range.—Set the horizontal hold control to the full counter-clockwise position.

Connect a 270K ohm resistor across C156.

Momentarily switch off channel and back. The picture will then be out of sync.

Turn the hold control clockwise slowly and observe the minimum number of bars obtained just before the picture pulls into sync. The picture should snap in from two complete blanking bars. If two bars are not obtained turn the locking range trimmer C153A in to obtain less bars or out to obtain more bars.

After adjustment of C153A, remove the 270K resistor, turn the horizontal hold control fully clockwise and readjust the frequency core of T109 until the picture is in sync and the horizontal blanking bar begins to move in the picture. Then repeat the entire "Check of Pull-in Range" procedure to this point. Repeat this procedure until two bar pull-in is obtained.

Turn the horizontal hold control to the maximum clockwise position. The picture should be just out of sync to the extent that the horizontal blanking bar appears as a single vertical or diagonal bar in the picture. Adjust the T109 Frequency Adjustment until this condition is fulfilled.

4.5 MC. VIDEO TRAP. — With a strong input from a station, detune the receiver from the correct fine tuning point. With a very short clip lead, short the trap winding of T103. Observe the picture for the appearance of a 4.5 mc. beat. If the beat appears in the picture, adjust L110 until the beat is eliminated.

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.

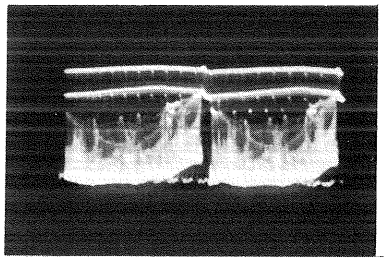
This weak signal can be obtained by connecting the shop antenna to the receiver through a ladder type attenuator pad. The number of stages in the pad depends upon the signal strength available at the antenna. A sufficient number of stages should be inserted so that a somewhat less than normal contrast picture is obtained when the picture control is at the maximum clockwise position. Only carbon type resistors should be used to construct the pad.

RESPONSE CURVES. — The response curves shown on page 12 and referred to throughout the alignment procedure were taken from a production set. Although these curves are typical, 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. The curves may be seen inverted and/or switched from left to right depending on the deflection polarity of the oscilloscope and the phasing of the sweep generator.

ALIGNMENT TABLE. — Both methods of oscillator alignment are presented in the alignment table. The service technician may thereby choose the method to suit his test equipment.

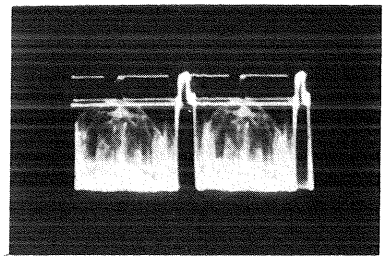
WAVEFORM PHOTOGRAPHS

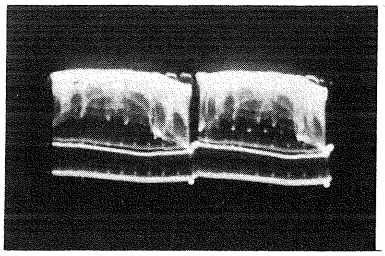


Input to 2nd Video Amplifier (Pin 7 of V106) (12AU7)

Figure 32—Vertical (17 Volts PP)

Figure 33—Horizontal (17 Volts PP)

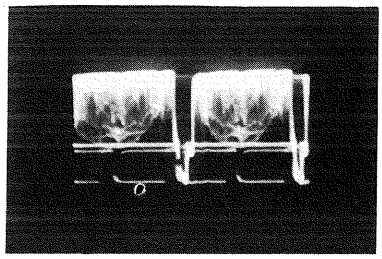


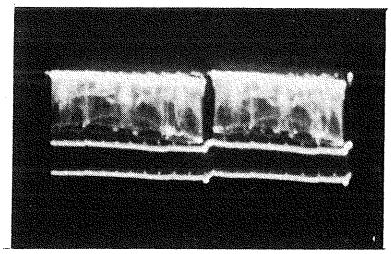


Output of 2nd Video Amplifier (Junction of L105 and R127) (Picture Max.)

Figure 34—Vertical (96 Volts PP)

Figure 35—Horizontal (96 Volts PP)

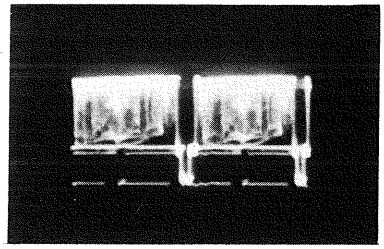


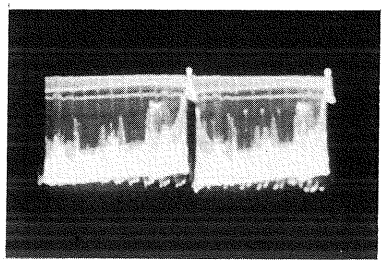


Input to Kinescope (Junction of R127 and R128) (Picture Max.)

Figure 36—Vertical (65 Volts PP)

Figure 37—Horizontal (65 Volts PP)

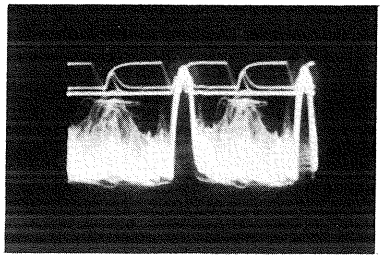


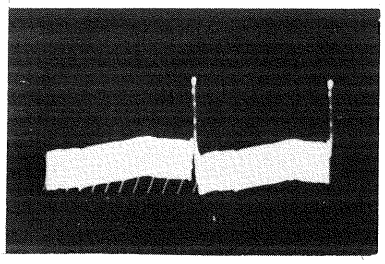


Input to 1st Sync Separator (Pin 1 of V108) (6SN7GT)

Figure 38—Vertical (25 Volts PP)

Figure 39—Horizontal (23 Volts PP)

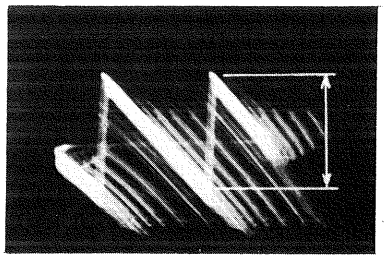


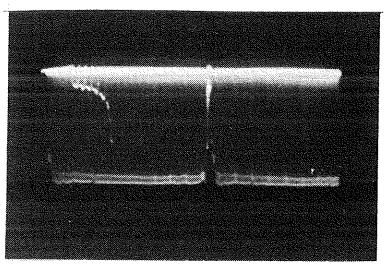


AGC Rectifier Cathode (Pin 6 of V108) (6SN7GT)

Figure 40—Vertical (4.7 Volts PP)

Figure 41—Horizontal (1.5 Volts PP)

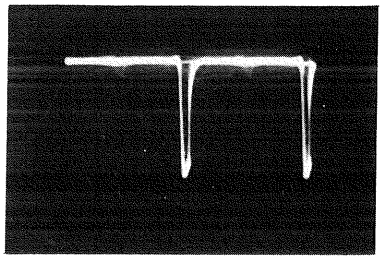




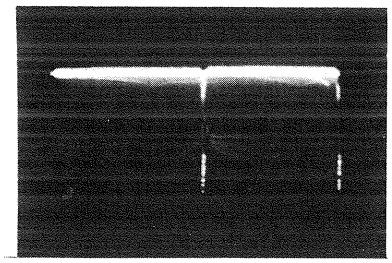
Output of AGC Rectifier (Pin 5 of V108) (6SN7GT)

Figure 42—Vertical (24 Volts PP)

Figure 43—Horizontal (24 Volts PP)



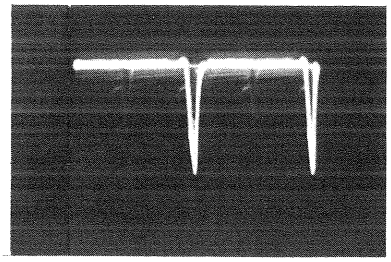
WAVEFORM PHOTOGRAPHS

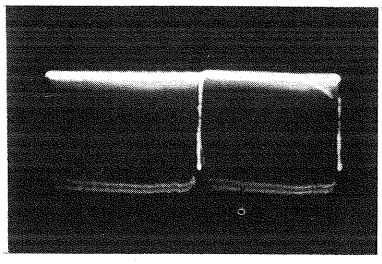


Output of 1st Sync Separator (Pin 2 of V108) (6SN7GT)

***Figure 44**—Vertical (26 Volts PP)*

***Figure 45**—Horizontal (25.5 Volts PP)*

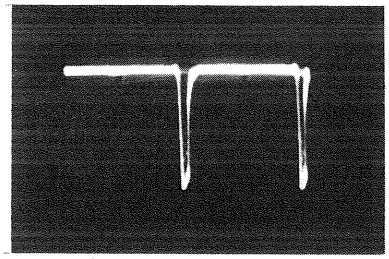


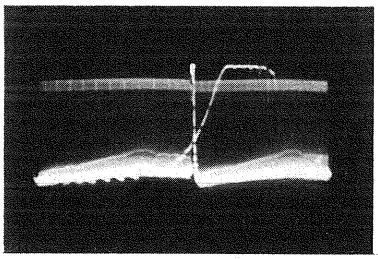


Input to Sync Amplifier (Junction of C137, C139 and R145)

***Figure 46**—Vertical (21 Volts PP)*

***Figure 47**—Horizontal (21 Volts PP)*

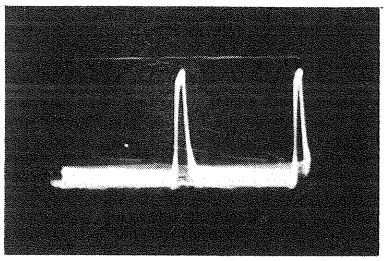


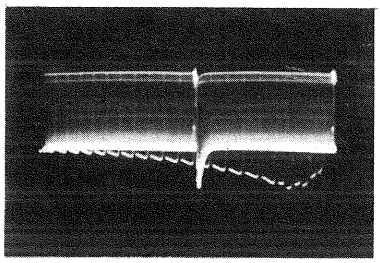


Output of Sync Amplifier (Pin 2 of V109) (6SN7GT)

***Figure 48**—Vertical (115 Volts PP)*

***Figure 49**—Horizontal (105 Volts PP)*

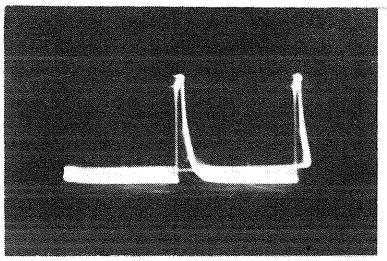




Cathode of 2nd Sync Separator (Pin 6 of V109) (6SN7GT)

***Figure 50**—Vertical (17 Volts PP)*

***Figure 51**—Horizontal (11 Volts PP)*



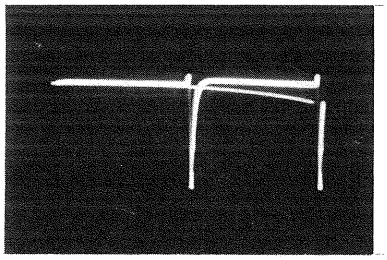
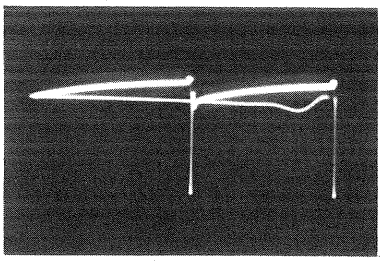


***Figure 52**—Output of Integrating Network (Junction of C144, C145 and R153) (45 Volts PP)*

***Figure 53**—Grid of Vertical Oscillator (720 Volts PP) (Pin 1 of V107) (6SN7GT)*



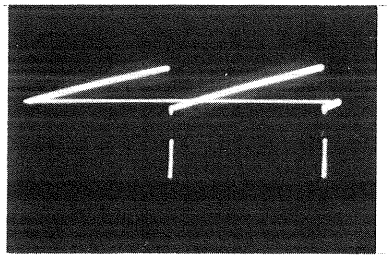
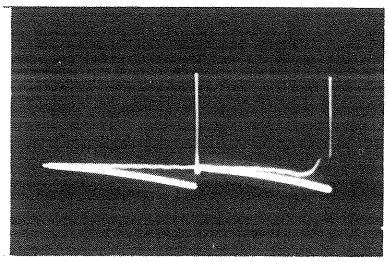


***Figure 54**—Grid of Vertical Output (160 Volts PP) (Pin 5 of V110) (6K6GT)*

***Figure 55**—Plate of Vertical Output (750 Volts PP) (Pin 3 of V110) (6K6GT)*



WAVEFORM PHOTOGRAPHS

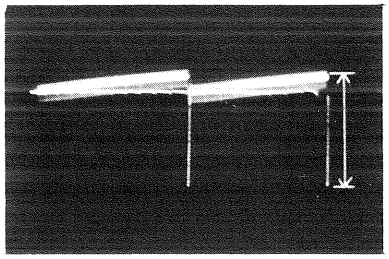


Figure 56—Input of Vertical Deflection Coils (75 Volts PP) (Junction of Green Lead of T108 and Green Lead of Yoke)

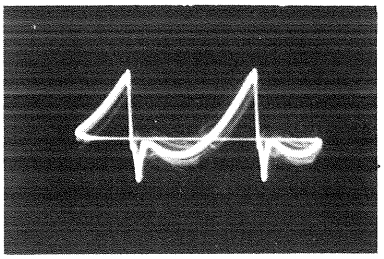


Figure 57—Input to Horizontal Oscillator (17.5 Volts PP) (Junction of C153A and C154)

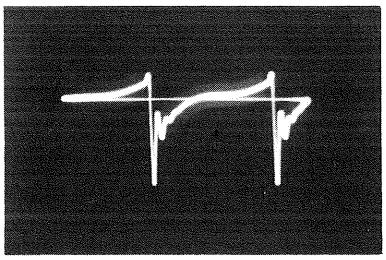


Figure 58—Junction of R168, R176 and R178 (150 Volts PP)

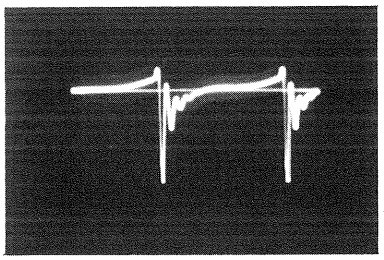


Figure 59—Grid of Horizontal Oscillator (480 Volts PP) (Pin 4 of V111) (6SN7GT)

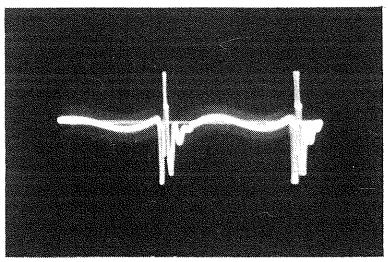


Figure 60—Plate of Horizontal Oscillator (270 Volts PP) (Pin 5 of V111) (6SN7GT)

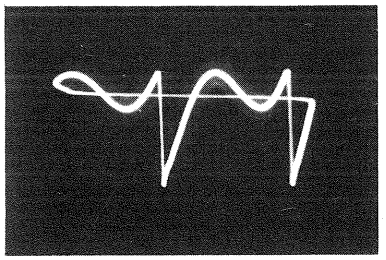


Figure 61—Terminal "C" of T109 (70 Volts PP)

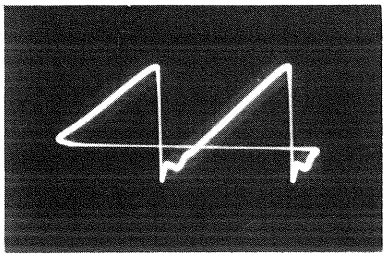


Figure 62—Input to Horizontal Output Tube (42 Volts PP) (Junction of C160, R183 and C153B)

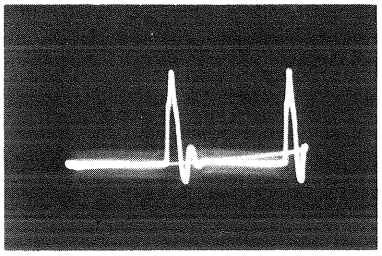


Figure 63—Plate of Horizontal Output (Approx. 6,500 Volts PP) (Measured Through a Capacity Voltage Divider Connected from Top Cap of V112 to Ground)

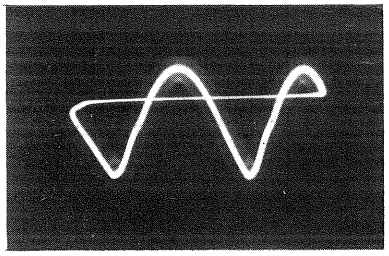


Figure 64—Terminal 1 of T110 (200 Volts PP)

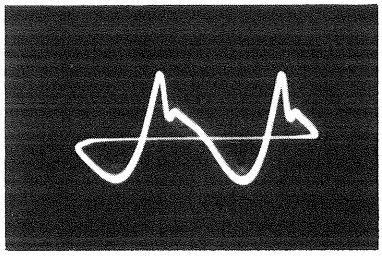


Figure 65—Plate of Damper (250 Volts PP) (Pin 5 of V114) (6W4GT)

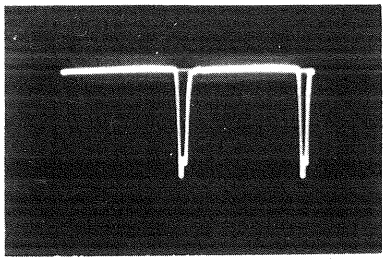


Figure 66—Input to Horizontal Deflection Coils (3,000 Volts PP)

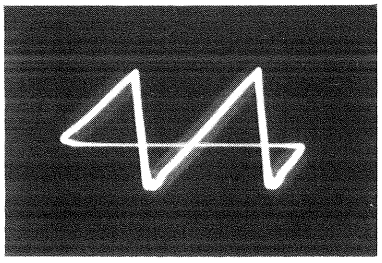


Figure 67—Horizontal Deflection Coil Current (0.5 Amp. PP) Measured by Inserting a 5-ohm Resistor in series with the yoke and observing the waveform across the resistor.

T164, TC165, TC166, TC167, TC168

VOLTAGE CHART

The following measurements represent two sets of conditions. In the first condition a 2200 microvolt test pattern signal was fed into the receiver, the picture was synced and the AGC threshold control was properly adjusted. The second condition was obtained by removing the antenna leads and short-circuiting the receiver antenna terminals. Voltages shown are as read with "Jr. VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles a-c. Symbol < means less than.

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	6AG5	R-F Amplifier	2200 Mu. V. Signal	5	130	6	132	2 & 7	0	1	-2.2	5	2	
			No Signal	5	67	6	111	2 & 7	0	1	0.0	14.0	5.0	
V2	6AG5	Converter	2200 Mu. V. Signal	5	*130 to 140	6	*130 to 140	2 & 7	0	1	*-3.0 to -7.0	*7.1 to 7.7	*2.3 to 2.7	*Depending upon channel
			No Signal	5	*107 to 109	6	*107 to 109	2 & 7	0	1	*-2.0 to -6.0	*5.3 to 5.9	*.8 to 1.0	
V3	6J6	R-F Oscillator	2200 Mu. V. Signal	1 & 2	*88 to 95	—	—	7	.19	5 & 6	*-5.1 to -7.3	*1.9 to 2.7	—	*Depending upon channel
			No Signal	1 & 2	*68 to 81	—	—	7	.16	5 & 6	*-4.5 to -6.6	*1.8 to 2.1	—	
V101	6BA6	1st Pix. I-F Amplifier	2200 Mu. V. Signal	5	128	6	128	7	.4	1	-11.0	1.9	.8	
			No Signal	5	95	6	95	7	1.73	1	+.2	8.1	3.4	
V102	6AG5	2d Pix. I-F Amplifier	2200 Mu. V. Signal	5	119	6	119	2 & 7	.78	1	0	8.8	2.4	
			No Signal	5	100	6	100	2 & 7	.62	1	0	7.4	1.6	
V103	6BA6	3d Pix. I-F Amplifier	2200 Mu. V. Signal	5	81	6	119	7	.52	1	-2.2	11.1	.3	
			No Signal	5	55	6	96	7	.62	1	+0.2	13.2	.3	
V104	6AG5	4th pix. I-F Amplifier	2200 Mu. V. Signal	5	159	6	135	2 & 7	1.5	1	0	7.2	2.2	
			No Signal	5	165	6	118	2 & 7	1.35	1	0	6.8	2.4	
V105 A	6AL5	Picture 2d Det.	2200 Mu. V. Signal	7	-116	—	—	1	-127	—	—	.3	—	
			No Signal	7	-131	—	—	1	-135	—	—	<0.1	—	
V105 B	6AL5	Sync Limiter	2200 Mu. V. Signal	2	-117	—	—	5	-58	—	—	—	—	
			No Signal	2	-63	—	—	5	-60	—	—	—	—	
V106	12AU7	1st Video Amplifier	2200 Mu. V. Signal	1	-18.7	—	—	3	-125	2	-129	2.6	—	
			No Signal	1	-28.0	—	—	3	-133	2	-135	6.6	—	
V106	12AU7	2d Video Amplifier	2200 Mu. V. Signal	6	*120	—	—	8	*-11.0	7	*-13.2	9.2	—	*At minimum contrast
			No Signal	6	*127	—	—	8	*-17.0	7	*-21.0	8.5	—	
			2200 Mu. V. Signal	6	*193	—	—	8	*-0.6	7	*-13.1	3.2	—	*At maximum contrast
			No Signal	6	*228	—	—	8	*-0.8	7	*-20.0	0.2	—	
V107 A	6SN7 GT	ACG Amplifier	2200 Mu. V. Signal	5	-11	—	—	6	-58	4	-61	.12	—	
			No Signal	5	+ 0.2	—	—	6	-60	4	-66	0	—	
V107 B	6SN7 GT	Vertical Oscillator	2200 Mu. V. Signal	2	125	—	—	3	-127	1	-170	.31	—	
			No Signal	2	120	—	—	3	-135	1	-175	.30	—	
V108	6SN7 GT	AGC Rectifier	2200 Mu. V. Signal	5	37	—	—	6	-2	4	-19.5	.3	—	
			No Signal	5	75	—	—	6	-22	4	-28.0	<.1	—	
V108	6SN7 GT	1st Sync Separator	2200 Mu. V. Signal	2	87	—	—	3	-3	1	-18.5	<.1	—	
			No Signal	2	73	—	—	3	-22	1	-28.0	<.1	—	

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			
V109	6SN7 GT	Sync Amplifier	2200 Mu. V. Signal	2	153	—	—	3	0	1	-5.0	5.8	—	
			No Signal	2	160	—	—	3	0	1	-5.6	5.4	—	
V109	6SN7 GT	Sync Separator	2200 Mu. V. Signal	5	241	—	—	6	-58	4	-117	.22	—	
			No Signal	5	240	—	—	6	-57	4	-65	.71	—	
V110	6K6-GT	Vertical Output	2200 Mu. V. Signal	3	240	4	240	8	-78	5	-107	10	2.0	Screen connected to plate
			No Signal	3	235	4	235	8	-83	5	-111	10	1.9	
V111	6SN7 GT	Horizontal Osc. Control	2200 Mu. V. Signal	2	50	—	—	3	-136	1	-127	.11	—	
			No Signal	2	14	—	—	3	*-155	1	*-147	.10	—	Hold control counterclockwise
			No Signal	2	78	—	—	3	*-140	1	*-142	.11	—	Hold control clockwise
V111	6SN7 GT	Horizontal Oscillator	2200 Mu. V. Signal	5	86	—	—	6	-127	4	-193	2.0	—	
			No Signal	5	80	—	—	6	-135	4	-205	1.7	—	
V112	6BG6G	Horizontal Output	2200 Mu. V. Signal	Cap	Do Not Meas.	8	152	3	-117	5	-145	67.9	8.1	
			No Signal	Cap	Do Not Meas.	8	150	3	-126	5	-157	66.0	8.0	
V113	1B3GT /8016	H. V. Rectifier	Brightness Min.	Cap	Do Not Meas.	—	—	2 & 7	12,300	—	—	0	—	
			Brightness Average	Cap	Do Not Meas.	—	—	2 & 7	11,700	—	—	.1	—	
V114	6W4GT	Damper	2200 Mu. V. Signal	5	Do Not Meas.	—	—	3	498	—	—	86	—	
			No Signal	5	Do Not Meas.	—	—	3	496	—	—	70	—	
V115	5U4G	Rectifier	2200 Mu. V. Signal	4 & 6	*385	—	—	2 & 8	267	—	—	225	—	*AC measured from plate to trans. center tap
			No Signal	4 & 6	*385	—	—	2 & 8	260	—	—	226	—	
V116	6AU6	1st Sound I-F Amplifier	2200 Mu. V. Signal	5	124	6	124	7	.87	1	-0.1	7.0	3.0	
			No Signal	5	107	6	107	7	.75	1	-0.15	6.4	2.3	
V117	6AU6	2nd Sound I-F Amplifier	2200 Mu. V. Signal	5	130	6	67	7	0	1	-9	4.3	1.5	
			No Signal	5	120	6	60	7	0	1	-0.37	3.7	1.6	
V118	6AL5	Sound Discrim.	2200 Mu. V. Signal	2	-8.4	—	—	5	5.8	—	—	—	—	
			No Signal	2	-0.4	—	—	5	0	—	—	—	—	
			2200 Mu. V. Signal	7	-3.7	—	—	1	0	—	—	—	—	
			No Signal	7	-0.4	—	—	1	0	—	—	—	—	
V119	6AV6	1st Audio Amplifier	2200 Mu. V. Signal	7	80	—	—	2	0	1	-.89	.48	—	
			No Signal	7	77	—	—	2	0	1	-.89	.47	—	
V120	6K6-GT	Audio Output	2200 Mu. V. Signal	3	193	4	135	8	-101	5	-127	12.4	2.1	
			No Signal	3	193	4	121	8	-109	5	-135	11.9	2.1	
V121	16GP4	Kinescope	2200 Mu. V. Signal	Cap	12,300	10	250	11	77	2	35	.06	—	Avg. Bright. Avg. Contrast
			2200 Mu. V. Signal	Cap	12,700	10	250	11	110	2	36	0	—	Min. Bright. Avg. Contrast
			2200 Mu. V. Signal	Cap	12,700	10	368	11	105	2	-2	0	—	Low Bright. Min. Contrast
			No Signal	Cap	11,700	10	366	11	73	2	48	.18	—	Avg. Bright. Avg. Contrast

T164, TC165, TC166, TC167, TC168

R-F UNIT WIRING DIAGRAM

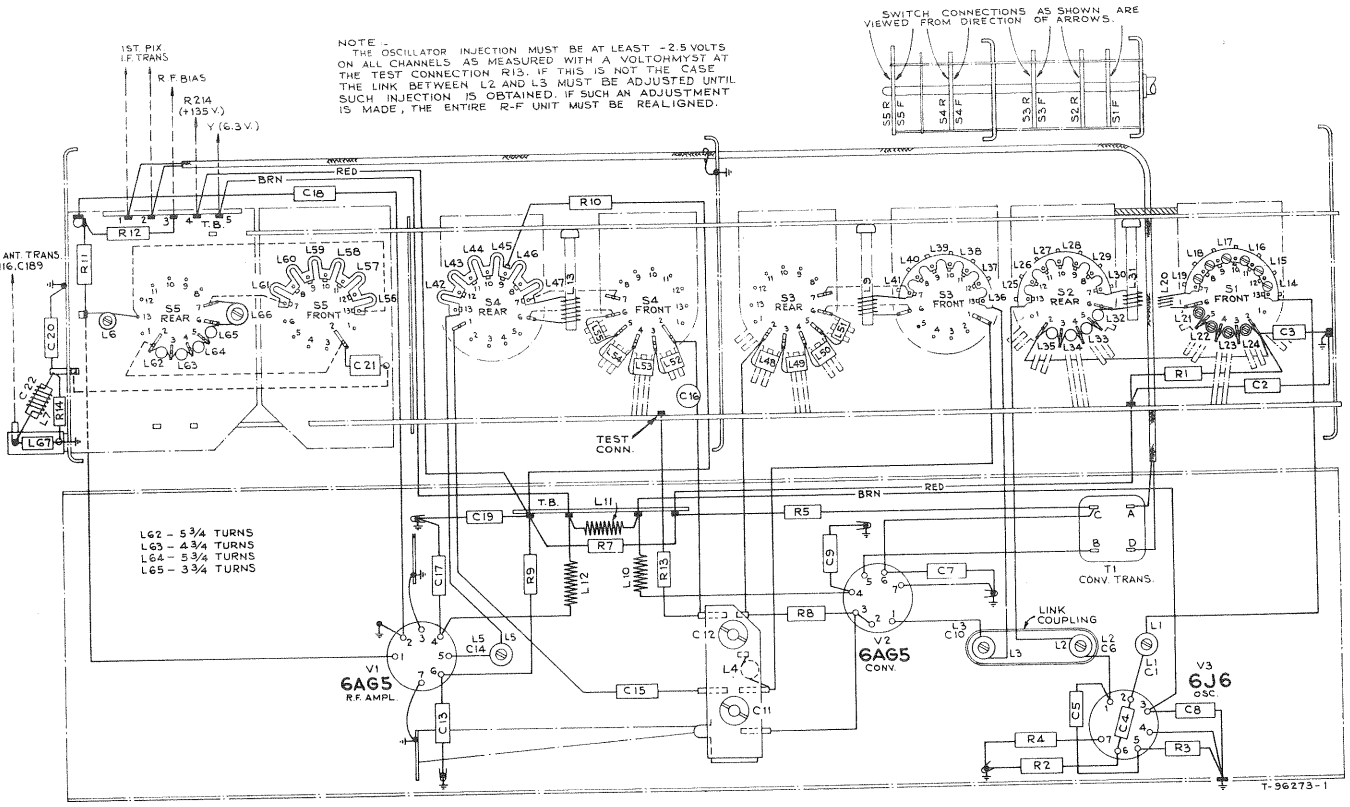
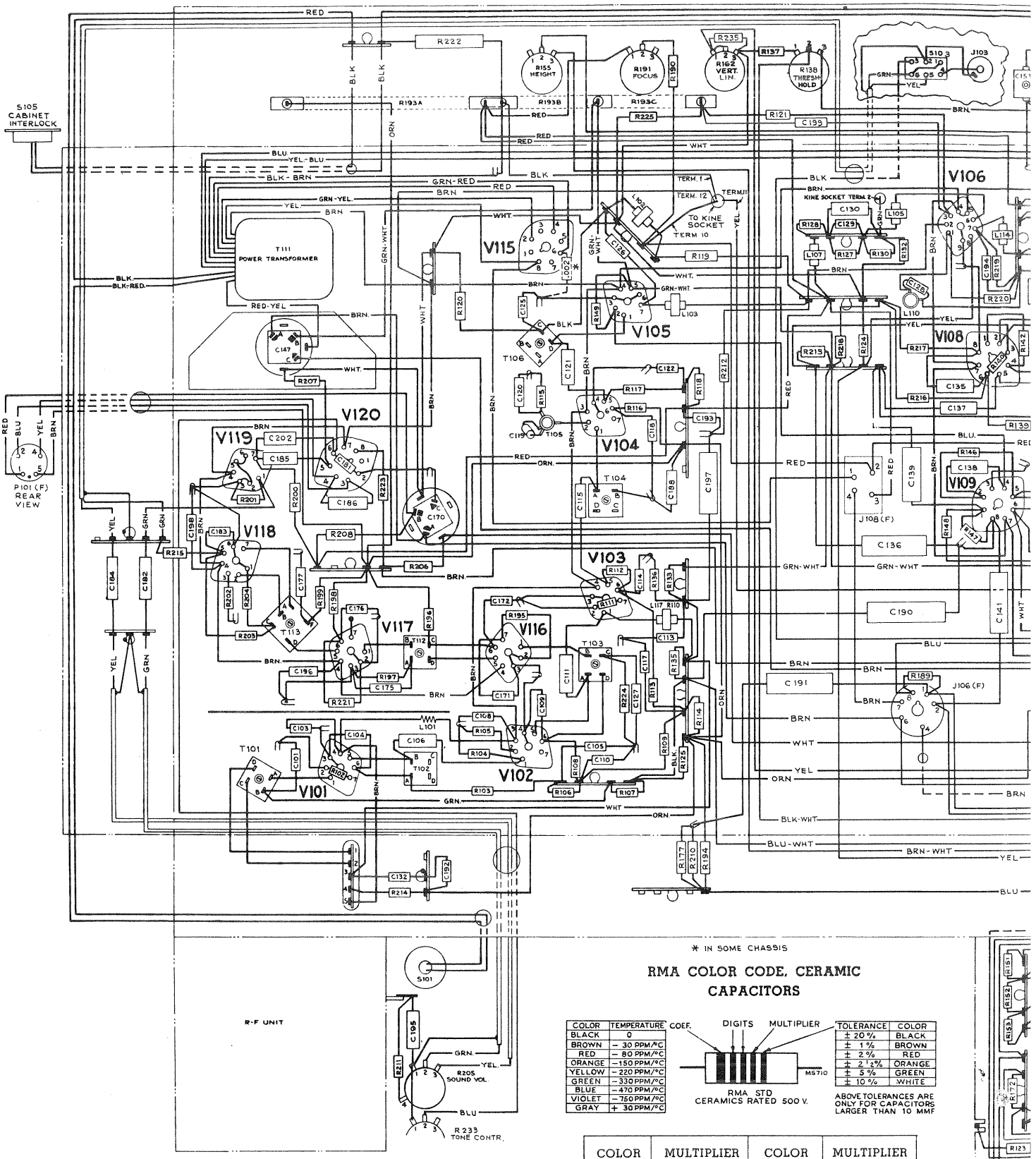


Figure 68—R-F Unit Wiring Diagram

CRITICAL LEAD DRESS:

1. The ground bus from pin 2 and the center shield of V117 socket should not be shortened or rerouted.
2. Do not change the dress of the filament leads or the by-pass capacitors in the picture or sound i-f circuits. The filament leads between V117, V118 and V119 should be down against the chassis and away from grid or plate leads.
3. If it is necessary to replace any of the 1500 mmf capacitors in the picture i-f circuit, the lead length must be kept as short as possible.
4. Picture i-f coupling capacitors C106, C111, C115 and C121 should be up and away from the chassis and should be clear of the pix i-f transformer adjustments by at least ¼ inch. If the dress of any of these capacitors is changed, the i-f alignment should be rechecked.
5. Dress black lead from terminal C of T106 down next to chassis.
6. Leads to L102 and L103 must be as short as possible.
7. Dress peaking coils L105, L106, L107 and L114 up and away from the chassis.
8. Dress C183 across tube pins 5 and 6 with leads not exceeding ⅜ inch.
9. Dress body of R215 as close to tube pin as possible.
10. Dress C129 and C130 up and away from the chassis.
11. Dress the yellow lead from the picture control away from the chassis and away from the volume-control leads. Dress the yellow lead from pin 8 of V106 away from the chassis.
12. Dress the green lead from pin 2 of V106 away from the chassis.
13. Dress R168, R176 and R178 up and away from the chassis.
14. The leads to the volume control should be dressed down against the chassis and away from V117 and V118.
15. Contact between the r-f oscillator frequency adjustment screws and the oscillator coils or channel switch eyelets must be avoided.
16. Dress three a-c leads to S101 under clamp and away from R211.
17. Dress black lead from power transformer and red lead from S102 to terminal board, on top side of four potentiometers.
18. Dress all leads from V115 to V122 on power transformer side of terminal board.
19. All solder joints in the high voltage section should be free of sharp edges.
20. The lead side of the V113 plate cap should be turned away from the fixed high voltage shield and the lead should be dressed away from all objects.
21. All leads under the horizontal plate in the high voltage section should be kept reasonably short and dressed away from the V113 corona ring.
22. The red-black lead from terminal 2 of the deflection yoke should be dressed around the green and yellow leads and away from the red lead. The loose end of the red-black wire should be heavily taped.



* IN SOME CHASSIS

RMA COLOR CODE, CERAMIC CAPACITORS

COLOR	TEMPERATURE COEF.
BLACK	0
BROWN	− 30 PPM/°C
RED	− 80 PPM/°C
ORANGE	−150 PPM/°C
YELLOW	−220 PPM/°C
GREEN	−330 PPM/°C
BLUE	−470 PPM/°C
VIOLET	−750 PPM/°C
GRAY	+ 30 PPM/°C

RMA STD CERAMICS RATED 500 V.

TOLERANCE	COLOR
± 20 %	BLACK
± 1 %	BROWN
± 2 %	RED
± 2½ %	ORANGE
± 5 %	GREEN
± 10 %	WHITE

ABOVE TOLERANCES ARE ONLY FOR CAPACITORS LARGER THAN 10 MMF

COLOR	MULTIPLIER	COLOR	MULTIPLIER
GRAY	.01	BROWN	10
WHITE	.1	RED	100
BLACK	1.	ORANGE	1,000

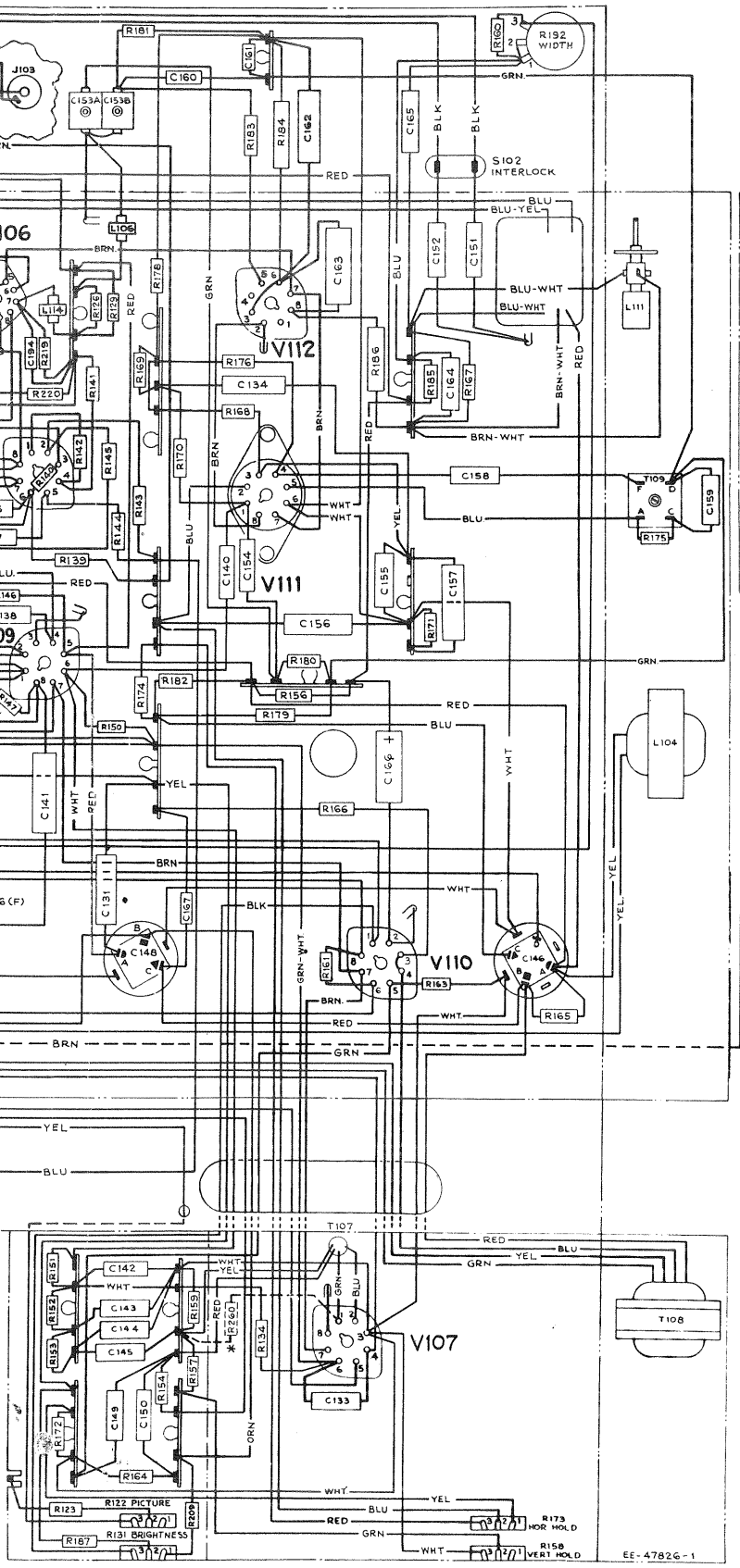
In some receivers, a four color ceramic capacitor color code is employed. It reads the same as the RMA color code except that the tolerance stripe is omitted.

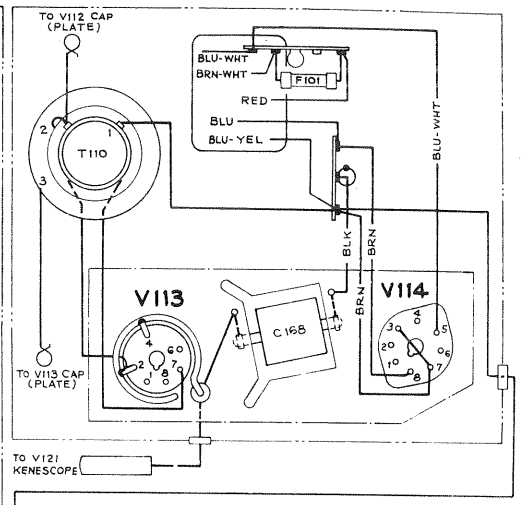
If the coefficient stripe is silver, it indicates that the capacitor has a very large temperature coefficient and is to be employed for by-pass or other usages where a wide variation of capacity is unimportant. Silver striped capacitors are rated at 350 volts unless otherwise marked.

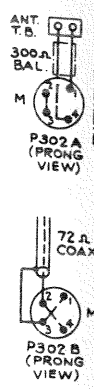
For digits, use digit column, page 22

CHASSIS WIRING DIAGRAM

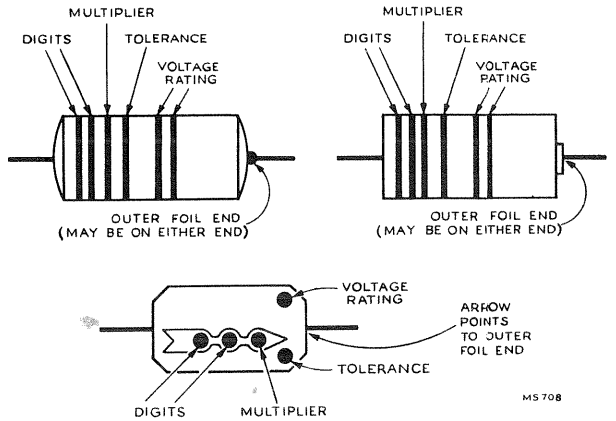
T164, TC165, TC166, TC167, TC168







COLOR CODES, MOULDED PAPER CAPACITORS



CAPACITY VALUE IN MMF

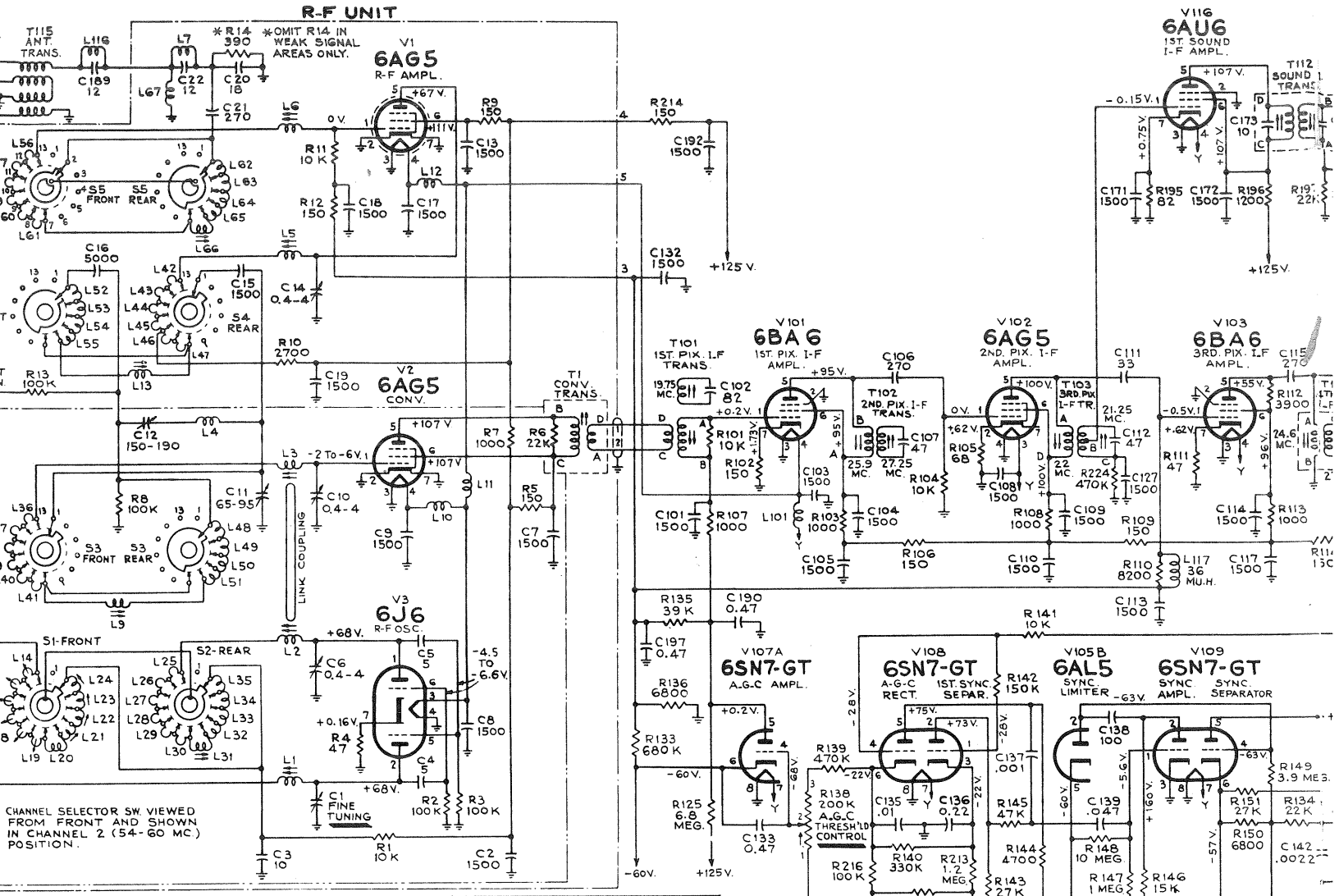
COLOR	DIGITS	MULTIPLIER
BLACK	0	1
BROWN	1	10
RED	2	100
ORANGE	3	1,000
YELLOW	4	10,000
GREEN	5	
BLUE	6	
VIOLET	7	
GRAY	8	
WHITE	9	

TOLERANCE

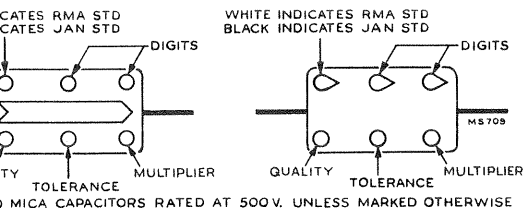
COLOR	TOLERANCE
BLACK BAND OR NONE	±20%
WHITE OR SILVER	±10%
YELLOW OR GOLD	±5%

The Voltage Rating is given in hundreds of volts. Only one band is employed for ratings under 1,000 volts. Two bands are employed for ratings over 1,000 volts. Use digit column to read voltage rating.

Figure 69—Chassis Wiring Diagram



RMA COLOR CODE, FIXED MICA CAPACITORS



MICA CAPACITORS RATED AT 500 V. UNLESS MARKED OTHERWISE

TOLERANCE		QUALITY			
	TOLERANCE	COLOR	CLASS	COLOR	CLASS
	±2%	BLACK	A	YELLOW	D
	±5%	BROWN	B	GRAY	I
	±10%	RED	C	WHITE	J
	±20%	ORANGE	D		

COLOR	DIGITS	MULTIPLIER
GOLD	—	.1
BLACK	0	1.
BROWN	1	10
RED	2	100
ORANGE	3	1,000
YELLOW	4	10,000
GREEN	5	
BLUE	6	
VIOLET	7	
GRAY	8	
WHITE	9	

resistance values in ohms. K =

capacitance values less than 1 in nd above 1 in MMF unless other- noted.

Coil resistance values less than 1 ohm are not shown.

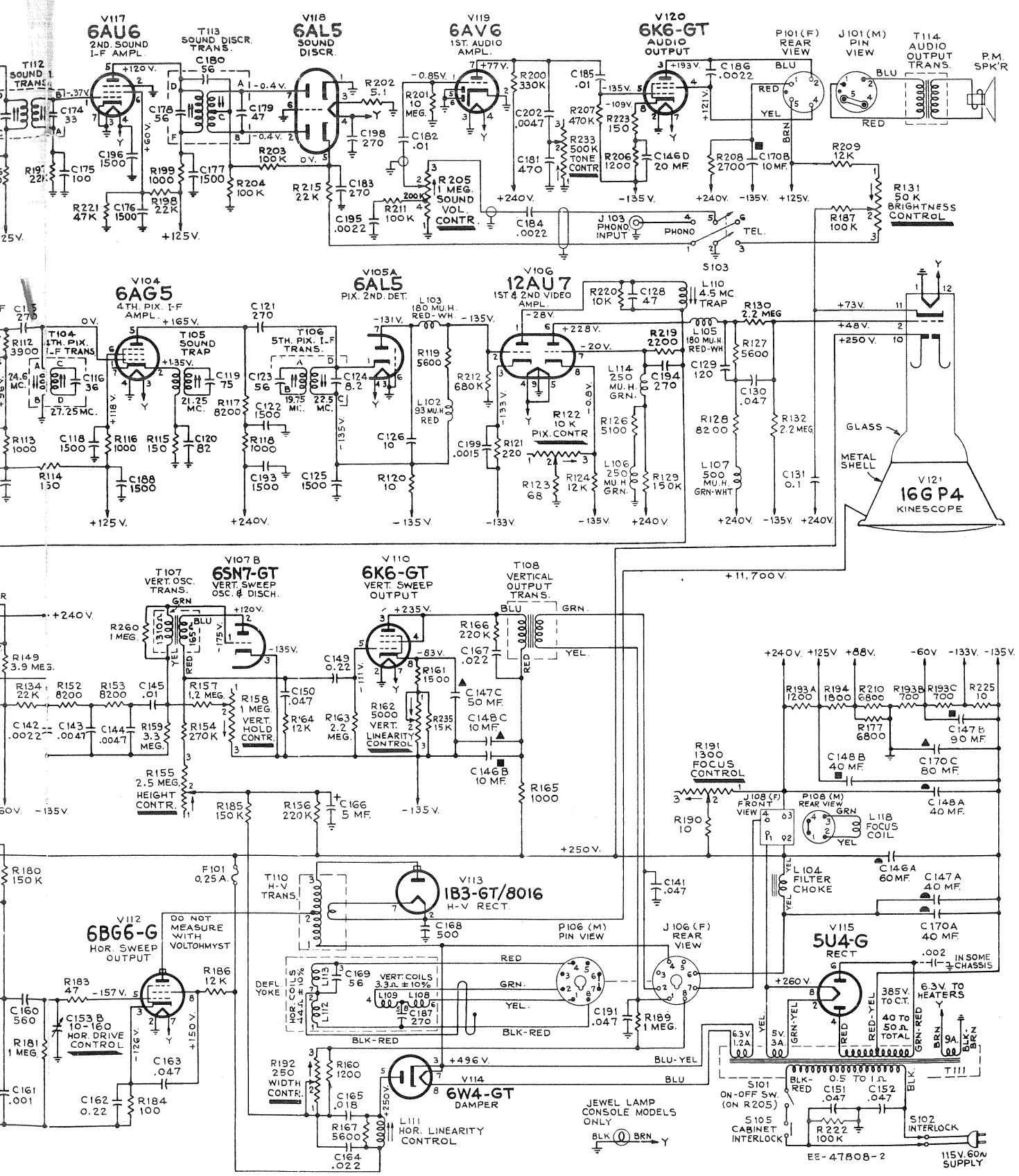
Direction of arrows at controls indicates clockwise rotation.

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

In some receivers, C141 was omitted.

In some receivers, R206 and R223 were 820 ohms.

In some receivers, R220 was 12K.



In some receivers, R121 was 39, R225 was 18, R128 was 6,800, R129 was 220K, L107 was 250 Muh and C139 was omitted.

In some receivers, R161 was 1,000 and R235 was omitted.

In some receivers, R160 and R167 were omitted.

In some receivers, R260 was 470K.

In some receivers, R187 was 150K and V121-10 was connected to arm (2) of height control R155. R188 (470K) was used between V121-11 and +125 v.

In some receivers, C151 and C152 were .01 mfd.

Figure 70—Circuit Schematic Diagram

T164, TC165, TC166, TC167, TC168

REPLACEMENT PARTS (Continued)

STOCK No.	DESCRIPTION
5039	Connector—4 contact male connector for speaker (J101)
75035	Speaker—12" P.M. speaker complete with cone and voice coil less output transformer and plug
75036	Transformer—Output transformer
	NOTE: If stamping on speaker in instrument does not agree with above speaker number, order replacement parts by referring to model number of instrument, number stamped on speaker and full description of part required.
	MISCELLANEOUS
74958	Back—Cabinet back for Model T164
75019	Back—Cabinet back for Model TC165
75026	Back—Cabinet back for Model TC166
74972	Back—Cabinet back for Model TC167
75020	Back—Cabinet back for Model TC168
72857	Board—"Ant" terminal board
71599	Bracket—Pilot lamp bracket for Models TC165, TC166, TC167, TC168
13103	Cap—Pilot lamp cap for Models TC165, TC166, TC167, TC168
71892	Catch—Bullet catch and strike for doors (1 set) (4 required for Model TC167 and 2 required for Model TC168)
X1917	Cloth—Grille cloth for mahogany or walnut instruments for Model T164
X1918	Cloth—Grille cloth for oak instruments for Model T164
X3074	Cloth—Grille cloth for mahogany or walnut instruments for Models TC165, and TC168, and maple instruments for Model TC168
X3089	Cloth—Grille cloth for oak instruments for Model TC165
X3088	Cloth—Grille cloth for mahogany or walnut instruments for Model TC167
X3101	Cloth—Grille cloth for mahogany and walnut instruments for Model TC166
X3090	Cloth—Grille cloth for oak instruments for Models TC166 and TC167
39153	Connector—4 contact male connector for antenna cable (P102)
30566	Connector—4 contact male connector, part of focus coil (P108)
35383	Connector—8 contact male connector, part of deflection yoke (P106)
74607	Decal—Control panel function decal for mahogany or walnut instruments
74608	Decal—Control panel function decal for oak or maple instruments
71984	Decal—Trade mark decal (RCA Victor) for Model T164
71768	Decal—Trade mark decal (RCA Victor) for Models TC167 and TC168
74809	Emblem—"RCA Victor" emblem

STOCK No.	DESCRIPTION
73642	Escutcheon—Channel marker escutcheon for mahogany or walnut instruments
73740	Escutcheon—Channel marker escutcheon for oak or maple instruments
72113	Foot—Rubber foot (4 required) for Model T164
74975	Glass—Safety glass for Model T164
74606	Glass—Safety glass for Models TC165, TC166, TC167 and TC168
37396	Grommet—Rubber grommet to mount speaker (4 required) for Models TC165, TC167 and TC168
73200	Hinge—Drop panel hinge (2 required) for Model T164
74308	Hinge—Cabinet door hinge (1 set) (4 required for Model TC167 and 2 required for Model TC168)
74959	Knob—Fine tuning knob—dark—for mahogany or walnut instruments (outer)
73995	Knob—Fine tuning knob—tan—for oak or maple instruments (outer)
74960	Knob—Channel selector knob—dark—for mahogany or walnut instruments (inner)
74961	Knob—Channel selector knob—tan—for oak or maple instruments (inner)
74962	Knob—Tone control, brightness control or vertical hold control knob—dark—for walnut or mahogany instruments (outer)
73999	Knob—Tone control, brightness control, or vertical hold control—tan—for oak or maple instruments (outer)
74963	Knob—Picture control, horizontal hold control or volume control and power switch knob—dark—for mahogany or walnut instruments (inner)
74001	Knob—Picture control, horizontal hold control or volume control and power switch knob—tan—for oak or maple instruments (inner)
11765	Lamp—Pilot lamp—Mazda 51—for Models TC165, TC166, TC167 and TC168
74162	Plate—Mounting plate for interlock switch
74450	Plate—Back plate for door pull (4 required) for Model TC167
74451	Pull—Door pull (4 required) for Model TC167
75021	Pull—Door pull (2 required) for Model TC168
74113	Screw—No. 8-32 x 1" trimit head screw for door pulls for Model TC167
74269	Screw—No. 8-32 x ¾" trimit head screw for door pull for Model TC168
73643	Spring—Spring clip for channel marker escutcheons
72845	Spring—Retaining spring for knobs Nos. 73995 and 74959
14270	Spring—Retaining spring for knobs Nos. 73999, 74960, 74961 and 74962
30330	Spring—Retaining spring for knobs Nos. 74001 and 74963
74966	Spring—Formed spring for kinescope masking panel (8 required)
72936	Stop—Door stop (2 required for Model TC167 and 1 required for Model TC168)
74161	Stud—Locating stud for back (2 required)

To obtain resistors for which no stock number is given, order by stating type, value of resistance, tolerance and wattage.

APPLY TO YOUR RCA DISTRIBUTOR FOR PRICES OF REPLACEMENT PARTS

REPLACEMENT PARTS (Continued)

T164, TC165, TC166, TC167, TC168

STOCK No.	DESCRIPTION
	3,900 ohms, ±5%, ½ watt (R112)
	3,900 ohms, ±10%, ½ watt (R171)
	4,700 ohms, ±10%, ½ watt (R144)
	5,100 ohms, ±5%, ½ watt (R126)
	5,600 ohms, ±5%, ½ watt (R119)
	5,600 ohms, ±10%, ½ watt (R218)
	5,600 ohms, ±10%, 1 watt (R127, R167)
	6,800 ohms, ±5%, ½ watt (R136)
	6,800 ohms, ±10%, ½ watt (R150)
	6,800 ohms, ±10%, 2 watts (R177, R210)
	8,200 ohms, ±5%, ½ watt (R175)
	8,200 ohms, ±10%, ½ watt (R152, R153)
	8,200 ohms, ±5%, 1 watt (R117, R128)
	10,000 ohms, ±5%, ½ watt (R104)
	10,000 ohms, ±10%, ½ watt (R141, R182, R220)
	12,000 ohms, ±5%, ½ watt (R164)
	12,000 ohms, ±10%, ½ watt (R209)
	12,000 ohms, ±10%, 1 watt (R186)
	12,000 ohms, ±10%, 2 watts (R124)
	15,000 ohms, ±10%, ½ watt (R235)
	15,000 ohms, ±10%, 1 watt (R146)
	22,000 ohms, ±10%, ½ watt (R134, R197)
	22,000 ohms, ±20%, ½ watt (R198, R215)
	27,000 ohms, ±10%, ½ watt (R143, R151)
	39,000 ohms, ±5%, ½ watt (R135)
	47,000 ohms, ±10%, ½ watt (R145)
	47,000 ohms, ±20%, ½ watt (R221)
	82,000 ohms, ±5%, 1 watt (R179)
	82,000 ohms, ±10%, 1 watt (R168)
	100,000 ohms, ±5%, ½ watt (R203, R204)
	100,000 ohms, ±10%, ½ watt (R187, R211, R216)
	100,000 ohms, ±10%, 1 watt (R174)
	100,000 ohms, ±20%, 2 watts (R222)
	120,000 ohms, ±10%, 1 watt (R172)
	150,000 ohms, ±10%, ½ watt (R129, R180, R185)
	150,000 ohms, ±20%, ½ watt (R142)
	150,000 ohms, ±5%, 1 watt (R176)
	220,000 ohms, ±10%, ½ watt (R156, R166)
	270,000 ohms, ±10%, ½ watt (R154)
	330,000 ohms, ±10%, ½ watt (R140, R170, R200)
	330,000 ohms, ±5%, 1 watt (R178)
	470,000 ohms, ±10%, ½ watt (R137, R139, R224)
	470,000 ohms, ±20%, ½ watt (R207)
	680,000 ohms, ±10%, ½ watt (R133, R212)
	820,000 ohms, ±10%, ½ watt (R169)
	1 megohm, ±10%, ½ watt (R147, R181)
	1 megohm, ±20%, ½ watt (R189, R260)
	1.2 megohm, ±5%, ½ watt (R157, R213)
	2.2 megohm, ±10%, ½ watt (R130, R132, R163)
	3.3 megohm, ±5%, ½ watt (R159)
	3.9 megohm, ±10%, ½ watt (R149)
	6.8 megohm, ±10%, ½ watt (R125)
	10 megohm, ±10%, ½ watt (R148)
	10 megohm, ±20%, ½ watt (R201)
74602	Screw—No. 10-32 x 1¾" cross recessed round head screw for focus coil adjustments (3 required)
74601	Screw—No. 8-32 x ⅜" cross recessed pan head screw for focus coil mounting (2 required)
71456	Screw—No. 8-32 x 7/16" wing screw for fastening support and bracket
75083	Screw—No. 8-32 wing screw for mounting deflection yoke
73584	Shield—Tube shield
74937	Sleeve—Rubber sleeve for focus coil
73117	Socket—Tube socket, 7 pin, miniature
75223	Socket—Tube socket, 9 pin, miniature.

STOCK No.	DESCRIPTION
31251	Socket—Tube socket, octal, wafer
73249	Socket—Tube socket, octal, ceramic
71508	Socket—Tube socket for 1B3GT/8016
74834	Socket—Kinescope socket
31364	Socket—Pilot lamp socket for KCS40A
74936	Spring—Suspension spring (coil type) for kinescope socket leads
74954	Spring—Compression spring for hood and yoke assembly (3 required)
74944	Support—Rubber support for 2nd anode lead
74948	Support—Bakelite supports (1 set) for mounting hi-voltage plate
46760	Switch—"TV-Phono" switch (S103)
74157	Switch—Cabinet interlock switch (S105)
73569	Transformer—Vertical oscillator transformer (T107)
74589	Transformer—First pix I-F transformer (T101, C102, R101)
74590	Transformer—Second pix I-F transformer (T102, C107)
74591	Transformer—Third pix I-F transformer (T103, C112)
74592	Transformer—Fourth pix I-F transformer (T104, C116)
73575	Transformer—Fifth pix I-F transformer (T106, C123, C124)
71424	Transformer—Sound I-F transformer (T112, C173, C174)
71427	Transformer—Sound discriminator transformer (T113, C178, C179, C180)
73576	Transformer—Horizontal ocscillator transformer (T109)
73578	Transformer—Antenna transformer complete with socket (T115, J102)
74949	Transformer—Power transformer, 115 volts, 60 cycles (T111)
74951	Transformer—High voltage transformer (T110)
74950	Transformer—Vertical output transformer (T108)
73577	Trap—4.5 mc trap (L110, C128)
71778	Trap—Sound trap (T105, C119)
73476	Trap—I-F trap (L116, C189)
74952	Yoke—Deflection yoke (L108, L109, L112, L113, C169, C187, P106)
	SPEAKER ASSEMBLIES FOR MODEL T164
	Stamped 92580-3 W RMA-274 RL105C5
75023	Cap—Dust cap
75024	Cone—Cone and voice coil assembly
5039	Connector—4 contact male connector for speaker (J101)
75025	Gasket—Speaker cone gasket
75022	Speaker—8" P.M. speaker complete with cone and voice coil (3.2 ohms) less output transformer and connector
75034	Transformer—Output transformer (T114)
	SPEAKER ASSEMBLIES FOR MODELS TC165, TC166, TC167, TC168
	Stamped 92569-10W RL 111-16 RMA 274 or 92569-10B
13867	Cap—Dust cap
74901	Cone—Cone and voice coil assembly for 92569-10W
75875	Cone—Cone and voice coil assembly for 92569-10B

T164, TC165, TC166, TC167, TC168

REPLACEMENT PARTS (Continued)

STOCK No.	DESCRIPTION
74947	Capacitor—Ceramic, 500 mmf., 20,000 volts (C168)
74250	Capacitor—Mica, 560 mmf. (C160)
71501	Capacitor—Ceramic, 1,500 mmf. (C101, C103, C104, C105, C108, C109, C110, C113, C114, C117, C118, C122, C125, C127, C132, C171, C172, C176, C177, C188, C192, C193, C196)
28417	Capacitor—Electrolytic, 5 mfd, 450 volts (C166)
71432	Capacitor—Electrolytic, comprising 2 sections of 40 mfd, 450 volts and 1 section of 10 mfd, 450 volts (C148A, C148B, C148C)
73582	Capacitor—Electrolytic, comprising 1 section of 40 mfd, 450 volts, 1 section of 10 mfd, 450 volts, and 1 section of 80 mfd, 200 volts (C170A, C170B, C170C)
73583	Capacitor—Electrolytic, comprising 1 section of 40 mfd, 450 volts, 1 section of 90 mfd, 150 volts and 1 section of 50 mfd, 150 volts (C147A, C147B, C147C)
73581	Capacitor—Electrolytic, comprising 1 section of 60 mfd, 450 volts, 2 sections of 10 mfd, 450 volts and 1 section of 20 mfd, 150 volts (C146A, C146B, C146C, C146D)
73801	Capacitor—Tubular, moulded paper, oil impregnated, .001 mfd, 1,000 volts (C137, C161)
73802	Capacitor—Tubular, paper, oil impregnated, .0015 mfd, 600 volts (C199)
73595	Capacitor—Tubular, paper, oil impregnated, .0022 mfd, 600 volts (C142, C184, C186, C195)
73920	Capacitor—Tubular, paper, oil impregnated, .0047 mfd, 600 volts (C143, C144, C202)
73561	Capacitor—Tubular, paper, oil impregnated, .01 mfd, 400 volts (C135, C182)
73594	Capacitor—Tubular, moulded paper, oil impregnated, .01 mfd, 600 volts (C145, C159)
73565	Capacitor—Tubular, paper, oil impregnated, .01 mfd, 1,000 volts (C185)
74727	Capacitor—Tubular, paper, oil impregnated, .018 mfd, 1,000 volts (C165)
73562	Capacitor—Tubular, paper, oil impregnated, .022 mfd, 400 volts (C155, C167)
73810	Capacitor—Tubular, paper, oil impregnated, .022 mfd, 1,000 volts (C164)
75071	Capacitor—Tubular, moulded paper, .047 mfd, 400 volts (C151, C152)
73553	Capacitor—Tubular, paper, oil impregnated, .047 mfd, 400 volts (C130, C134)
73592	Capacitor—Tubular, paper, oil impregnated, .047 mfd, 600 volts (C139, C156)
73597	Capacitor—Tubular, paper, oil impregnated, .047 mfd, 1,000 volts (C141, C150, C163, C191)
73557	Capacitor—Tubular, paper, oil impregnated, 0.1 mfd, 600 volts (C131)
73794	Capacitor—Tubular, paper, oil impregnated, 0.22 mfd, 400 volts (C136, C162)
74957	Capacitor—Tubular, paper, oil impregnated, 0.22 mfd, 600 volts (C149)
73787	Capacitor—Tubular, paper, oil impregnated, 0.47 mfd, 200 volts (C133, C157, C190, C197)
73154	Choke—Filter choke (L104)
71449	Coil—Horizontal linearity control coil (L111)
74983	Coil—Focus coil (L118, P108)
73477	Coil—Filament choke coil (L101)
74170	Coil—Peaking coil (36 muh) (L117, R110)
71527	Coil—Peaking coil (93 muh) (L102)
74214	Coil—Peaking coil (180 muh) (L103, L105)
71526	Coil—Peaking coil (250 muh) (L106, L114)

STOCK No.	DESCRIPTION
75252	Coil—Peaking coil (500 muh) (L107)
31027	Connector—4 contact female connector for focus coil (J108)
30568	Connector—4 contact male connector—part of focus coil (P108)
60942	Connector—8 contact female connector for deflection yoke (J106)
74594	Connector—Male connector for power cable
5040	Connector—4 contact female connector for speaker cable (P101)
74967	Connector—Anode connector
72734	Control—Horizontal and vertical hold control (R158, R173)
74047	Control—Brightness and picture control (R122, R131)
74048	Control—Volume control, tone control and power switch (R205, R233, S101)
71441	Control—Vertical linearity control (R162)
71440	Control—Height control (R155)
74597	Control—Focus control (R191)
74475	Control—AGC threshold control (R138)
74945	Control—Width control (R192)
71457	Cord—Power cord and plug
71437	Cover—Insulating cover for electrolytics Nos. 71432, 73581 and 73582
74956	Cushion—Rubber cushion for deflection yoke hood (2 required)
73600	Fuse—0.25 amps., 250 volts (F101)
71799	Grommet—Rubber grommet for horizontal yoke lead exit or 2nd anode lead exit
37396	Grommet—Rubber grommet for mounting ceramic tube socket
75445	Hood—Deflection yoke hood less rubber cushions
35787	Jack—Phono input jack (J103)
74953	Magnet—Ion trap magnet (P.M.)
18469	Plate—Bakelite mounting plate for electrolytics
75444	Plate—Bakelite plate complete with tube socket for high voltage rectifier
72067	Resistor—Wire wound, 5.1 ohms, ½ watt (R202)
18471	Resistor—Wire wound, 10 ohms, ½ watt (R190)
74955	Resistor—Voltage divider comprising 1 section of 1,200 ohms, 16 watts, and 2 sections of 700 ohms, 5½ watts (R193A, R193B, R193C)
	Resistor—Fixed, composition—
	10 ohms, ±20%, ½ watt (R120)
	10 ohms, ±10%, ½ watt (R225)
	47 ohms, ±5%, ½ watt (R111)
	47 ohms, ±20%, ½ watt (R183)
	68 ohms, ±10%, ½ watt (R105)
	68 ohms, ±20%, ½ watt (R123)
	82 ohms, ±10%, ½ watt (R195)
	100 ohms, ±10%, 2 watts (R184)
	150 ohms, ±5%, ½ watt (R102)
	150 ohms, ±10%, ½ watt (R115, R223)
	150 ohms, ±20%, ½ watt (R106, R109, R114, R214)
	220 ohms, ±10%, ½ watt (R121)
	1,000 ohms, ±20%, ½ watt (R103, R107, R108, R113, R116, R118, R165, R199)
	1,200 ohms, ±10%, ½ watt (R196)
	1,200 ohms, ±10%, 1 watt (R160, R206)
	1,500 ohms, ±10%, ½ watt (R161)
	1,800 ohms, ±10%, 2 watts (R194)
	2,200 ohms, ±10%, ½ watt (R219)
	2,700 ohms, ±10%, ½ watt (R217)
	2,700 ohms, ±10%, 2 watts (R208)

REPLACEMENT PARTS

STOCK No.	DESCRIPTION
	R-F UNIT ASSEMBLIES KRK 5B
73465	Belt—Drive belt
75069	Board—R-F unit power connection terminal board
75067	Bracket—Vertical bracket for holding r-f oscillator tube shield
73478	Cable—I-F transmission cable (W1)
73441	Cam—Fine tuning adjustment
74035	Capacitor—Ceramic, 5 mmf. (C4, C5)
53511	Capacitor—Ceramic, 10 mmf. (C3)
54207	Capacitor—Ceramic, 18 mmf. (C20)
73449	Capacitor—Ceramic trimmer comprising 1 section of 150-190 mmf. and 1 section of 65-95 mmf. (C11, C12)
73091	Capacitor—Ceramic, 270 mmf. (C21)
71501	Capacitor—Ceramic, 1,500 mmf. (C2, C7, C8, C9, C13, C15, C17, C18, C19)
73473	Capacitor—Ceramic, 5,000 mmf. (C16)
73460	Coil—R-F plate coil for channel 6 (L13)
73461	Coil—Rear section—Oscillator plate coil for channel 6 (L20)
73462	Coil—Coupling inductance coil (L4)
73475	Coil—Antenna filter shunt coil (C67)
73476	Coil—I-F trap (L7, C22)
73477	Coil—Choke coil (L10, L11, L12)
73874	Coil—Front section—Oscillator plate coil for channel 6 (L31)
74108	Coil—Fine tuning coil (1½ turns) with adjustable inductance core and capacitor stud (plunger adjustment) (L1, C1)
74109	Coil—Trimmer coil (1½ turns) with adjustable inductance core and capacitor stud (screw adjustment for oscillator section or converter section) (L2, L3, C6, C10)
74110	Coil—Trimmer coil (3 turns) with adjustable inductance core and capacitor stud (screw adjustment) for r-f amplifier section (L5, C14)
73455	Core—Sliding core for fine tuning control trimmer
74187	Core—Adjustable core for coil L9
71493	Connector—Oscillator segment connector
73440	Detent—R-F unit detent mechanism and fibre shaft
71487	Form—Coil form for coil L31
73453	Form—Coil form assembly for L9, L13
73442	Link—Link assembly for fine tuning
71462	Loop—Oscillator to converter trimmer loop connector
73634	Nut—Speed nut for drive belt shield
73436	Plate—Front plate and bushing
73464	Pulley—Idler pulley
	Resistor—Fixed, composition:
	47 ohms, ±20%, ½ watt (R4)
	150 ohms, ±20%, ½ watt (R5, R9, R12)
	390 ohms, ±10%, ½ watt (R14)
	1,000 ohms, ±20%, ½ watt (R7)
	2,700 ohms, ±10%, ½ watt (R10)
	10,000 ohms, ±20%, ½ watt (R1, R11)
	100,000 ohms, ±20%, ½ watt (R2, R3, R8, R13)
14343	Retainer—Channel selector shaft retaining ring
30340	Retainer—Retainer ring for fine tuning stud
70881	Screw—No. 4-40 x ¼" binder head screw for adjusting coils L14, L15, L16, L17, L18, L19
73640	Screw—No. 4-40 x ⅝" adjusting screw for L66
74575	Screw—No. 4-40 x 17/32" adjusting screw for L6
71475	Screw—No. 4-40 x 15/32" adjusting screw for coils L21, L22, L23, L24
73437	Shaft—Channel selector shaft complete with pawl and stud
73438	Shaft—Fine tuning control shaft and pulley
73439	Shaft—Actuating shaft for fine tuning control
75443	Shield—"U" shaped shield for bottom of r-f unit
72951	Shield—Metal tube shield for V3
73454	Shield—Metal shield for drive belt
73632	Shield—Metal tube shield for V1
71494	Socket—Tube socket, moulded, 7 prong, saddle mounted
73450	Socket—Tube socket, ceramic, 7 prong, bottom mounted
74576	Spacer—Insulating spacer for front plate (4 required)
75068	Spring—Retaining spring for r-f oscillator tube shield
73457	Spring—Return spring for fine tuning control core
74188	Spring—Retaining spring for adjustable core RCA 74187
74578	Spring—Retaining spring for adjusting screws RCA 73640 and RCA 74575
73468	Stator—Front oscillator section stator complete with rotor, segment, coils and adjusting screws (S1, L14, L15, L16, L17, L18, L19, L21, L22, L23, L24)
73469	Stator—Rear oscillator section stator complete with rotor, segment and coils (S2, L25, L26, L27, L28, L29, L30, L32, L33, L34, L35)
73633	Stator—Antenna stator complete with rotor and coils (S5, L6, L56, L57, L58, L59, L60, L61, L62, L63, L64, L65, L66, C21)
73470	Stator—Converter stator complete with rotor and coils (S3, L9, L36, L37, L38, L39, L40, L41, L48, L49, L50, L51)
73471	Stator—R-F amplifier stator complete with rotor and coils (S4, L13, L42, L43, L44, L45, L46, L47, L52, L53, L54, L55, C15, C16, R10)
75446	Stud—Capacitor stud—brass, No. 4-40 x 13/16" with 3/64" screwdriver slot for trimmer coils 74109 and 74110, uncoded or coded "ER"
75447	Stud—Capacitor stud—brass, No. 4-40 x 13/16" with 3/64" screwdriver slot for trimmer coils 74109 and 74110, coded numerically or "Hi Q"
73448	Transformer—Converter transformer (T1, R6)
73466	Washer—Insulating washer for front shield (1 set)
2917	Washer—"C" washer for channel selector shaft or fine tuning shaft and cam
	CHASSIS ASSEMBLIES KCS40 - T164 KCS40A - TC165, TC166, TC167, TC168
75086	Bracket—Focus coil mounting bracket—upper
75087	Bracket—Focus coil mounting bracket—lower
74946	Capacitor—Mica trimmer comprising 1 section of 4-70 mmf. and 1 section of 10-160 mmf. (C153A, C153B)
39604	Capacitor—Mica, 10 mmf. (C126)
74105	Capacitor—Mica, 33 mmf. (C111)
64062	Capacitor—Ceramic, 82 mmf. (C120)
73090	Capacitor—Mica, 82 mmf. (C140, C154)
39396	Capacitor—Ceramic, 100 mmf. (C175)
75060	Capacitor—Mica, 100 mmf. (C138)
73921	Capacitor—Ceramic, 120 mmf. (C129)
73102	Capacitor—Mica, 180 mmf. (C158)
73922	Capacitor—Ceramic, 270 mmf. (C183, C194, C198)
73091	Capacitor—Mica, 270 mmf. (C106, C115, C121)
39644	Capacitor—Mica, 470 mmf. (C181)